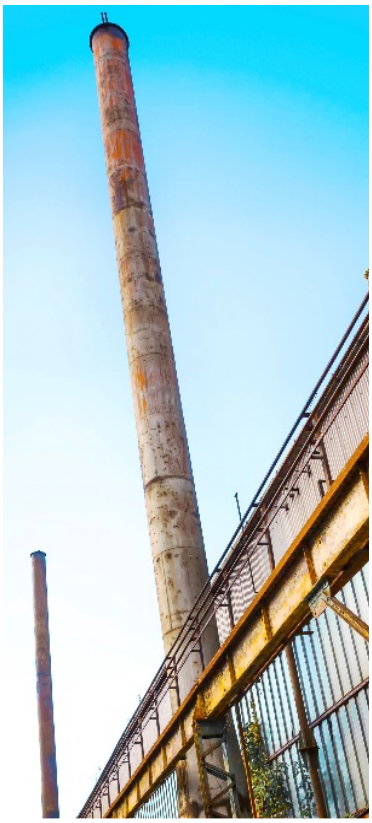
Site Management Plan

Old Erie Canal Site
Site No. 859015
124 Columbia Street
Clyde, New York

Parker-Hannifin Corporation and General Electric



Site Management Plan

Old Erie Canal Site
Wayne County
Clyde, New York
NYSDEC Site Number: 859015
USEPA ID # NYD041292772

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035048 | Report No 9 | November 2021

Executive Summary

The following provides a summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance, and reporting activities required by this Site Management Plan:

Site Identification:	Site #859015, Old Erie Canal Site, 124 Columbia Street, Clyde, NY
Institutional Controls:	1. The property may be used for industrial use.
	2. Environmental Easement.
	3. All ECs must be operated, maintained, and inspected at a frequency as specified in this SMP.
	4. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Wayne County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
	5. Groundwater and other environmental or public health monitoring must be performed as defined in this SMP.
	6. All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP.
	7. Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP.
	8. Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement.
	9. The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 1.2, and any potential impacts that are identified must be monitored or mitigated.
	10. Vegetable gardens and farming on the site are prohibited.
Engineering Controls:	1. Cover system.
	2. Storm sewer pipe extension.
	3. Positive Pressure Indoor Air Environment.
	4. Off-Site Sub Slab Depressurization System.

Site Identification: Site #859015, Old Erie Canal Site, 124 Columbia Street, Clyde, NY

Inspections:	Frequency
1. Cover system.	Annually
2. Storm sewer pipe extension.	Annually
3. Positive indoor air pressure.	Annually
4. Off-Site Sub Slab Depressurization System.	Annually
Monitoring:	
1. Positive indoor air pressure.	Monthly
2. Groundwater Monitoring Wells	Quarterly
3. Off-Site Sub Slab Depressurization System.	• By homeowner - weekly or at homeowner's discretion • Annual inspection by Remedial Party
Maintenance:	
1. Storm sewer pipe extension.	As needed
2. Off-Site Sub Slab Depressurization System.	As needed
Reporting:	
1. Groundwater Data.	Quarterly
2. Periodic Review Report.	Annually

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

Certification Statement

I, RICHARD J. SNYDER, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

P.E.

August 4, 2021

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List of Acronyms

AATech	Advanced Atomization Technologies, Inc.
BTA	Barge Turnaround Area
ASP	Analytical Services Protocol
CAMP	Community Air Monitoring Plan
Cis-1,2-DCE	cis-1,2-Dichloroethene
CRA	Conestoga Rovers & Associates
CSIA	Compound-Specific Isotope Analysis
CTP	Communication Test Point
CVOC	Chlorinated Volatile Organic Compound
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO_2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
DHC	Dehalococcoides
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
EWP	Excavation Work Plan
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FS	Feasibility Study
GE	General Electric Company
HASP	Health and Safety Plan
IC	Institutional Control
IRM	Interim Remedial Measure
MEK	Methyl Ethyl Ketone
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operation and Maintenance
OBG	O'Brien and Gere
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PCR	Polymerase Chain Reaction
PID	Photoionization Detector
PPB	Parts Per Billion
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan

RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RI	Remedial Investigation
ROD	Record of Decision
RSO	Remedial Site Optimization
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SSDS	Sub-slab Depressurization System
SVI	Soil Vapor Intrusion
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
VC	Vinyl Chloride
VCR-A	Vinyl Chloride Reductase
VOC	Volatile Organic Compound

1. Introduction

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the Old Erie Canal Site located in Clyde, New York (hereinafter referred to as the "Site") and supersedes any previously issued Interim Site Management Plans. The Site location is shown on Figure1.1. The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program Site No. 859015, which is administered by the New York State Department of Environmental Conservation (NYSDEC).

Parker Hannifin Corporation (Parker) and General Electric Company (GE) entered into an Order on Consent on December 6, 2013, with the NYSDEC to remediate the Site. A figure showing the Site layout and boundaries of this Site is provided as Figure 1.2. The boundaries of the Site are more fully described in the metes and bounds Site description that is part of the Environmental Easement provided in Appendix A.

After completion of the remedial work, some contamination was left at this Site, which is hereafter referred to as "remaining contamination." Institutional and Engineering Controls (ICs and ECs) have been incorporated into the Site remedy to control exposure to remaining contamination and ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with the Wayne County Clerk, requires compliance with this SMP and all ECs and ICs placed on the Site.

This SMP was prepared to manage remaining contamination at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the Site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC).
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the Order on Consent (Index #B8-0533-98-06; Site #859015) for the Site, and thereby subject to applicable penalties.

All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the Site is provided on Table 1.1.

This SMP was prepared by GHD, on behalf of Parker and GE, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the Site.

1.2 Owner and Remedial Party Responsibilities

Parker and GE are the remedial parties for the Site. The Site owner is Advanced Atomization Technologies, Inc. (AATech), a joint venture between Parker and GE. The responsibilities of the owner and remedial parties are detailed in Appendix B.

1.3 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the Site conditions. In accordance with the Environmental Easement for the Site, the NYSDEC will provide a notice of any approved changes to the SMP and append these notices to the SMP that is retained in its files.

1.4 Notifications

Notifications will be submitted by the property owner or the remedial parties to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- A 60-day advance notice of any proposed changes in Site use that are required under the terms of the Order on Consent, 6NYCRR Part 375, and/or Environmental Conservation Law.
- A 7-day advance notice of any field activity associated with the remedial program.
- A 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan (EWP).
- Notice within 48-hours of any damage or defect to the foundation, structures, or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the Site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the Order on Consent, and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the Site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1.1 includes contact information for the above notifications as well as a full listing of Site-related contact information. The information in Table 1.1 will be updated, as necessary, to provide accurate contact information.

2. Summary of Previous Investigations and Remedial Actions

2.1 Site Location and Description

Parker and GE are the remedial parties for the Site. The current Site owner and operator is Advanced Atomization Technologies, Inc. (AATech), a joint venture between Parker and GE. AATech's operations include the manufacture and testing of fuel injection nozzles for military and industrial applications.

The Old Erie Canal Site is an approximately 6.532-acre portion of the AATech Facility located in Clyde, Wayne County, New York. The Site includes the following parcels on the Wayne County Tax Map (see Figures 1.1 and 1.2):

- The approximately 5.84-acre portion of Parcel 1 identified as Section 74112 Block 13 Lot 193379
- The approximately 0.729-acre Parcel 2 identified as Section 74112 Block 13 Lot 158377

The Site is bounded by Columbia Street to the north, a public walking path, active rail line, and the New York State Barge Canal to the south, commercial property to the east, and residential property to the west (see Figure 1.2). A drainage channel passes to the west of the manufacturing building and eventually drains to the Barge Canal. The boundaries of the site are more fully described in Appendix A.

2.2 Physical Setting

2.2.1 Land Use

The Site consists of the following: a main manufacturing/office building, a maintenance/support/garage building, parking areas, the former barge turnaround area (BTA), and vacant undeveloped areas. The Site is zoned for commercial/industrial use and current operations by AATech include the manufacture and testing of fuel injection nozzles for military and industrial applications.

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include commercial and residential properties. The properties immediately south of the Site include a public walking path, active rail line, and the barge canal; the properties immediately north of the Site are residential; the properties immediately east of the Site include a commercial property; and the properties to the west of the Site are residential.

2.2.2 Geology

Bedrock is encountered at approximately 25 feet below ground surface and is overlain by a layer of glacial till that typically ranges from 10 to 20 feet in thickness. The till is thinnest or absent within the former BTA. Layers of sand and gravel overlay the till. A layer of fill material comprises the uppermost layer and is of greater thickness in the BTA.

Geologic cross-sections were prepared by O'Brien & Gere Engineers, Inc. (OBG) and presented in the Remedial Investigation (RI) and Supplemental Groundwater Investigation (SGI) reports. Copies of the cross-sections are presented on Figures 2.2 through 2.4. A cross-section location plan is shown on Figure 2.1. Site Lithology is summarized on Table 2.1

2.2.3 Site Bedrock

The bedrock beneath the Site consists of shale and dolomitic limestone of the Late Silurian Syracuse-Camillus Formation. Based on the lithological descriptions of the bedrock cores presented in the RI Report, the bedrock is gray to dark greenish-gray, fine-grained, moderately fractured shale and thinly bedded gray dolomitic limestone, which is also moderately fractured.

During the Site investigations, the bedrock was encountered at depths ranging between 16.5 and 31 feet below grade. The bedrock surface generally slopes from the northeast to the southwest. A contour map showing the surface elevation of the bedrock is presented on Figure 2.5.

2.2.4 Hydrogeology

Groundwater flow in the area is generally to the south. There are overburden and bedrock groundwater aquifers present. Groundwater has been measured at depths ranging from 2 to 10 feet below ground surface. Overburden groundwater elevation contours are presented on Figure 2.6. Bedrock groundwater elevation contours are presented on Figure 2.7. Groundwater elevation data is provided in Table 2.2. Groundwater monitoring well construction logs are provided in Appendix C.

According to the final RI Report prepared by OBG in 2005 there were seven properties located within a ½ mile radius of the Site that had private drinking water wells. GHD contacted the Village of Clyde Water Department to determine the current status of the water supply at these residences. All but one residence, 21 John Street located 0.4 miles north of the Site, is connected to the public water system, two of the residences, 137 Caroline Street (0.2 miles northeast) and 89 Duncan Street (0.5 miles northwest) are connected to the public water supply and are listed as also having wells on the property.

2.3 Investigation and Remedial History

The following narrative provides a remedial history timeline and a summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8 - References.

The NYSDEC and New York State Department of Health (NYSDOH) conducted a number of environmental investigations and sampling rounds at the Site and surrounding residential properties between 1989 and 1994. These investigations involved collection of surface soil, groundwater, surface water, stormwater, sub-slab soil gas, residential well and basement sump water, and residential indoor air samples. Samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), Target Analyte List (TAL) metals, and total cyanide. The results of the NYSDEC and NYSDOH investigations were presented in the "Remedial Investigation/Feasibility Study Work Plan," prepared by OBG and approved by the NYSDEC in December 2001.

A Remedial Investigation (RI) was conducted by OBG on behalf of GE and Parker between April 2002 and January 2005. The results of the RI were reported in the:

1. "Remedial Investigation Report," prepared by OBG and dated November 2003
2. "Remedial Investigation Addendum No. 1 Report," prepared by OBG and dated May 13, 2005

A Supplemental Groundwater Investigation (SGI) was conducted in November/December 2006 to gather additional data to be considered in the Feasibility Study (FS). The "Supplemental Groundwater Investigation Summary Report" prepared by OBG and dated March 29, 2007, was included in the FS prepared by Conestoga-Rovers & Associates dated March 30, 2007, updated February 11, 2008, and amended February 15, 2011. The NYSDEC issued the Record of Decision (ROD) in April 2013.

A Remedial Design/Remedial Action (RD/RA) Work Plan dated April 19, 2016 was conditionally approved by the NYSDEC in a letter dated September 20, 2016. The final version of the work plan was issued on October 21, 2016.

2.3.1 Nature and Extent of Contamination

As presented in the ROD, the primary contaminants of concern at the Site are chlorinated volatile organic compounds (CVOCs) in soil, groundwater, and soil vapor. SVOCs and metals have been identified as contaminants of concern in surface soils located in the BTA. Soil vapor impacts (CVOCs) were identified at one off-Site residential property.

Concentrations of trichloroethene (TCE) up to 580,000 parts per billion (ppb), cis-1, 2-dichloroethene (cis-1,2-DCE) up to 180,000 ppb, and vinyl chloride (VC) up to 73,200 ppb were detected on Site. The highest concentrations of CVOCs in groundwater were detected at a location under the manufacturing building and in overburden and bedrock groundwater from monitoring wells installed within the BTA.

CVOCs were detected at concentrations up to 130,000 ppb in subsurface soil samples collected from beneath the manufacturing building. Surface soil samples collected from the drainage

swale located to the west and southwest of the manufacturing building contained SVOCs, arsenic, and cadmium above 6 NYCRR Part 375 soil cleanup objectives (SCOs) for industrial use.

Sub-slab soil vapor samples collected from beneath the manufacturing building detected elevated levels of CVOCs. TCE was detected at concentrations up to 75,000 micrograms per cubic meter (ug/m3).

Soil vapor intrusion sampling was conducted at eight structures located to the north of the facility, across Columbia Street during the RI. Based on the concentrations of Site-related chemicals detected in soil vapor samples collected near one structure and the corresponding indoor air levels at that structure, a sub-slab depressurization system (SSDS) was recommended and installed. No further action was recommended for the remaining seven homes evaluated.

As stated in the ROD, based on the findings of the RI, the primary contaminants of concern at the Site are:

- TCE
- DCE
- Vinyl chloride
- Toluene
- Xylene (mixed)
- Benz(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Chrysene
- Dibenz(a,h)anthracene
- Fluoranthene
- Indeno(1,2,3-cd)pyrene
- Arsenic
- Cadmium

2.3.2 Interim Remedial Measures

The following interim remedial measures (IRMs) have been completed at the Site based on conditions observed during the RI.

2.3.2.1 Storm Sewer Closures

The results of storm water sampling conducted during the RI revealed the presence of VOCs in stormwater discharging to catch basin CB-3 and in two upgradient manholes (MH-3A and MH-3B) on the Site. Based on the results of the stormwater sampling and subsequent evaluations of the Site storm sewers, an IRM was completed in November 2003 consisting of:

- Decommissioning of storm sewer lines 3 and 4 by filling them with flowable fill.
- Decommissioning of manholes MH-3A and MH-3B and catch basins CB-3E and CB-3 by filling them with concrete.
- Installation of concrete water-stops on abandoned storm sewer lines 3 and 4 to minimize potential migration of groundwater along the sewer bedding. The water-stops are concrete barriers installed within the drainage system.
- Regrading and paving a portion of the parking lot behind the manufacturing building to direct surface water away from the locations of the abandoned catch basins and storm sewer lines.

2.3.3 Off-Site Soil Vapor Mitigation

As a result of soil vapor intrusion (SVI) investigations, mitigation measures were implemented at an off-Site residence based on the levels of VOCs in the soil vapor samples collected near the structure and the corresponding indoor air levels at that structure.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the ROD dated April 4, 2013, are as follows:

Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles from contaminated groundwater.

RAOs for Environmental Protection

- Restore groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Prevent the discharge of contaminants to surface water.
- Remove the source of ground or surface water contamination.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

2.5 Remaining Contamination

2.5.1 Soil

Subsurface soil contaminants identified during the RI/FS include; acetone, cis-1,2-DCE, methylene chloride, toluene, TCE, VC, and lead.

Acetone, methylene chloride, toluene, and TCE were detected both in the vicinity of the manufacturing building and the former BTA at concentrations that exceed the 6 NYCRR Part 375 SCOs for unrestricted use, but less than the restricted-industrial use SCOs.

Lead was detected at sample location GP-25 which is located within the former BTA. The maximum concentration detected does not exceed the restricted-industrial use SCO.

Table 2.3 and Figure 2.8 summarize the results of soil samples that exceed the Unrestricted Use SCOs at the Site after completion of remedial action. The primary contaminants of concern in shallow (surface) soils within the BTA are SVOCs and metals that exceeded Restricted Industrial Use SCOs. Two impacted areas (SED-6 and SED-7) were capped with one foot of clean soil. The cap consists of a filter fabric demarcation layer overlain by six inches of fill and six inches of topsoil.

The existing 48-inch storm sewer pipe was extended through the southern end of the BTA to prevent contact of surface water with the soils exceeding industrial use SCOs within the BTA. Soils excavated during the pipe extension construction were removed and disposed off-Site. Clean soils approved by NYSDEC were imported for use as backfill. Based on the pre-design work plan (August 2014), confirmatory sampling was not needed in these areas since impacts were previously defined.

Table 2.4 and Figure 2.9 summarize the results of all soil samples that exceed the Restricted-Industrial Use SCOs at the Site after completion of remedial action.

2.5.2 Groundwater

The primary groundwater Site contaminants identified during the RI are TCE, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, and VC, as well benzene, toluene, and xylene (BTX) associated with the historical manufacturing operations on Site and disposal of waste materials within the former BTA. Groundwater contamination was identified in two primary locations on the Site: in the former BTA and under the manufacturing building.

The inorganic compound antimony, found in groundwater was only slightly above standards and was also found in up gradient monitoring wells and is considered to represent site background conditions. Therefore, metals in groundwater are not considered site-specific contaminants of concern. Table 2.5 and Figure 2.10 summarize the most current groundwater monitoring that exceed the standards, criteria, and guidance (SCGs) after completion of the remedial action.

2.5.3 Soil Vapor

As stated in the ROD, the contaminant that is considered to be the primary contaminant of concern driving the remediation of soil vapor is TCE. There are no direct SCGs for comparison of soil vapor. Sub-slab and indoor air sampling were completed in March of 2017 and identified elevated concentrations of Site contaminants of concern present beneath the floor slab of the manufacturing building.

Table 2.6 and Figure 2.11 summarize the results of the March 2017 sub-slab and indoor air sampling.

3. Institutional and Engineering Control Plan

3.1 General

Since remaining contamination exists at the Site, ICs and ECs are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the Site. The IC/EC Plan is one component of the SMP, and revisions must be approved by the NYSDEC.

This plan provides:

- A description of all IC/ECs on the Site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the EWP (as provided in Appendix D) for the proper handling of remaining contamination that may be disturbed during subsurface work on the Site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

A series of ICs is required by the ROD to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and (3) limit the use and development of the Site to industrial uses only. Adherence to these ICs on the Site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figure 1.2.

These ICs are:

- The property may be used for industrial use;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP.
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Wayne County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;

- Data and information pertinent to Site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- Access to the Site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 1.2, and any potential impacts that are identified must be monitored or mitigated; and
- Vegetable gardens and farming on the Site are prohibited.

3.3 Engineering Controls

3.3.1 Cover Systems

Exposure to remaining surface contamination at the Site is prevented by a cover system placed over two locations within the former BTA as well as the existing Site buildings, concrete and asphalt paved areas. The cover system within the former BTA is comprised of demarcation layer covered by a minimum of 6 inches of fill and 6 inches of topsoil. Figure 3.1 presents the location of the cover system and applicable demarcation layers. The EWP provided in Appendix D outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the Site and provided in Appendix E.

3.3.2 Stormwater Pipe Extension

The surface soil remedy consisted of extension of the 48-inch stormwater culvert pipe to convey existing stormwater flows downstream to prevent contact of stormwater with impacted surface soils.

The location of the manhole and pipe extension are shown on Figure 3.1. All soils excavated during construction were disposed off-Site. Clean fill was imported for backfilling and restoration.

The stormwater pipe extension will be inspected as part of the Site-wide inspection discussed in the Monitoring and Sampling Plan included in Section 4 of this SMP.

3.3.3 Positive Indoor Air Pressure

The method of soil vapor mitigation identified in the RD/RA Work Plan consists of the existing epoxy-coated concrete floor slab and the positive indoor air pressure environment maintained within the manufacturing building.

The air handling system creating the positive indoor air pressure was not specifically designed or installed as a remedial system. However, the manufacturing area of the building is operated under positive pressure to control the indoor temperature and humidity, and to limit dust and outside air from entering the building. This indoor positive pressure differential from the outside air pressure is automated based on pressure readings from manometers located within the manufacturing building.

The soil vapor remedy included one round of sub-slab and indoor air sampling to confirm that the existing positive indoor air pressure conditions, which are based on AATech's operational requirements, are effective in preventing potential exposure via soil vapor intrusion. The sampling was completed in March 2017. The results of the sampling are presented on Table 2.6. TCE, the contaminant of concern driving the soil vapor remedy, was detected in all of the sub-slab soil vapor samples at concentrations ranging from 0.28 µg/m^3 at location F (new addition) to 33,200 µg/m^3 at location C. The results of the indoor air samples were all less than 1 µg/m^3. These results confirm that vapor intrusion of site contaminants of concern is not occurring and that the current air handling system is effective in preventing exposures.

Information regarding the operation of the air pressure monitoring system is documented in the Operation and Maintenance (O&M) Plan (Section 5 of this SMP).

3.3.4 Groundwater Injection Wells and Monitoring Wells

The groundwater remedy consists of one round of in-situ enhanced bioremediation through injection of potassium lactate and emulsified vegetable oil (EVO) with a diammonium phosphate (DAP) followed by quarterly groundwater monitoring.

Forty-six semi-permanent overburden injection wells and three semi-permanent bedrock injection wells were installed to implement the in-situ treatment. The Injection wells are shown on Figure 3.2.

The monitoring well network consists of 12 program wells and 11 perimeter wells as well as three general wells for hydraulic monitoring.

3.3.5 Existing Off-Site Sub Slab Depressurization System

The objective of the off-Site sub-slab depressurization system (SSDS) is to prevent any pollutants that may travel from the contaminated Site via soil vapor from entering the residence located at 155 Columbia Street. The SSDS was installed by OBG in 2006. OBG prepared an O&M plan for the SSDS dated November 2007. The Remedy set forth in the ROD includes the continued O&M of the SSDS at the residence located at 155 Columbia Street.

3.3.5.1 Off-Site System Installation Details

According to the OBG O&M Plan, the following tasks were completed during the installation of the off-Site SSDS:

1. Sealing of evident wall cracks using caulk.

2. Trenching and installation of perforated piping in the existing basement floor as shown on Figure 3.3.
3. Installation of SSP1 using 4-inch diameter PVC pipe at the location indicated on Figure 3.3. The pipe was sealed to the hole in the concrete floor and rises up and penetrates through the north wall of the structure. A "tee" fitting was installed to allow for installation of SSP2 to ventilate the inaccessible crawlspace.
4. The SSP1/SSP2 pipe was routed to a Model HP-220 low pressure and high flow centrifugal fan, located on the northern exterior wall of the building. From this fan unit, a discharge stack was installed to a point one foot above the eave of the roof.
5. The fan unit was hardwired into the circuit breaker panel. The circuit load was tested, and a circuit exhibiting less than 80 percent load was utilized to operate the fan. A lockable switch (lockable using a tie strap) was installed between the junction box and the fan.
6. Permanent stickers were placed accordingly to identify all piping and electrical connections. A U-tube manometer was placed on the suction pipe at eye-level so the property owner can use it as an operational check of the system. The manometer will continuously measure the static pressure (vacuum) in the suction pipe.
7. With the fan on, communication testing was conducted utilizing the communication test points (CTP) identified on Figure 3.3. The CTPs yielded negative sub-slab pressure readings from 0.041" water gauge (wg) to 0.755"wg, which were above the acceptable minimum of 0.002"wg (as measured with a micro-manometer).
8. Innocuous smoke testing of pipe joints and SSP seal(s) was conducted to verify that no leaks were present in the SSDS. Additionally, smoke testing was used to verify that the SSDS was not creating a back-draft condition on the building's hot water heater.
9. The property owner was instructed on how to check system performance using the U-tube manometer, and what to do in the event of a system shutdown.

Information regarding the operation and maintenance of the off-Site SSDS system are documented in the O&M Plan (Section 5 of this SMP).

3.4 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the RAOs identified by the ROD. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

3.4.1 Cover System

The cover system is a permanent control, and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.4.2 Sewer Pipe Extension

The sewer pipe extension is a permanent control, and the quality and integrity of the piping will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.4.3 Positive Indoor Pressure

The air handling system creating the positive indoor air pressure was not designed or installed as a remedial system; however, the positive pressure environment is required for Quality Assurance/Quality Control (QA/QC) by AATech's current manufacturing operations. If manufacturing operations should ever cease and/or the positive pressure environment should no longer be maintained within the building, it would become necessary to conduct an evaluation of whether installation of an active SSDS or other mitigation system would be required.

This evaluation would require a determination of the future use of the building, collection of sub-slab and indoor air vapor samples, and interpretation of the analytical results to determine whether contaminants in soil vapor present a potential to be detrimental to the quality of the indoor air.

3.4.4 Existing Off-Site Sub Slab Depressurization System

The active SSDS will not be discontinued unless prior written approval is granted by the NYSDEC and the NYSDOH. In the event that monitoring data indicates that the SSDS may no longer be required, a proposal to discontinue the SSDS will be submitted by the remedial party to the NYSDEC and NYSDOH.

3.4.5 Monitoring Wells and Injection Wells Associated with In-Situ Treatment

3.4.5.1 Monitoring Wells

Groundwater monitoring activities to assess the in-situ treatment will continue, as determined by the NYSDEC with consultation with NYSDOH, until residual groundwater concentrations are found to be consistently below ambient water quality standards, the Site SCGs, or have become asymptotic at an acceptable level over an extended period. In the event that monitoring data indicates that monitoring may no longer be required, a proposal to remove the monitoring wells will be submitted by the remedial party. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

3.4.5.2 Injection Wells

The injection wells will be removed once it has been determined that no additional injections are necessary. The need for additional injections will be considered as part of the initial two-year post-injection evaluation as described in Section 6.1. If the evaluation determines that a second round of injections is not warranted, the wells will be removed, If the evaluation indicates that an additional round of injections is required the wells will remain in place until the second two-year post-injection evaluation is complete.

4. Monitoring and Sampling Plan

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of Site management for the Site are included in the Quality Assurance Project Plan (QAPP) provided in Appendix F.

This Monitoring and Sampling Plan describes the methods to be used for:

- Site-wide inspections;
- Positive indoor air pressure monitoring;
- Off-site SSDS monitoring;
- Groundwater sampling;
- Assessing compliance with applicable NYSDEC SCGs, particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating Site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Information on all designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7 of this SMP.

4.2 Site–wide Inspection

Site-wide inspections will be performed at a minimum of once per year by a QEP or P.E. or their designee when the ground is visible. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. During these inspections, an inspection form will be completed as provided in Appendix G – Site Management Forms. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including Site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General Site conditions at the time of the inspection;

- The Site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that Site records are up to date.

Inspections of all remedial components installed at the Site will be conducted. A comprehensive Site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report (PRR). The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- Confirm that Site records are up to date.

Reporting requirements are outlined in Section 7 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the Site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.3 Remedial System Monitoring

4.3.1 Positive Indoor Air Pressure

AATech maintains positive indoor air pressure relative to outdoor air as a requirement of the manufacturing process. As confirmed by the March 2017 indoor air and sub-slab vapor sampling, the positive indoor air pressure and epoxy-coated concrete floor are effective in preventing exposures via soil vapor intrusion.

The positive indoor air pressure is monitored continually and recorded at set intervals by four Setra differential pressure transmitters (Model #26710R1WB11A1HD) mounted at the locations shown on Figure 4.1. These transmitters monitor the pressure within four monitoring zones; West, Center, East, and Office. These manometers measure the differential pressure between the indoor air and the outside air. The manometers are tied to a software control program called Envision for BAC Talk, Version 3.0.

Each air handling system is controlled automatically based on a number of set points to control operation, with one of the automated inputs being the building pressure within the manufacturing area. The software will respond to an increase or decrease in the indoor air pressure through activation of the air handling systems. The control of the air handling systems and a log of a number

of operating parameters and manometer readings is maintained on a dedicated computer located within the maintenance engineering office.

The sub-floor to indoor air differential pressure is monitored by six Setra differential pressure transmitters (Model # 26710R1WB11A1HD) installed as part of the remedial action. These manometers are the same make and model as the building manometers.

The sub-floor manometers are located with one in the West manufacturing space, two in the Center manufacturing area (includes the lunchroom sub-floor manometer), two in the East manufacturing area, and one in the office area. The sub-floor manometers measure the differential pressure between the sub-floor and the indoor air. The sub-floor manometers are also tied into the BAC Talk system.

The pressure differentials are displayed continuously and are recorded set intervals.

The indoor air pressure is affected by the opening and closing of shipping and ingress/egress doors. Changes in the indoor air pressure differential readings result in an inverse change in the sub-floor pressure differential. When the indoor air pressure differential decreases (i.e., pressure in the building shows a decrease), the sub-floor pressure shows a corresponding increase.

The monitoring system locally displays an alert condition on the monitoring screen if the pressure gradient is continually higher in the sub-slab vs. the indoor environment for more than one hour. A one-hour interval was selected because the indoor air pressure fluctuates frequently throughout the day with the opening and closing of shipping doors and this time interval allows the indoor air pressures to recover.

The monitoring requirements and schedule for the indoor positive pressure are presented on Table 4.1.

This monitoring data will be downloaded monthly to a database and daily average reports will be generated to document that the positive air pressure relative to outdoor air is being adequately maintained. The monthly reports will be submitted with the annual Periodic Review Report (PRR).

4.3.2 Off-Site Sub-Slab Depressurization System Monitoring

The off-Site SSDS will be inspected annually. This inspection is targeted to be performed during the heating season. A copy of the SSDS inspection form is located in Appendix G. Parker and GE will prepare a summary report for the homeowner following the inspection which will document the findings and the condition of the system. The completed inspection form will be included in the subsequent PRR.

Unscheduled inspections may take place when a suspected failure of the off-Site SSDS system has been reported or an emergency occurs that is deemed likely to affect the operation of the system. Off-Site SSDS system components to be monitored include, but are not limited to, the components included in the off-Site SSDS system monitoring requirements and schedule provided as Table 4.2.

A complete list of components to be inspected is provided in the Inspection Checklist, provided in Appendix G. If any equipment readings are not within their specified operation range, any

equipment is observed to be malfunctioning, or the system is not performing within specifications; maintenance and repair, as per the O&M Plan, is required immediately.

4.4 Post-Remediation Media Monitoring and Sampling

Samples shall be collected from the Site groundwater monitoring well network on a routine basis. The initial post injection sampling frequency will be quarterly for 2 years (eight events). After the eighth sample event, a mass reduction evaluation will be completed as described in Section 6.1 to determine if an additional round of injection is required. Once the evaluation is complete, a summary report will be submitted to NYSDEC with a determination of the effectiveness of the remedy and recommendations for either and additional injection/monitoring program or continued monitoring at a revised frequency.

Sampling locations, required analytical parameters, and schedule are provided in Table 4.3. Modification to the sampling requirements as well as the frequency will require approval from the NYSDEC.

The groundwater samples will be analyzed for the following parameters:

Field Parameters:

- *pH*
- *temperature*
- *conductivity*
- *ORP (oxidation reduction potential)*
- *DO (dissolved oxygen)*
- *Turbidity*

VOCs

Natural Attenuation (NA) Parameters:

- Total and dissolved iron, manganese, and sodium
- Ammonia nitrogen
- Sulfate
- Sulfide
- Total Organic Carbon
- Nitrate
- Orthophosphate
- Dissolved gasses (ethane, ethene, and methane)
- Chloride
- Alkalinity

C^{13} compound-specific isotope analysis (CSIA) will also be performed on each VOC of interest (e.g., TCE, cis-1,2-DCE, and VC) annually at monitoring wells MW-4B, MW-6S/6B, MW-14S, MW-15S, and MW-17S.

In addition, analysis for the prevalence of dehalococcoides (DHC) and vinyl chloride reductase (vcr-A) by polymerase chain reaction (PCR) will be conducted at wells MW-4B, MW-6S/6B,

MW-14S, MW-15S, MW-17S, and MW-19S at one year post injection. It is not anticipated that subsequent monitoring will be necessary, but monitoring may be repeated to aid in trouble-shooting if problems are encountered in the remedy.

The monitoring program also includes the collection of two surface water samples from the canal at the following locations:

- Approximately 100 feet upstream of the discharge from the former BTA.
- South of the MW-3 well cluster.

Monitoring of the canal will be performed for VOCs only.

Hydraulic monitoring will be conducted at all monitoring wells in the network on a semiannual basis in the spring and fall.

Detailed sample collection and analytical procedures and protocols are provided in the QAPP.

Any purge water generated during sampling will be drummed for off-Site disposal.

4.4.1 Groundwater Sampling

As part of the groundwater monitoring, 12 program wells and 11 perimeter wells are sampled to evaluate the effectiveness of the remedial system. Groundwater monitoring will be performed quarterly to assess the performance of the remedy, with additional perimeter monitoring wells monitored annually. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The network of monitoring wells has been installed to monitor the plume (program wells) and perimeter wells at the Site and to monitor both the overburden groundwater and bedrock groundwater. Monitoring well locations are shown on Figure 3.2.

Table 4.4 summarizes the wells identification number, location, depths, and screened intervals of the wells. Monitoring well construction logs are included in Appendix C of this document.

If biofouling or silt accumulation occurs in the on-Site and/or off-Site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent PRR. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 7 – Reporting Requirements.

4.4.2 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in the QAPP. Other observations (e.g., groundwater monitoring well integrity, etc.) will also be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the QAPP.

5. Operation and Maintenance Plan

5.1 General

This O&M Plan provides a brief description of the measures necessary to operate, monitor, and maintain the mechanical components of the remedy selected for the Site.

The only mechanical component installed as part of the remedy is the off-Site SSDS. The mechanical components that maintain the positive indoor air pressure are operated and maintained as part of AATech's production operations and were not designed or installed as part of the remedy.

This O&M Plan:

- Includes the procedures necessary to allow individuals unfamiliar with the Site to operate and maintain the off-Site SSDS.
- Will be updated periodically to reflect changes in Site conditions or the manner in which the air pressure manometers or off-Site SSDS are operated and maintained.

5.2 Off-Site Sub-Slab Depressurization System

The remedy set forth in the ROD includes the continued O&M of the SSDS at the residence located at 155 Columbia Street. The activities outlined in this SMP are based on the OBG O&M Plan. The low pressure and high flow centrifugal fan that was installed came with a 5-year manufacturer's warranty and has a 10-year life expectancy. The current fan is greater than 10 years old and is still functioning well. Replacement parts/fan motors are readily available if needed. Maintenance personnel from AATech will conduct any electrical or mechanical repairs if needed.

As part of a long-term O&M program, the property owner assumed primary responsibility for verifying SSDS operation through periodic checks of the U-tube manometer installed at each SSP. If the owner observes a change in manometer reading, they will contact AATech. A telephone number was provided to the owner to be used for maintenance requests.

The owner was also asked to notify AATech in the event that any remodeling of the structure, additions to the structure, or updating of heating units is planned. System modifications and/or re-commissioning may be necessary dependent on the structure change that takes place. These

changes will be evaluated on an individual basis by AATech, and necessary action should be taken such that the system provides effective depressurization as designed and commissioned.

Further detail regarding the O&M of the off-Site SSDS is provided in Appendix I - Operation and Maintenance Manual. A copy of this O&M Manual, along with the complete SMP, is to be maintained at the Site. This O&M Plan is not to be used as a stand-alone document, but as a component document of this SMP.

5.3 Positive Indoor Air Pressure

The air handling system creating the positive indoor air pressure condition was not specifically designed or installed as a remedial system. However, the March 2017 sub-slab and indoor air sampling confirmed that the indoor air pressure maintained by AATech's operations is effective in preventing soil vapor intrusion. Operation and maintenance of the air handling systems is based on AATech's operational requirements. AATech conducts general maintenance (i.e., filter changes) on the heating, ventilation, and cooling (HVAC) system. All other HVAC services are contracted to:

Bricco Enterprises LLC
147 Geneva Street
Clyde, NY 14433
Phone: (315) 923-0002

The BAC Talk instrumentation programming and interfacing for the manometers is provided by:

Pasco
10101 Foothills Blvd.
Roseville, CA 95747
1-800-722-8700 or 916-786-3800
Local – 315-488-0262

If the facility positive pressure environment is completely shut down or there are changes in operations such that the positive pressure environment is determined not to be needed, the potential for soil vapor intrusion will be re-evaluated at that time. Additional indoor air and sub-slab sampling and alternative measures must be implemented if the evaluation indicates the potential for soil vapor intrusion remains.

Since the positive indoor air pressure is a function of AATech's operations, no operational details are included in this SMP. A copy of the BAC Talk Operators Manual is provided as Appendix H for informational purposes.

The condition of the manometers and monitoring points will be inspected as part of the Site-wide inspection discussed in Section 4. Maintenance, repair, or replacement will be conducted as needed.

6. Periodic Assessments/Evaluations

6.1 Mass Reduction Evaluation

After the initial 2-year post injection monitoring period, an evaluation of the treatment program will be performed based on the mass reduction of groundwater contaminants. Mass reduction will be quantified in the following ways:

- Percent removal of individual TCE and daughter products (cis-1,2-DCE, VC, and ethene) will be calculated by comparing the concentrations of these compounds in µg/L to pre-treatment levels. It is anticipated that concentrations of cis-1,2-DCE and/or VC may increase during the initial stages of biotreatment. Concentrations of cis-1,2-DCE and VC typically peak and then decline over time as the remedy progresses toward complete dechlorination to ethene.
- Percent removal of individual TCE and daughter products will be calculated by comparing the molar concentrations of these compounds to pre-treatment levels.
- Preparation of a molar mass balance showing overall reductions in chlorinated compounds.
- Accumulation of free chloride will also be monitored in the treatment area. Free chloride is generated from the reductive dechlorination of TCE and its daughter products. Concentrations of free chloride can be compared to concentrations of sodium to differentiate chloride generated from dechlorination from that produced by road salt. In the latter case, the molar ratio of chloride to sodium will be approximately 1:1.
- Finally, CSIA will be used to confirm biodegradation of TCE and its daughter products. Reductive dechlorination produces a positive shift in the C^{13}/C^{12} isotope ratio in TCE and its daughter products that is not concentration dependent. Thus, this analysis can provide an independent measurement of biodegradation even in situations when contaminant concentrations may be fluctuating due to other causes (e.g., desorption of TCE from soil, dissolution of TCE from residual DNAPL, and/or the production of daughter products from reductive dechlorination).

The evaluation will include the following criteria:

- After the second year of treatment, a reduction in the average TCE concentration of approximately 50 percent should be observed over most of the Site.
- This reduction in the TCE concentration should be accompanied by the generation of daughter products (1,2-cis-DCE, VC, and ethene). A clear pattern of progression along the reductive dechlorination pathway should be evident in the data set over time, such that concentrations of cis-1,2-DCE and VC should show evidence of peaking and then declining as the remedy progresses toward complete dechlorination to ethene. Ethene levels should increase over baseline conditions, although there are also biological and physical processes that can degrade ethene to CO_2, reduce ethene to ethane, or remove ethene from solution via volatilization.
- Chloride should be generated by the reductive dechlorination process and levels of free chloride should increase over baseline conditions.

- The CSIA data should show evidence of enrichment in the C^{13} isotope for TCE, cis-1,2-DCE, and VC as reductive dechlorination advances.
- DHC and vcr-A counts should remain high after amendment with carbon sources and nutrients. The biological activity at the Site is already quite high, so a significant population of DHC is likely already present.

If these criteria are not largely met after the initial 2-year period or if the remedy is judged to be effective but analysis of TOC indicates the aquifer is becoming depleted in biodegradable carbon and significant VOCs continue to persist, additional enhancement will be considered and an additional round of nutrients, potassium lactate, and EVO, and/or bacterial inoculum may be applied. If an additional injection/application is conducted, a second 2-year post injection groundwater monitoring program will be implemented at a reduced frequency followed by a second mass reduction evaluation. If the remedy is judged to be ineffective after the second evaluation, alternate treatment and monitoring programs will be discussed with the NYSDEC based on the Site conditions at that time.

If either the first or second evaluation deems the remedy effective but residual concentrations of contaminants of concern remain, a polishing treatment may be proposed at that time.

6.2 Remedial Site Optimization

A Remedial Site Optimization (RSO) study will be conducted any time that the NYSDEC or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the ROD;
- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;
- There is an anticipated transfer of the Site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a Site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the Site's cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

The RSO study will focus on overall Site cleanup strategy, process optimization and management with the intent of identifying impediments to cleanup and improvements to Site operations to

increase efficiency, cost effectiveness, and remedial time frames. Green remediation technology and principals are to be considered when performing the RSO.

A general outline of the Table of Contents for a RSO Report is provided in Appendix J.

6.3 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns, and wide temperature fluctuation resulting from global climactic change and instability have the potential to significantly impact the performance, effectiveness, and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the Site is prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a summary of vulnerability assessments that will be conducted for the Site during periodic assessments, and briefly summarizes the vulnerability of the Site and/or engineering controls to severe storms/weather events and associated flooding.

The following potential vulnerabilities will be assessed and discussed during periodic reviews:

- Flood Plain: The Site and surrounding area are located within the Seneca-Oneida-Oswego River drainage basin according to the NYSDEC. The Site appears to be entirely in a Zone C floodplain area as depicted on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), Panel Number 360890 0001 B for the Village of Clyde, New York. Floodplain areas designated as Zone C indicate areas of minimal flood hazard.
- Site Drainage and Storm Water Management: The Site is predominately paved and covered by the manufacturing building. Strom water is directed south through the storm sewer system to the Clyde River/Erie Canal. The former BTA is a designated wetland.
- Erosion: There is no evidence of erosion at the Site. The soil cover areas within the former BTA are vegetated to prevent erosion. The covers will be monitored annually during the Site-wide inspection and after major storm events.
- High Wind: There are no remedial systems susceptible to high wind damage present at the Site.
- Electricity: The off-Site SSDS system would be susceptible to power loss during severe storm events. In addition, the air handling units that maintain the positive pressure environment within the AATech manufacturing facility would also be susceptible to power loss during severe storm events.
- Spill/Contaminant Release: There is no remedial system at the Site that would be susceptible to a spill or other contaminant release due to storm-related damage caused by flooding, erosion, high winds, or loss of power.

7. Reporting Requirements

7.1 Site Management Forms

All Site management inspection, maintenance, and monitoring events will be recorded on the appropriate Site management forms provided in Appendix G. Any revisions to these forms must be approved by the NYSDEC.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the Site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 7.1 and summarized in the PRR.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

7.2 Interim Reports

Interim reports, such as groundwater monitoring reports and the mass reduction evaluation report(s) will be submitted to NYSDEC. Groundwater monitoring reports will be submitted once the

groundwater data has been validated. The mass reduction evaluation report(s) will be submitted after the eight post-injection monitoring events. All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc.);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

7.3 Periodic Review Report

A PRR will be submitted to the Department beginning 16 months after the Certificate of Completion (COC) is issued. After submittal of the initial PRR, the next PRR shall be submitted annually to the Department or at another frequency as may be required by the Department. In the event that the Site is subdivided into separate parcels with different ownership, a single PRR will be prepared that addresses the Site described in Appendix A -Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the PRR. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the Site.
- Results of the required annual Site inspections and severe condition inspections, if applicable.
- All applicable Site management forms and other records generated for the Site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.

- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.
- A Site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the Site-specific RD/RA Work Plan, and ROD;
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
  - Any new conclusions or observations regarding Site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan;
  - Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the ROD; and
  - The overall performance and effectiveness of the remedy.

7.3.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a Professional Engineer licensed to practice in New York State will prepare, and include in the PRR, the following certification as per the requirements of NYSDEC DER-10:

"*For each institutional or engineering control identified for the site, I certify that all of the following statements are true:*

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental easement;*

- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program; and*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, _____, of _____, am certifying as Owner's/Remedial Party's Designated Site Representative. I have been authorized and designated by all site owners/remedial parties to sign this certification for the site."

The signed certification will be included in the PRR.

The PRR will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the Site is located, and the NYSDOH Bureau of Environmental Exposure Investigation. The PRR may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

7.4 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Work Plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC.

7.5 Remedial Site Optimization Report

In the event that an RSO is to be performed (see Section 6.2), upon completion of an RSO, an RSO report must be submitted to the Department for approval. A general outline for the RSO report is provided in Appendix J. The RSO report will document the research/investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model, and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs, etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

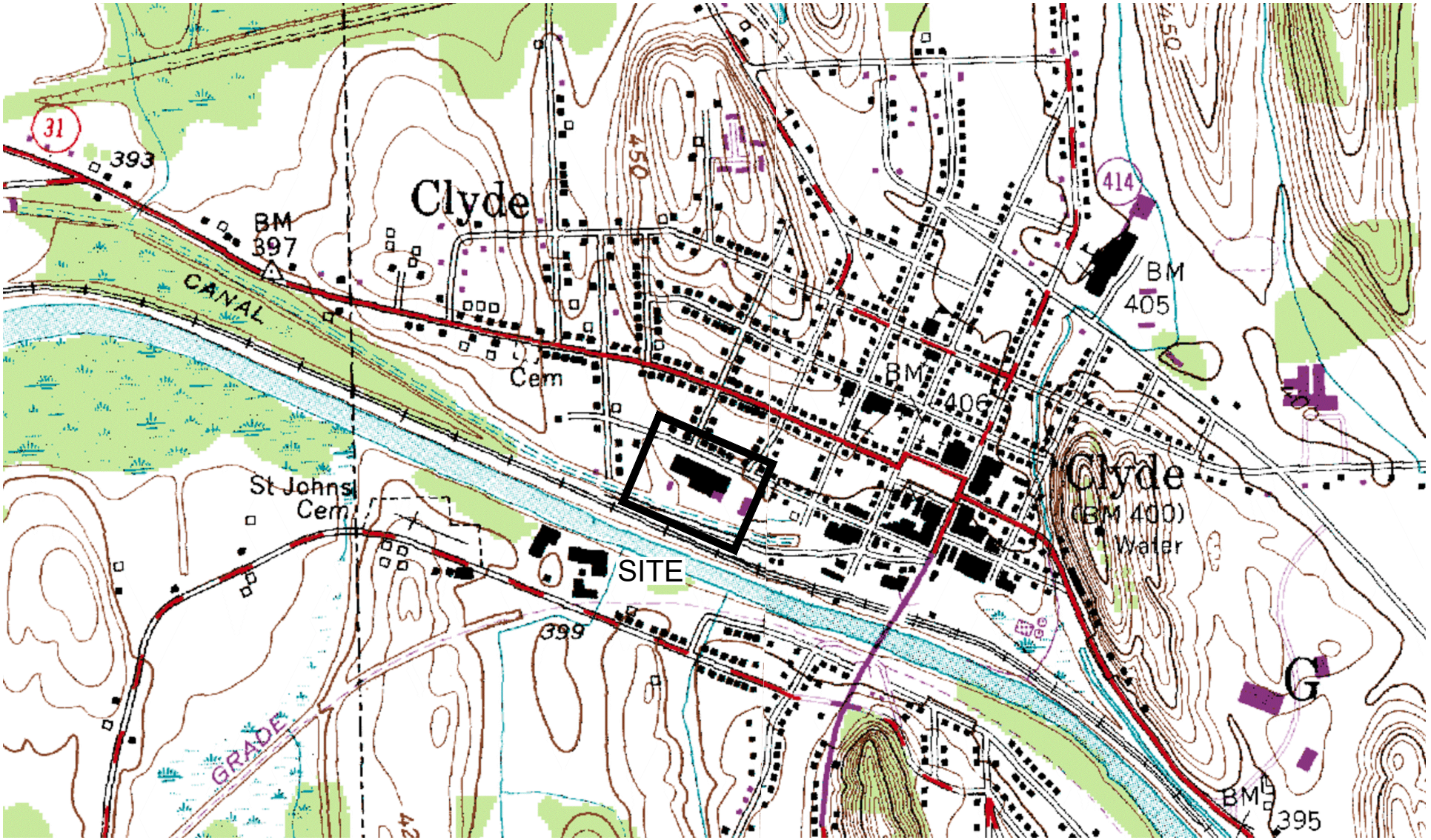
The RSO report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located, Site Control, and the NYSDOH Bureau of Environmental Exposure Investigation.

8. References

- O'Brien and Gere Engineers, Inc., "Remedial Investigation Report, Old Erie Canal Site, Clyde, New York," November 24, 2003.

- O'Brien and Gere Engineers, Inc., "Supplemental Ground Water Investigation Summary Report, Old Erie Canal site, Clyde, New York," March 29, 2007.
- New York State Department of Environmental Conservation, 6 NYCRR Part 375-6 Remedial Program Soil Cleanup Objectives, December 14, 2006 [Part 375].
- New York State Department of Environmental Conservation, New York Stare Stormwater Management Design Manual, dated August 2010.
- Correspondence from K. Galanti, (CRA) to M. P. Gillette, P.E. (NYSDEC), dated July 13, 2010.
- Correspondence from K. Galanti, (CRA) to M. P. Gillette, P.E. (NYSDEC), dated February 15, 2011.
- Correspondence from M. P. Gillette, P.E. (NYSDEC) to K. Galanti, (CRA), dated December 21, 2012.
- Correspondence from K. Galanti, (CRA) to M. P. Gillette, P.E. (NYSDEC), dated January 25, 2013.
- New York State Department of Environmental Conservation, Division of Environmental Remediation, Record of Decision: Old Erie Canal – Village of Clyde Section State Superfund Project, Clyde, Wayne County, Site No. 859015, dated April 2013.
- New York State Department of Environmental Conservation, Order on Consent and Administrative Order: Old Erie Canal – Village of Clyde Section (Site #859015), dated November 2013.
- GHD, “Remedial Design/Remedial Action Work Plan, Old Erie Canal Site, Site No. 859015,” October 21, 2016.
- 6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.
- NYSDEC DER-10 – “Technical Guidance for Site Investigation and Remediation.”
- NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

Figures



GHD

OLD ERIE CANAL SITE

SITE LOCATION MAP

Project No. **35048**
Report No. **009**
Date **JUL 18**

FIGURE 1.1

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Plot Date: 12 November 2021 - 12:38 PM

Source:

LEGEND:

- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY
- WETLAND BOUNDARY

N

0 80'

GHD

OLD ERIE CANAL SITE

SITE LAYOUT

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 1.2

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 1.2.dwg
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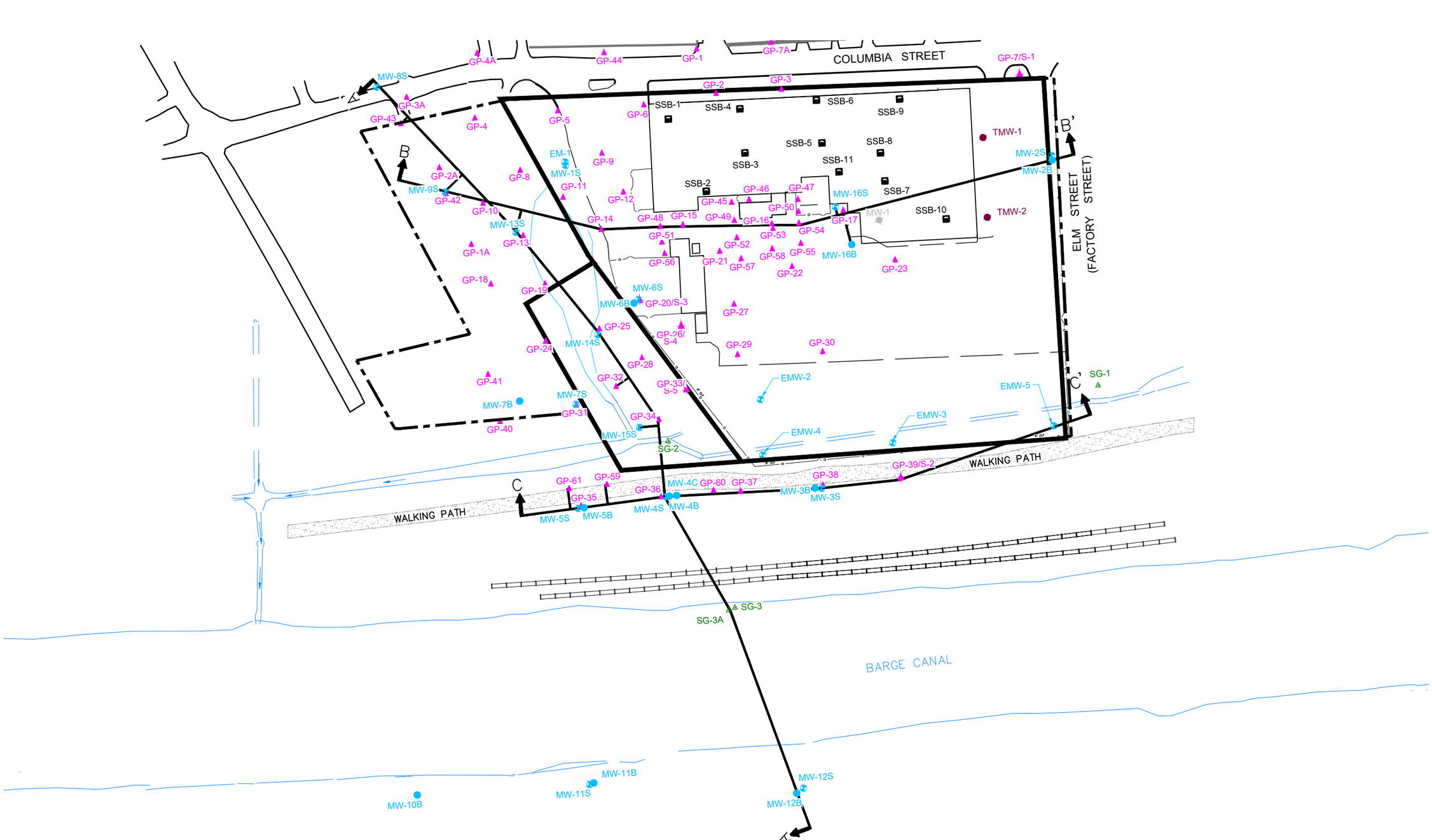

SOURCE:
"SUPPLEMENTAL GROUND WATER INVESTIGATION SUMMARY REPORT", O'BRIEN & GERE ENGINEERS, INC. FEB 12, 2007

LEGEND

- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY
- CANAL
- STORM SEWER
- 48-INCH CMP
- MW-3S — OVERBURDEN MONITORING WELL
- MW-3B — BEDROCK MONITORING WELL
- GP-39 — DIRECT PUSH SAMPLE LOCATION
- GP-7/S-1 — DIRECT PUSH AND SUBSURFACE SOIL SAMPLE LOCATION
- SSB-10 — SUB-SLAB SOIL AND GROUND WATER SAMPLE LOCATION
- TEMPORARY MONITORING WELL
- WELL REMOVED

N

0 120'

GHD

OLD ERIE CANAL SITE

GEOLOGIC CROSS SECTION LOCATION MAP

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 2.1

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.1.dwg
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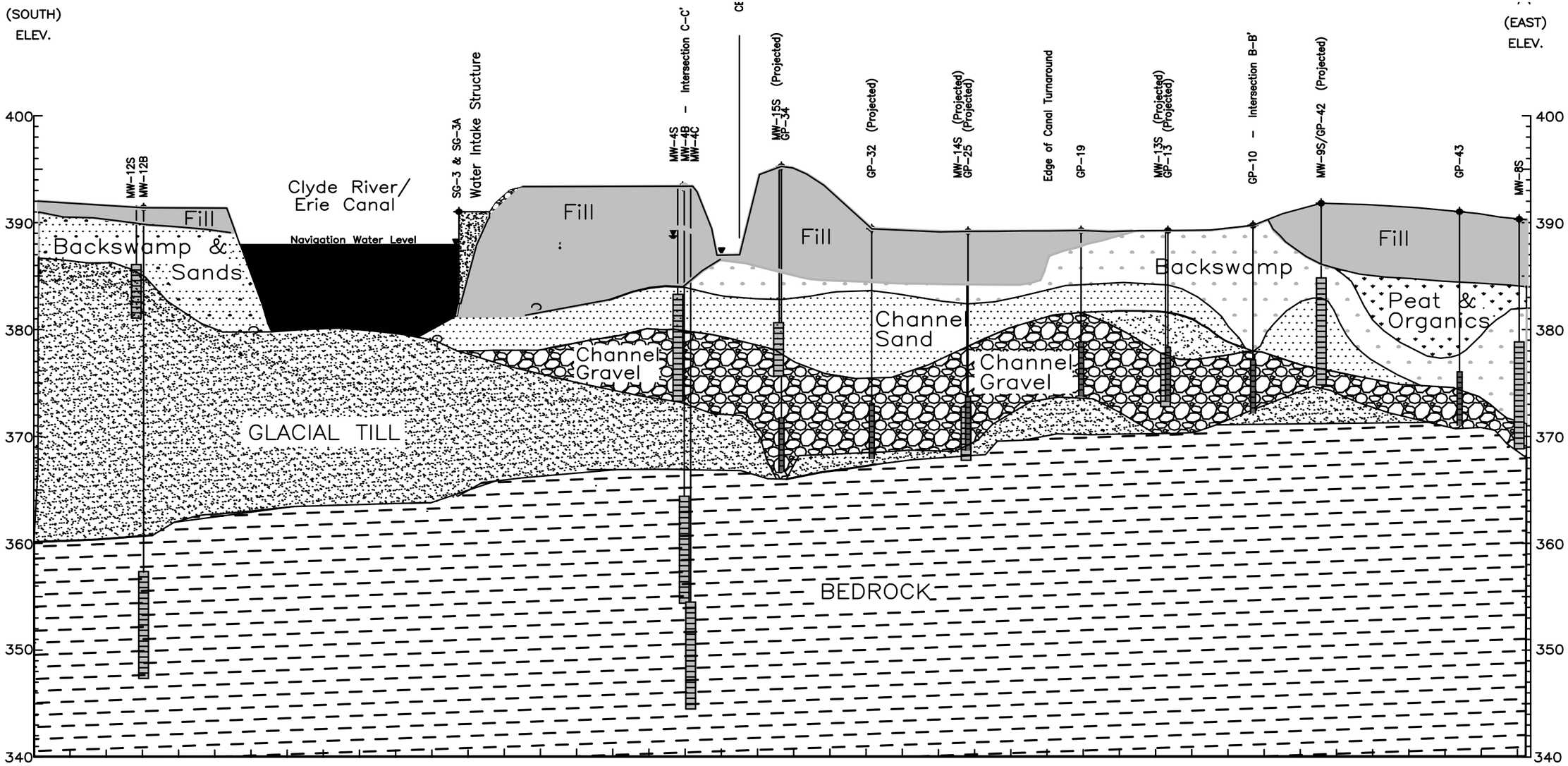


MW-5
MONITORING WELL DESCRIPTION
RISER PIPE
SCREENED SECTION
BACKFILLED SECTION OF BORING
TD = 44.4' TOTAL DEPTH OF BORING (feet below grade)
(391.4) ELEVATION (feet above mean sea level)

GP-39
GEOPROBE WELL IDENTIFICATION
1-INCH PVC RISER PIPE
SCREENED INTERVAL
BACKFILLED SECTION OF BORING
TD = 29.3' TOTAL DEPTH OF BORING (feet below grade)
(395.3) ELEVATION (feet above mean sea level)

FILL: Black to Brownish Black Cinders, Ash, Slag, Brick and Glass Mixed with Gravel Sand and Silt.

PEAT AND ORGANIC DEPOSITS: Brown Silt, organics, leaves and wood.

BACKSWAMP DEPOSITS: Yellowish Gray to Olive, Interbedded Silt and Clay Layers and Laminae.

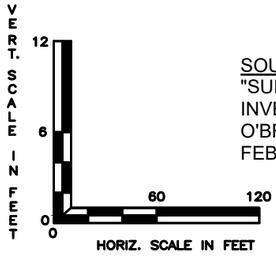
CHANNEL SANDS: Yellowish Brown to Gray, Medium to Fine Grained Sand

CHANNEL GRAVEL: Gray to Dark Gray Poorly Sorted, Coarse to Fine grained Gravel, Sand and Silt.

REWORKED GLACIAL TILL: Reddish Brown Clayey Silt with Some Coarse to Fine Sand and Little Gravel and Organics.

GLACIAL TILL: Reddish Brown Clayey Silt with Some Coarse to Fine Sand and Little Gravel, Very Dense, Dry.

Bedrock: Dark Gray to Greenish Gray Medium to Fine grained Shale with Interbedded Layers of Dolomitic Limestone and Gypsum Stringers



SOURCE:
"SUPPLEMENTAL GROUND WATER INVESTIGATION SUMMARY REPORT", O'BRIEN & GERE ENGINEERS, INC. FEB 12, 2007

OLD ERIE CANAL SITE

NORTH-SOUTH GEOLOGIC CROSS SECTION A-A'

Project No. 35048
Report No. 009
Date JUL 18

FIGURE 2.2

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.2.dwg
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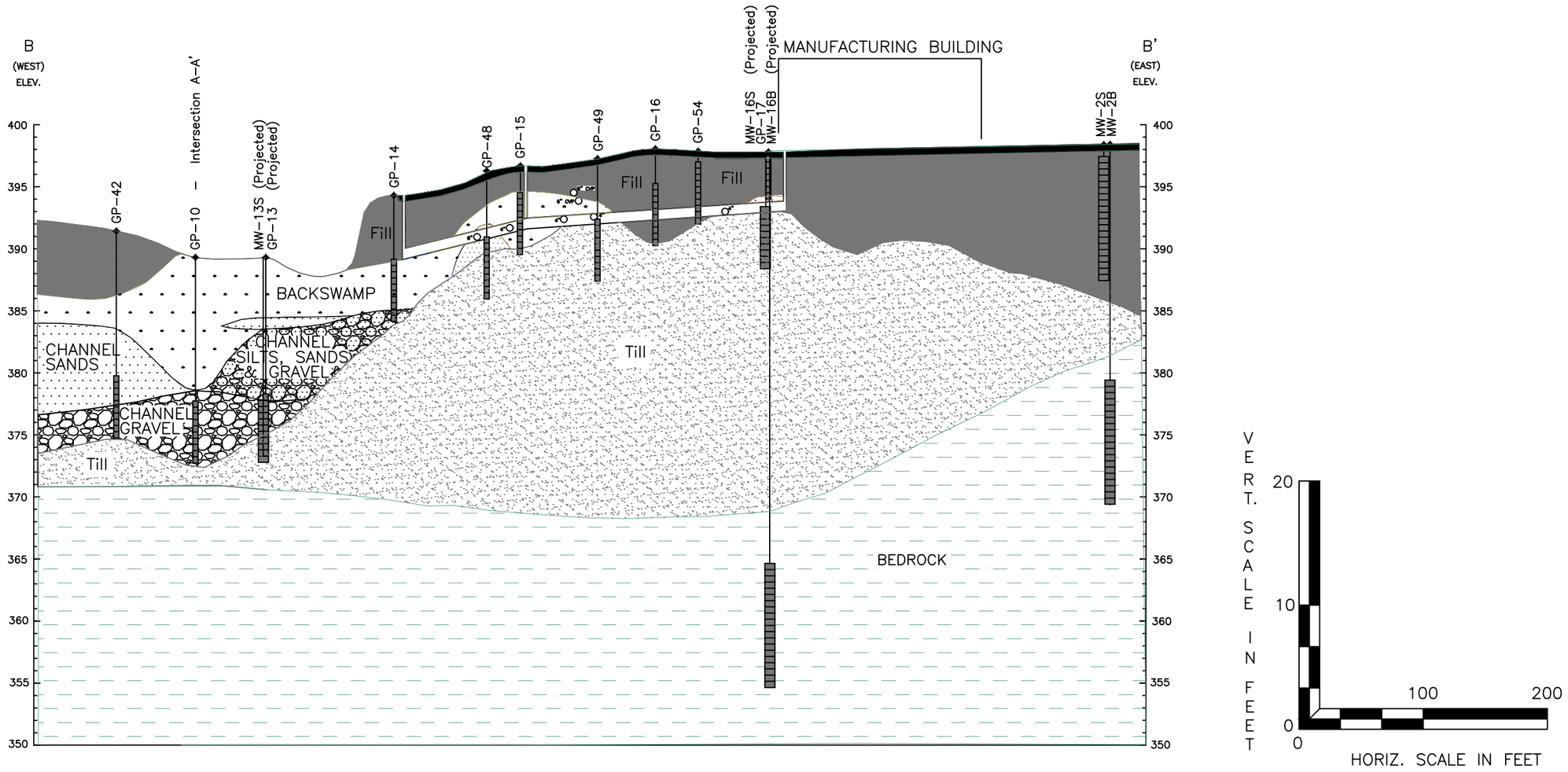

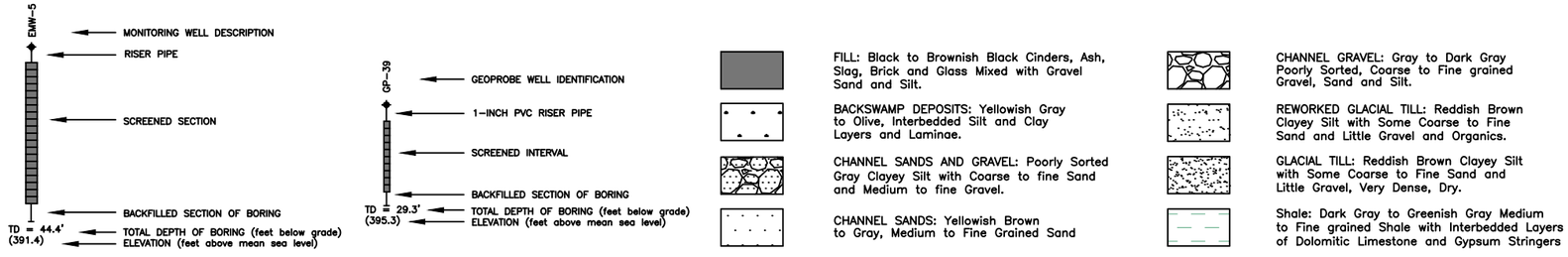

SOURCE:
"SUPPLEMENTAL GROUND WATER INVESTIGATION SUMMARY REPORT", O'BRIEN & GERE ENGINEERS, INC. FEB 12, 2007

OLD ERIE CANAL SITE

EAST-WEST GEOLOGIC CROSS SECTION B-B'

Project No. **35048**
Report No. **009**
Date **JUL 18**

FIGURE 2.3

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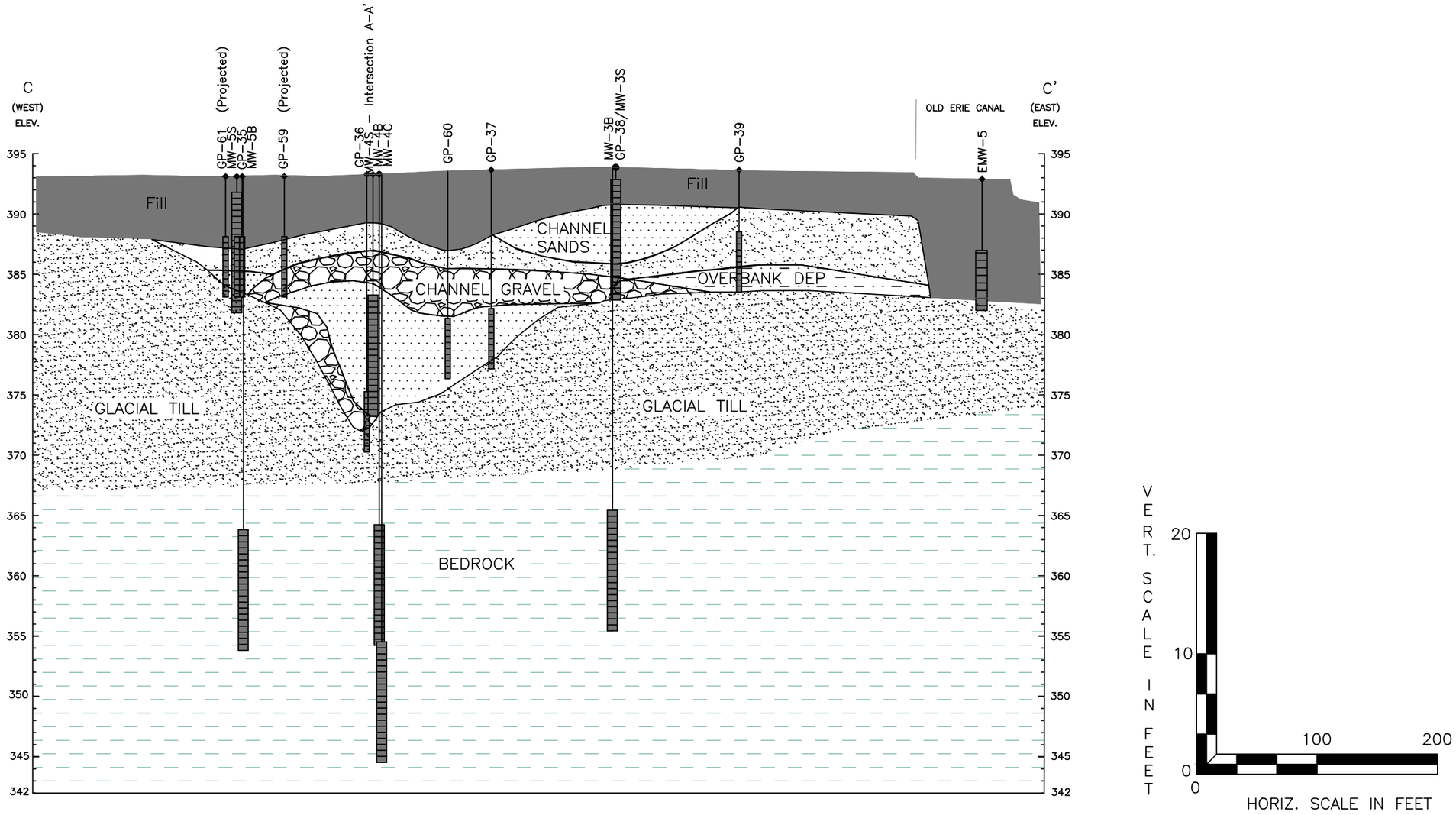

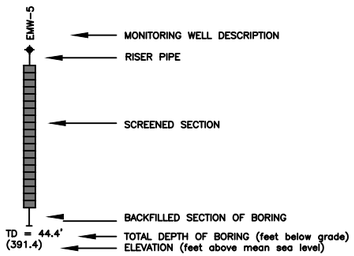

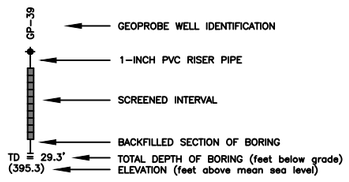

FILL: Black to Brownish Black Cinders, Ash, Slag, Brick and Glass Mixed with Gravel Sand and Silt.

OVERBANK DEPOSITS: organics, leaves and wood.

BACKSWAMP DEPOSITS: Yellowish Gray to Olive, Interbedded Silt and Clay Layers and Laminae.

CHANNEL SANDS: Yellowish Brown to Gray, Medium to Fine Grained Sand

CHANNEL GRAVEL: Gray to Dark Gray Poorly Sorted, Coarse to Fine grained Gravel, Sand and Silt.

REWORKED GLACIAL TILL: Reddish Brown Clayey Silt with Some Coarse to Fine Sand and Little Gravel and Organics.

GLACIAL TILL: Reddish Brown Clayey Silt with Some Coarse to Fine Sand and Little Gravel, Very Dense, Dry.

Shale: Dark Gray to Greenish Gray Medium to Fine grained Shale with Interbedded Layers of Dolomitic Limestone and Gypsum Stringers

SOURCE:
"SUPPLEMENTAL GROUND WATER INVESTIGATION SUMMARY REPORT", O'BRIEN & GERE ENGINEERS, INC. FEB 12, 2007

OLD ERIE CANAL SITE

EAST-WEST GEOLOGIC CROSS SECTION C-C'

Project No. **35048**
Report No. **009**
Date **JUL 18**

FIGURE 2.4

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.4.dwg
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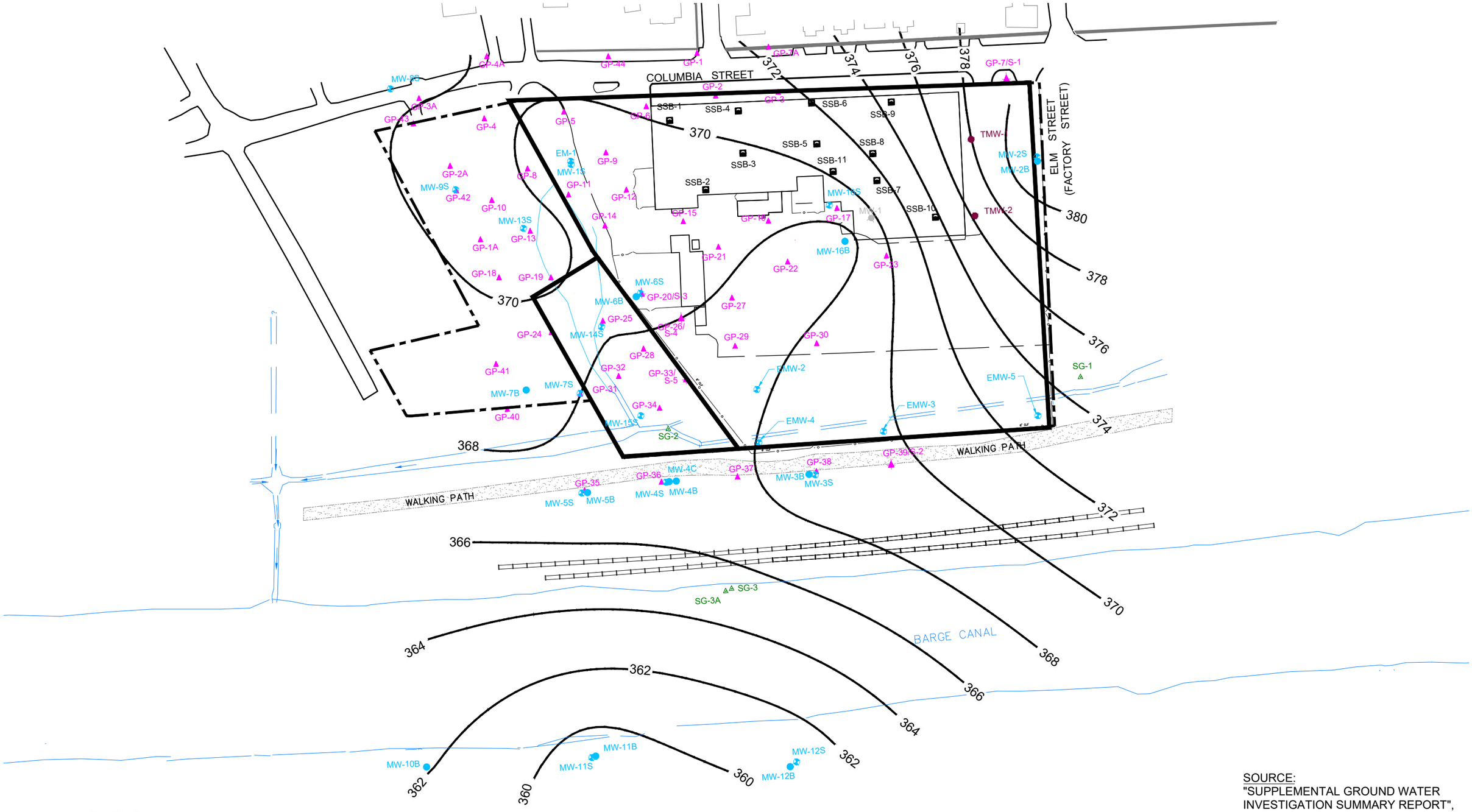

LEGEND

- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY
- CANAL
- STORM SEWER
- 48-INCH CMP
- MW-3B — BEDROCK MONITORING WELL
- GP-39 — DIRECT PUSH SAMPLE LOCATION
- OVERBURDEN MONITORING WELL
- GP-7/S-1 — DIRECT PUSH AND SUBSURFACE SOIL SAMPLE LOCATION
- SSB-10 — SUB-SLAB SOIL AND GROUND WATER SAMPLE LOCATION
- TEMPORARY MONITORING WELL
- TEMPORARY MONITORING WELL INSTALLED DURING
- REMOVED WELL

SOURCE:
"SUPPLEMENTAL GROUND WATER INVESTIGATION SUMMARY REPORT", O'BRIEN & GERE ENGINEERS, INC. FEB 12, 2007

N

0 120'

GHD

OLD ERIE CANAL SITE

BEDROCK SURFACE CONTOURS

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 2.5

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.5.dwg
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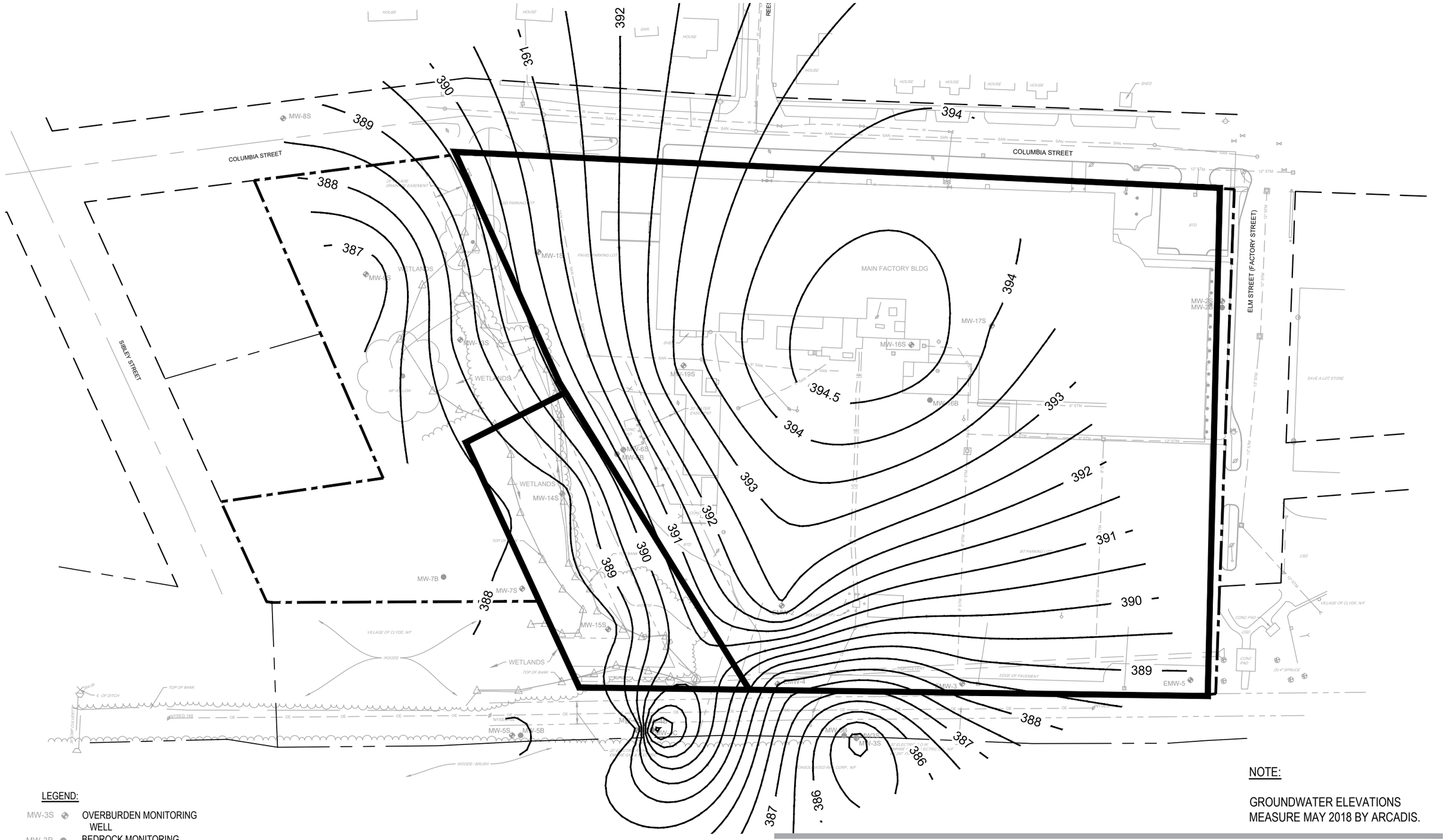

LEGEND:

- MW-3S — OVERBURDEN MONITORING WELL
- MW-3B — BEDROCK MONITORING WELL
- WETLAND BOUNDARY
- SITE BOUNDARY
- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY

NOTE:

GROUNDWATER ELEVATIONS MEASURE MAY 2018 BY ARCADIS.

N

0 80'

GHD

OLD ERIE CANAL SITE

OVERBURDEN GROUNDWATER CONTOURS MAY 2018

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 2.6

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.6.dwg
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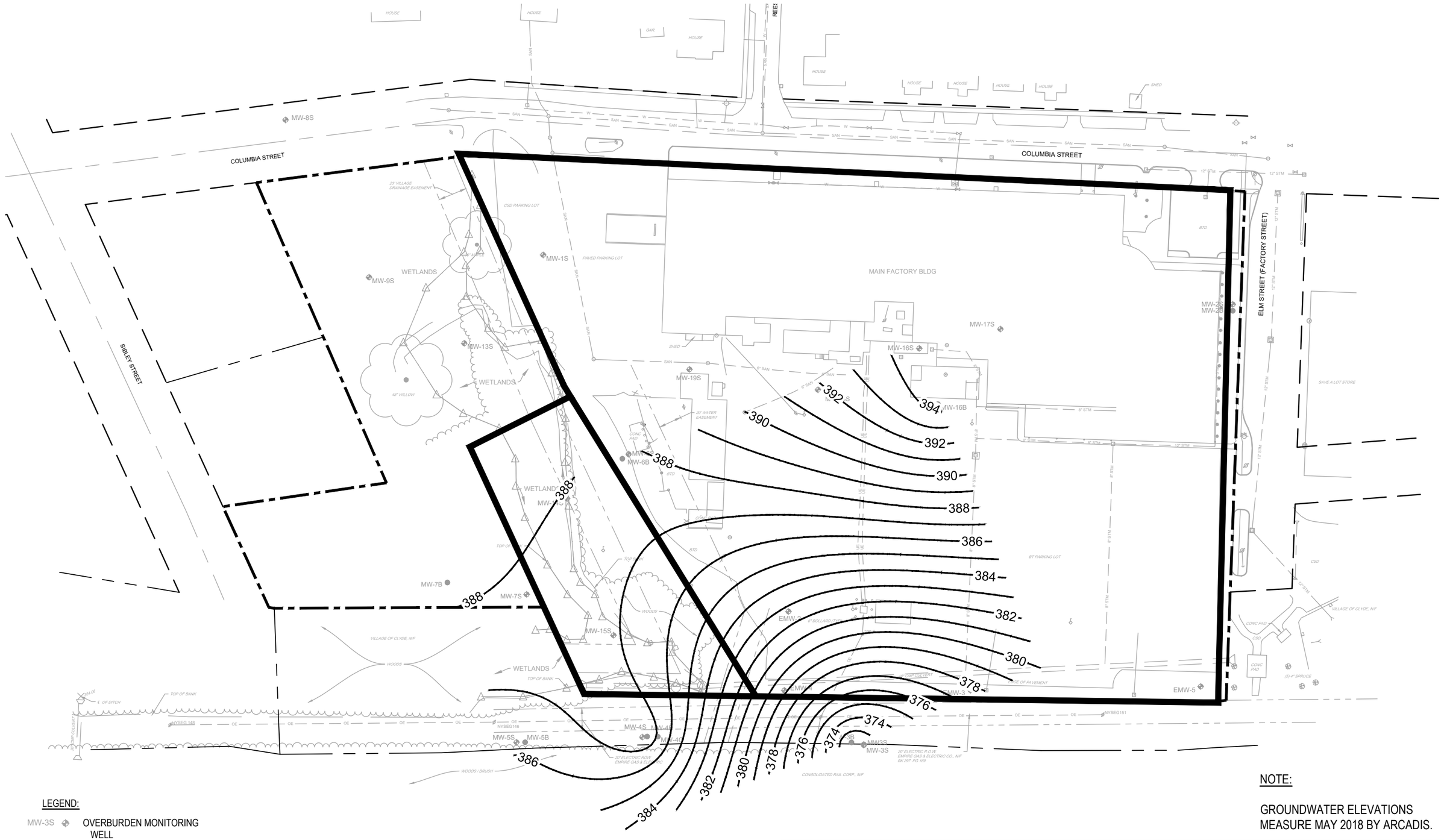


LEGEND:

- MW-3S — OVERBURDEN MONITORING WELL
- MW-3B — BEDROCK MONITORING WELL
- WETLAND BOUNDARY
- SITE BOUNDARY
- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY

NOTE:

GROUNDWATER ELEVATIONS MEASURE MAY 2018 BY ARCADIS.

N

0 80'

GHD

OLD ERIE CANAL SITE

BEDROCK GROUNDWATER CONTOURS MAY 2018

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 2.7

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.7.dwg
Plot Date: 12 November 2021 - 12:42 PM

Source:

	Sample Location:	SS-01
	Sample Date:	5/21/2002
Constituent	UNRESTRICTED USE SCO (1)	Units	
4,4'DDD	3.3	µg/Kg	480 J
4,4'DDE	3.3	µg/Kg	2100 J
4,4'-DDT	3.3	µg/Kg	370 J

	Sample Location:	GP-20	GP-20
	Sample Depth (ft. bgs):	12-16	12-16
	Sample Date:	5/1/2002	5/1/2002
			Duplicate
Compound	UNRESTRICTED USE (1)	Units		
cis-1,2-DCE	250	µg/Kg	8900	14000
Toluene	700	µg/Kg	4300 B	
Trichloroethene	470	µg/Kg		590 J
Vinyl chloride	20	µg/Kg	460 J	1200 J

	Sample Location:	GP-26
	Sample Depth (ft. bgs):	12-14
	Sample Date:	4/30/2002
Compound	UNRESTRICTED USE (1)	Units	
Methylene chloride	50	µg/Kg	89
Vinyl chloride	20	µg/Kg	84

	Sample Location:	SSB-3	SSB-3
	Sample Depth (ft. bgs):	4-6	4-6
	Sample Date:	1/2005	1/2005
			Duplicate
Compound	UNRESTRICTED USE (1)	Units		
Acetone	50	µg/Kg	630 J	570
cis-1,2-DCE	250	µg/Kg	1600 J	1300
Vinyl chloride	20	µg/Kg	560 J	120 J

	Sample Location:	SSB-6
	Sample Depth (ft. bgs):	4-6
	Sample Date:	1/2005
Compound	UNRESTRICTED USE (1)	Units	
cis-1,2-DCE	250	µg/Kg	1200 J
Vinyl chloride	20	µg/Kg	210

	Sample Location:	SSB-5
	Sample Depth (ft. bgs):	4-6
	Sample Date:	1/2005
Compound	UNRESTRICTED USE (1)	Units	
Acetone	50	µg/Kg	130

	Sample Location:	SSB-9
	Sample Depth (ft. bgs):	2-4
	Sample Date:	1/2005
Compound	UNRESTRICTED USE (1)	Units	
Acetone	50	µg/Kg	320

	Sample Location:	SED 06
	Sample Date:	5/21/2002
Constituent	UNRESTRICTED USE SCO (1)	Units	
Arsenic	13	mg/Kg	113 J
Barium	350	mg/Kg	391 J
Cadmium	2.5	mg/Kg	85.7 J
Chromium	30	mg/Kg	209 J
Copper	50	mg/Kg	139 J
Lead	63	mg/Kg	183 J
Manganese	1600	mg/Kg	1640 J
Nickel	30	mg/Kg	78.7 J
Selenium	3.9	mg/Kg	6.9 J
Mercury	0.18	mg/Kg	0.889 J
Silver	2	mg/Kg	6.3 J
Zinc	109	mg/Kg	812 J
Benzo(b)fluoranthene	1000	µg/Kg	1400 J
Indeno(1,2,3-cd)pyrene	500	µg/Kg	670 J

	Sample Location:	SSB-8
	Sample Depth (ft. bgs):	8.9.3
	Sample Date:	1/2005
Compound	UNRESTRICTED USE (1)	Units	
cis-1,2-DCE	250	µg/Kg	680
Trichloroethene	470	µg/Kg	6200 J

	Sample Location:	SSB-7
	Sample Depth (ft. bgs):	8.3-9.3
	Sample Date:	1/2005
Compound	UNRESTRICTED USE (1)	Units	
cis-1,2-DCE	250	µg/Kg	10000 J
Trichloroethene	470	µg/Kg	130000 J

	Sample Location:	GP-25
	Sample Depth (ft. bgs):	8-12
	Sample Date:	4/26/2002
Compound	UNRESTRICTED USE (1)	Units	
cis-1,2-DCE	250	µg/Kg	700 J
Trichloroethene	470	µg/Kg	4700
Lead	29.1	63	1480

	Sample Location:	GP-16
	Sample Depth (ft. bgs):	8-12
	Sample Date:	5/2/2002
Compound	UNRESTRICTED USE (1)	Units	
cis-1,2-DCE	250	µg/Kg	1400
Trichloroethene	470	µg/Kg	2100

	Sample Location:	GP-33
	Sample Depth (ft. bgs):	12-16
	Sample Date:	4/30/2002
Compound	UNRESTRICTED USE (1)	Units	
Methylene chloride	50	µg/Kg	200
Vinyl chloride	20	µg/Kg	25 J

	Sample Location:	GP-32
	Sample Depth (ft. bgs):	12-16
	Sample Date:	4/23/2002
Compound	UNRESTRICTED USE (1)	Units	
cis-1,2-DCE	250	µg/Kg	2400
Methylene chloride	50	µg/Kg	180 J
Vinyl chloride	20	µg/Kg	200 J

	Sample Location:	SED 07
	Sample Date:	5/21/2002
Constituent	UNRESTRICTED USE SCO (1)	Units	
Arsenic	13	mg/Kg	102 J
Barium	350	mg/Kg	456 J
Cadmium	2.5	mg/Kg	60.1 J
Chromium	30	mg/Kg	159 J
Copper	50	mg/Kg	103 J
Lead	63	mg/Kg	134 J
Nickel	30	mg/Kg	58.9 J
Selenium	3.9	mg/Kg	7.2 J
Mercury	0.18	mg/Kg	0.284 J
Silver	2	mg/Kg	4.4 J
Zinc	109	mg/Kg	646 J

LEGEND:

- SURFACE SOIL LOCATION
- GP-39 ▲ DIRECT PUSH SAMPLE LOCATION
- GP-7/S-1 DIRECT PUSH AND SUBSURFACE SOIL SAMPLE LOCATION
- SSB-6 SUB-SLAB SOIL AND GROUNDWATER SAMPLE LOCATION
- SED 7N SHALLOW SOIL SAMPLE LOCATION
- WETLAND BOUNDARY
- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY

N

0 80'

GHD

OLD ERIE CANAL SITE

REMAINING CONTAMINANT CONCENTRATIONS EXCEEDING UNRESTRICTED USE SOIL CLEANUP OBJECTIVES IN SOIL

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 2.8

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.8.dwg
Plot Date: 12 November 2021 - 12:43 PM

Source:

	Sample Location	SED 6E
	Sample Date:	8/29/2014
Constituent	Industrial Use (1)	Units	
Benzo(a)pyrene	1100	µg/Kg	1800

	Sample Location	SED 6N
	Sample Date:	8/29/2014
Constituent	Industrial Use (1)	Units	
Arsenic	16	mg/Kg	22

	Sample Location	SED 06
	Sample Date:	5/21/2002
Constituent	Industrial Use (1)	Units	
Arsenic	16	mg/Kg	113 J
Cadmium	60	mg/Kg	85.7 J

	Sample Location	SED 6S
	Sample Date:	8/29/2014
Constituent	Industrial Use (1)	Units	
Arsenic	16	mg/Kg	29

	Sample Location	SED 7N
	Sample Date:	8/29/2014
Constituent	Industrial Use (1)	Units	
Benzo(a)pyrene	1100	µg/Kg	2300

	Sample Location	SED 07
	Sample Date:	5/21/2002
Constituent	Industrial Use (1)	Units	
Arsenic	16	mg/Kg	102 J
Cadmium	60	mg/Kg	60.1 J

COLUMBIA STREET

COLUMBIA STREET

ELM STREET (FACTORY STREET)

MAIN FACTORY BLDG

WETLANDS

WETLANDS

WETLANDS

WETLANDS

GP-1 GP-2A GP-3A GP-4 GP-4A GP-5 GP-6 GP-7/S-1 GP-8 GP-9 GP-10 GP-11 GP-12 GP-13 GP-14 GP-15 GP-16 GP-17 GP-18 GP-19 GP-20/S-3 GP-21 GP-22 GP-23 GP-24 GP-25 GP-26/S-4 GP-27 GP-28 GP-29 GP-30 GP-31 GP-32 GP-33/S-5 GP-34 GP-35 GP-36 GP-37 GP-38 GP-39/S-2 GP-40 GP-41 GP-42 GP-43

SS-1

SSB-1 SSB-2 SSB-3 SSB-4 SSB-5 SSB-6 SSB-7 SSB-8 SSB-9 SSB-10 SSB-11

BH-101 BH-102 BH-103 BH-104 BH-105 BH-106 BH-107

SED 6E SED 6C SW / SED 6 SED 6S SED 6W SW/SED-6

SED 7N SED 7C SW / SED 7 SED 7E SED 7W SW/SED-7 SED 7S

SW/SED-3 SW/SED-4 SW/SED-8 SW/SED-9

LEGEND:

- SURFACE SOIL LOCATION
- GP-39 DIRECT PUSH SAMPLE LOCATION
- GP-7/S-1 DIRECT PUSH AND SUBSURFACE SOIL SAMPLE LOCATION
- SSB-6 SUB-SLAB SOIL AND GROUNDWATER SAMPLE LOCATION
- SED 7N SHALLOW SOIL SAMPLE LOCATION
- WETLAND BOUNDARY
- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY

N

0 80'

GHD

OLD ERIE CANAL SITE

REMAINING CONTAMINANT CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVES IN SOIL

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 2.9

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.9.dwg
Plot Date: 12 November 2021 - 12:43 PM

Source:

	Sample Location:	SS-01
	Sample Date:	5/21/2002
Constituent	UNRESTRICTED USE SCO (1)	Units	
4,4'DDD	3.3	µg/Kg	480 J
4,4'DDE	3.3	µg/Kg	2100 J
4,4'-DDT	3.3	µg/Kg	370 J

	Sample Location:	SED 06
	Sample Date:	5/21/2002
Constituent	UNRESTRICTED USE SCO (1)	Units	
Arsenic	13	mg/Kg	113 J
Barium	350	mg/Kg	391 J
Cadmium	2.5	mg/Kg	85.7 J
Chromium	30	mg/Kg	209 J
Copper	50	mg/Kg	139 J
Lead	63	mg/Kg	183 J
Manganese	1600	mg/Kg	1640 J
Nickel	30	mg/Kg	78.7 J
Selenium	3.9	mg/Kg	6.9 J
Mercury	0.18	mg/Kg	0.889 J
Silver	2	mg/Kg	6.3 J
Zinc	109	mg/Kg	812 J
Benzo(b)fluoranthene	1000	µg/Kg	1400 J
Indeno(1,2,3-cd)pyrene	500	µg/Kg	670 J

	Sample Location:	SED 07
	Sample Date:	5/21/2002
Constituent	UNRESTRICTED USE SCO (1)	Units	
Arsenic	13	mg/Kg	102 J
Barium	350	mg/Kg	456 J
Cadmium	2.5	mg/Kg	60.1 J
Chromium	30	mg/Kg	159 J
Copper	50	mg/Kg	103 J
Lead	63	mg/Kg	134 J
Nickel	30	mg/Kg	58.9 J
Selenium	3.9	mg/Kg	7.2 J
Mercury	0.18	mg/Kg	0.284 J
Silver	2	mg/Kg	4.4 J
Zinc	109	mg/Kg	646 J

	Sample Location:	SED 03
	Sample Date:	5/21/2002
Constituent	UNRESTRICTED USE SCO (1)	Units	
Lead	63	mg/Kg	102 J
Mercury	0.18	mg/Kg	0.622 J
Zinc	109	mg/Kg	1060 J
4,4'DDD	3.3	µg/Kg	58 J
4,4'DDE	3.3	µg/Kg	79 J
4,4'-DDT	3.3	µg/Kg	58 J
Benzo(b)fluoranthene	1000	µg/Kg	1400 J
Benzo(k)fluoranthene	800	µg/Kg	900 J
Chrysene	1000	µg/Kg	1100 J

LEGEND:

- SURFACE SOIL LOCATION
- WETLAND BOUNDARY
- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY
- SED 9 SHALLOW SOIL SAMPLE LOCATION

N

0 80'

GHD

OLD ERIE CANAL SITE

REMAINING CONTAMINANT CONCENTRATIONS EXCEEDING UNRESTRICTED USE SOIL CLEANUP OBJECTIVES IN SURFACE SOIL

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 2.9A

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.9A.dwg
Plot Date: 12 November 2021 - 12:43 PM

Source:

Sample Location:			MW-13S
Sample Date:			05/09/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
cis-1,2-Dichloroethene	5	ug/L	10,100
trans-1,2-Dichloroethene	5	ug/L	30.7
Trichloroethene	5	ug/L	8.1 J
Vinyl chloride	2	ug/L	531

Sample Location:			MW-01S
Sample Date:			05/10/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
1,1-Dichloroethene	5	ug/L	7.2 [7.0]
cis-1,2-Dichloroethene	5	ug/L	1,140 [1,160]
Tetrachloroethene	5	ug/L	28.7 [25.2]
trans-1,2-Dichloroethene	5	ug/L	72.2 [68.5]
Trichloroethene	5	ug/L	697 [695]
Vinyl chloride	2	ug/L	111 [107]

Sample Location:			MW-19S
Sample Date:			05/09/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
1,1-Dichloroethane	5	ug/L	16.7
cis-1,2-Dichloroethene	5	ug/L	630
Tetrachloroethene	5	ug/L	6.9
trans-1,2-Dichloroethene	5	ug/L	7.4
Trichloroethene	5	ug/L	240
Vinyl chloride	2	ug/L	133

Sample Location:			MW-18S
Sample Date:			05/11/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
cis-1,2-Dichloroethene	5	ug/L	174
Vinyl chloride	2	ug/L	15.5

Sample Location:			MW-16S
Sample Date:			08/31/17
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
Vinyl chloride	2	ug/L	1.8 [2.1]

Sample Location:			MW-17S
Sample Date:			05/10/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
cis-1,2-Dichloroethene	5	ug/L	62.6
Vinyl chloride	2	ug/L	58.3

Sample Location:			MW-06S
Sample Date:			05/11/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
cis-1,2-Dichloroethene	5	ug/L	28,300
Ethylbenzene	5	ug/L	35.1 J
m&p-Xylenes	5	ug/L	205
o-Xylene	5	ug/L	37.1 J
Toluene	5	ug/L	7,910
Total Xylenes	5	ug/L	242
trans-1,2-Dichloroethene	5	ug/L	107
Vinyl chloride	2	ug/L	34,800

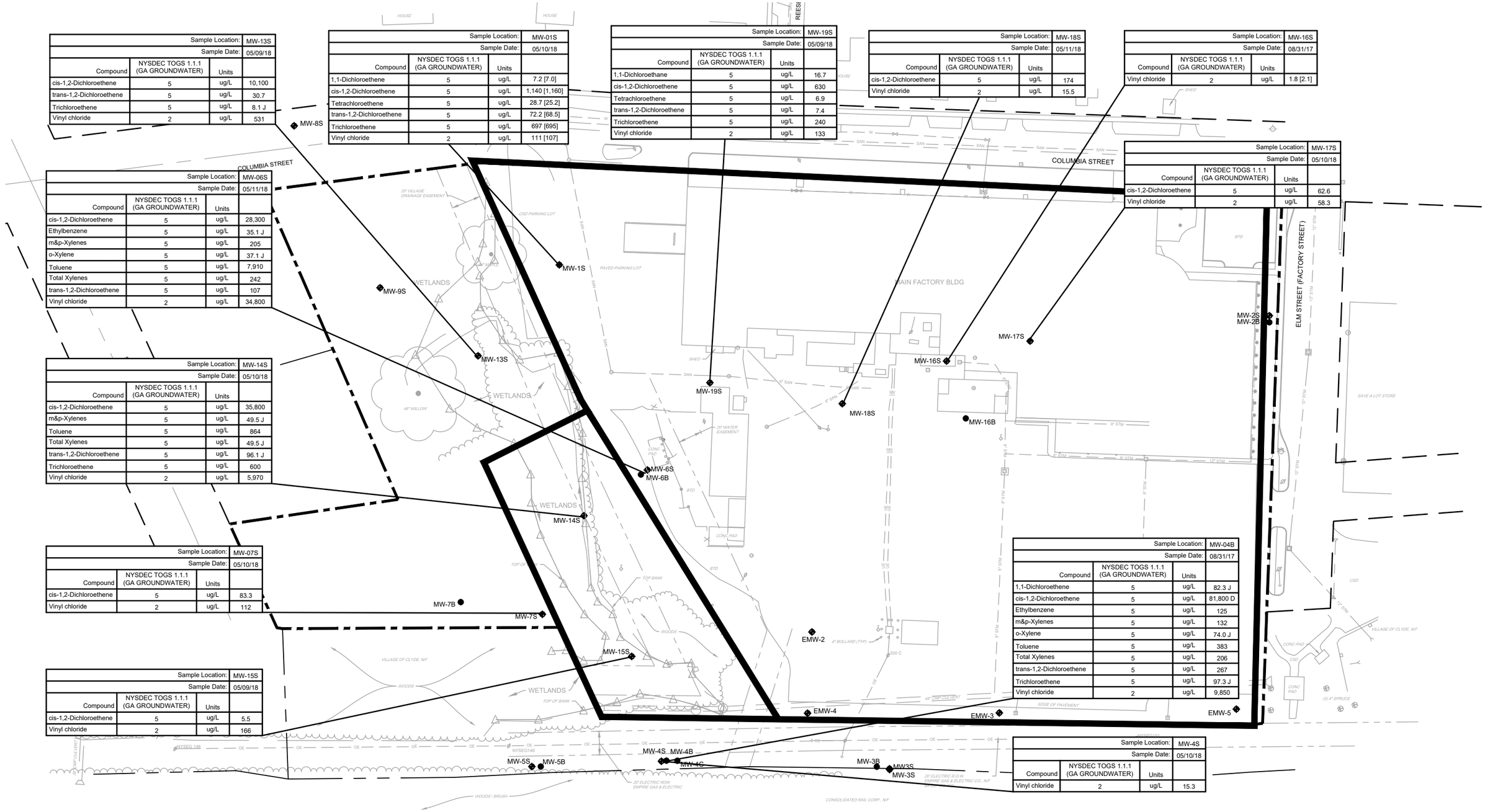
Sample Location:			MW-14S
Sample Date:			05/10/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
cis-1,2-Dichloroethene	5	ug/L	35,800
m&p-Xylenes	5	ug/L	49.5 J
Toluene	5	ug/L	864
Total Xylenes	5	ug/L	49.5 J
trans-1,2-Dichloroethene	5	ug/L	96.1 J
Trichloroethene	5	ug/L	600
Vinyl chloride	2	ug/L	5,970

Sample Location:			MW-07S
Sample Date:			05/10/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
cis-1,2-Dichloroethene	5	ug/L	83.3
Vinyl chloride	2	ug/L	112

Sample Location:			MW-15S
Sample Date:			05/09/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
cis-1,2-Dichloroethene	5	ug/L	5.5
Vinyl chloride	2	ug/L	166

Sample Location:			MW-04B
Sample Date:			08/31/17
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
1,1-Dichloroethene	5	ug/L	82.3 J
cis-1,2-Dichloroethene	5	ug/L	81,800 D
Ethylbenzene	5	ug/L	125
m&p-Xylenes	5	ug/L	132
o-Xylene	5	ug/L	74.0 J
Toluene	5	ug/L	383
Total Xylenes	5	ug/L	206
trans-1,2-Dichloroethene	5	ug/L	267
Trichloroethene	5	ug/L	97.3 J
Vinyl chloride	2	ug/L	9,850

Sample Location:			MW-4S
Sample Date:			05/10/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units	
Vinyl chloride	2	ug/L	15.3



LEGEND:

- MW-3S ◆ OVERBURDEN MONITORING WELL
- MW-3B ● BEDROCK MONITORING WELL
- WETLAND BOUNDARY
- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY

N

0 80'

GHD

OLD ERIE CANAL SITE

REMAINING CONTAMINATION IN GROUNDWATER - GROUNDWATER MONITORING RESULTS EXCEEDING AMBIENT GROUNDWATER QUALITY STANDARDS - MAY 2018

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 2.10

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.10.dwg
Plot Date: 12 November 2021 - 12:43 PM

Source:

Compound	Units	NYSDOH Air Guideline Value (µg/m3)	Sample Location A Northwest Column 17A and 17 SV-04	IA-04
1,1-Dichloroethene	ug/m3	NC	ND 0.79	ND 0.79
trans-1,2-Dichloroethene	ug/m3	NC	12	93.2
cis-1,2-Dichloroethene	ug/m3	NC	6.3	0.52J
Toluene	ug/m3	NC	3.5	4.1
Trichloroethene	ug/m3	2	107	0.47
Vinyl chloride	ug/m3	NC	ND 0.10	ND 0.10
m.p-Xylene	ug/m3	NC	3.5	4.3
o-Xylene	ug/m3	NC	1.9	1.7

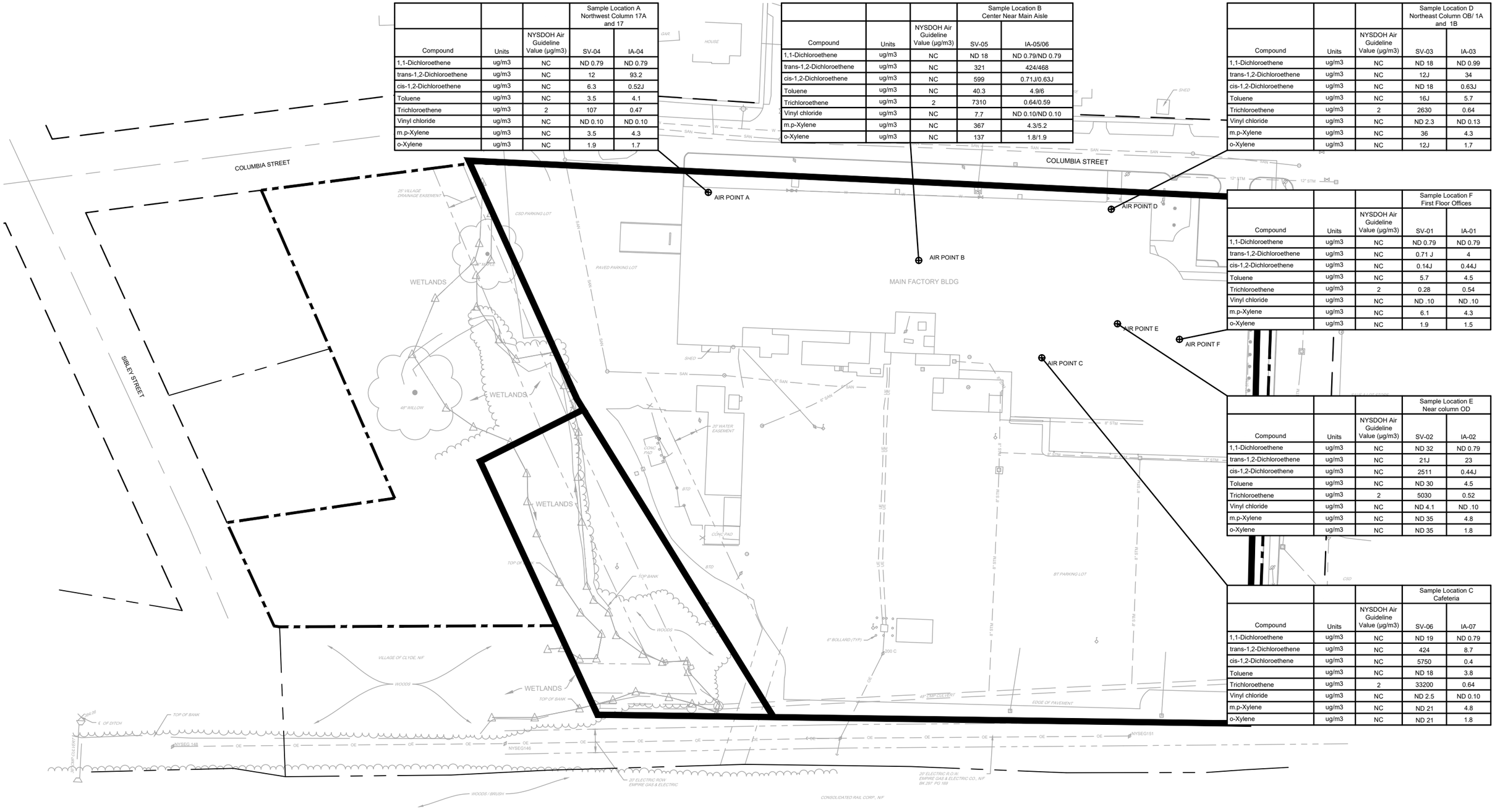
Compound	Units	NYSDOH Air Guideline Value (µg/m3)	Sample Location B Center Near Main Aisle SV-05	IA-05/06
1,1-Dichloroethene	ug/m3	NC	ND 18	ND 0.79/ND 0.79
trans-1,2-Dichloroethene	ug/m3	NC	321	424/468
cis-1,2-Dichloroethene	ug/m3	NC	599	0.71J/0.63J
Toluene	ug/m3	NC	40.3	4.9/6
Trichloroethene	ug/m3	2	7310	0.64/0.59
Vinyl chloride	ug/m3	NC	7.7	ND 0.10/ND 0.10
m.p-Xylene	ug/m3	NC	367	4.3/5.2
o-Xylene	ug/m3	NC	137	1.8/1.9

Compound	Units	NYSDOH Air Guideline Value (µg/m3)	Sample Location D Northeast Column OB/ 1A and 1B SV-03	IA-03
1,1-Dichloroethene	ug/m3	NC	ND 18	ND 0.99
trans-1,2-Dichloroethene	ug/m3	NC	12J	34
cis-1,2-Dichloroethene	ug/m3	NC	ND 18	0.63J
Toluene	ug/m3	NC	16J	5.7
Trichloroethene	ug/m3	2	2630	0.64
Vinyl chloride	ug/m3	NC	ND 2.3	ND 0.13
m.p-Xylene	ug/m3	NC	36	4.3
o-Xylene	ug/m3	NC	12J	1.7

Compound	Units	NYSDOH Air Guideline Value (µg/m3)	Sample Location F First Floor Offices SV-01	IA-01
1,1-Dichloroethene	ug/m3	NC	ND 0.79	ND 0.79
trans-1,2-Dichloroethene	ug/m3	NC	0.71 J	4
cis-1,2-Dichloroethene	ug/m3	NC	0.14J	0.44J
Toluene	ug/m3	NC	5.7	4.5
Trichloroethene	ug/m3	2	0.28	0.54
Vinyl chloride	ug/m3	NC	ND .10	ND .10
m.p-Xylene	ug/m3	NC	6.1	4.3
o-Xylene	ug/m3	NC	1.9	1.5

Compound	Units	NYSDOH Air Guideline Value (µg/m3)	Sample Location E Near column OD SV-02	IA-02
1,1-Dichloroethene	ug/m3	NC	ND 32	ND 0.79
trans-1,2-Dichloroethene	ug/m3	NC	21J	23
cis-1,2-Dichloroethene	ug/m3	NC	2511	0.44J
Toluene	ug/m3	NC	ND 30	4.5
Trichloroethene	ug/m3	2	5030	0.52
Vinyl chloride	ug/m3	NC	ND 4.1	ND .10
m.p-Xylene	ug/m3	NC	ND 35	4.8
o-Xylene	ug/m3	NC	ND 35	1.8

Compound	Units	NYSDOH Air Guideline Value (µg/m3)	Sample Location C Cafeteria SV-06	IA-07
1,1-Dichloroethene	ug/m3	NC	ND 19	ND 0.79
trans-1,2-Dichloroethene	ug/m3	NC	424	8.7
cis-1,2-Dichloroethene	ug/m3	NC	5750	0.4
Toluene	ug/m3	NC	ND 18	3.8
Trichloroethene	ug/m3	2	33200	0.64
Vinyl chloride	ug/m3	NC	ND 2.5	ND 0.10
m.p-Xylene	ug/m3	NC	ND 21	4.8
o-Xylene	ug/m3	NC	ND 21	1.8



LEGEND:

- WETLAND BOUNDARY
- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY
- AIR POINT ⊕ SUBSLAB MONITORING POINT

N

0 80'

GHD

OLD ERIE CANAL SITE

SOIL VAPOR & INDOOR AIR SAMPLE RESULTS MARCH 2017

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 2.11

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 2.11.dwg
Plot Date: 12 November 2021 - 12:43 PM

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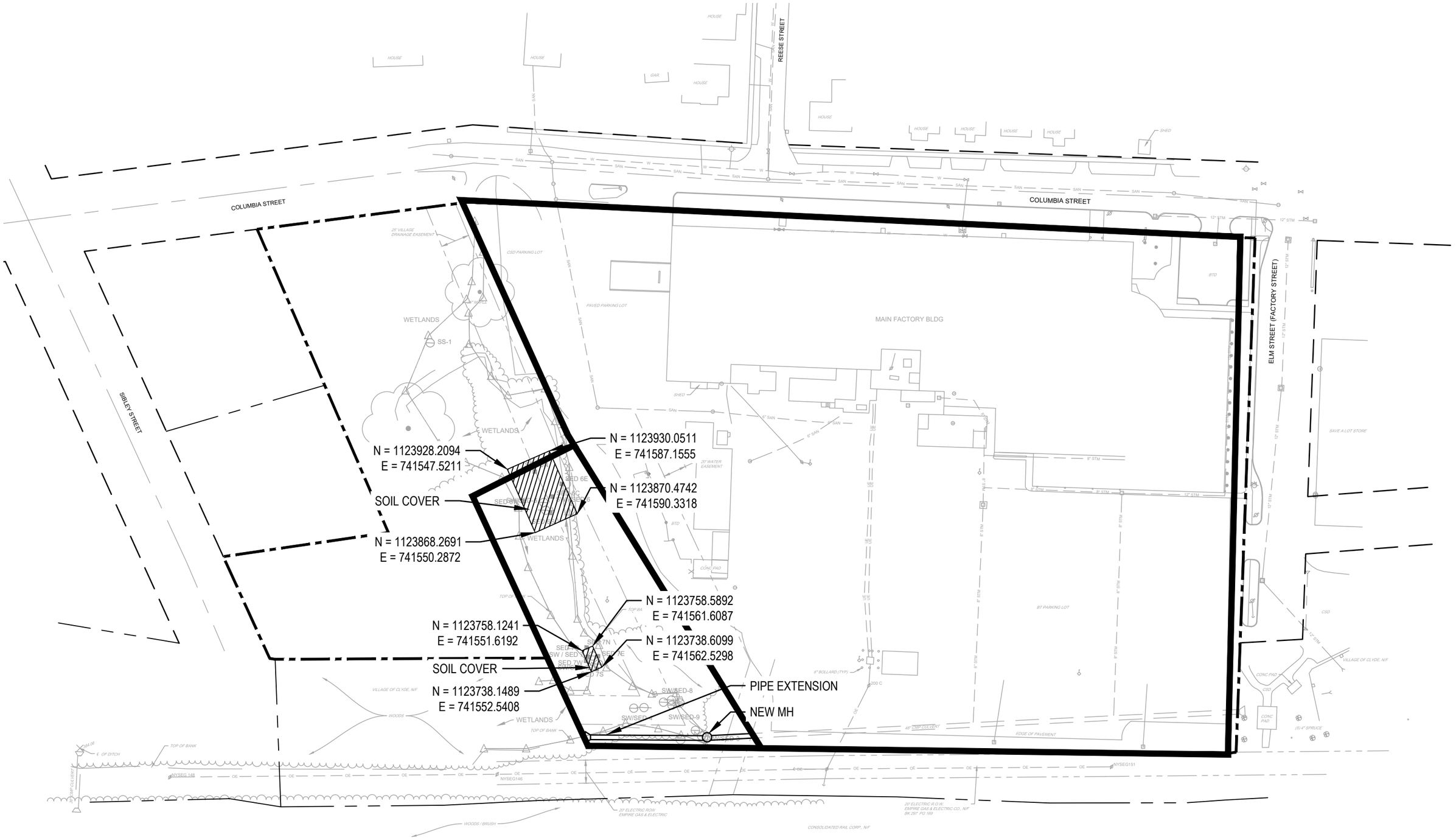


LEGEND:

- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUDARY
- WETLAND BOUNDARY
- SOIL COVER AREA

N

0 80'

GHD

OLD ERIE CANAL SITE

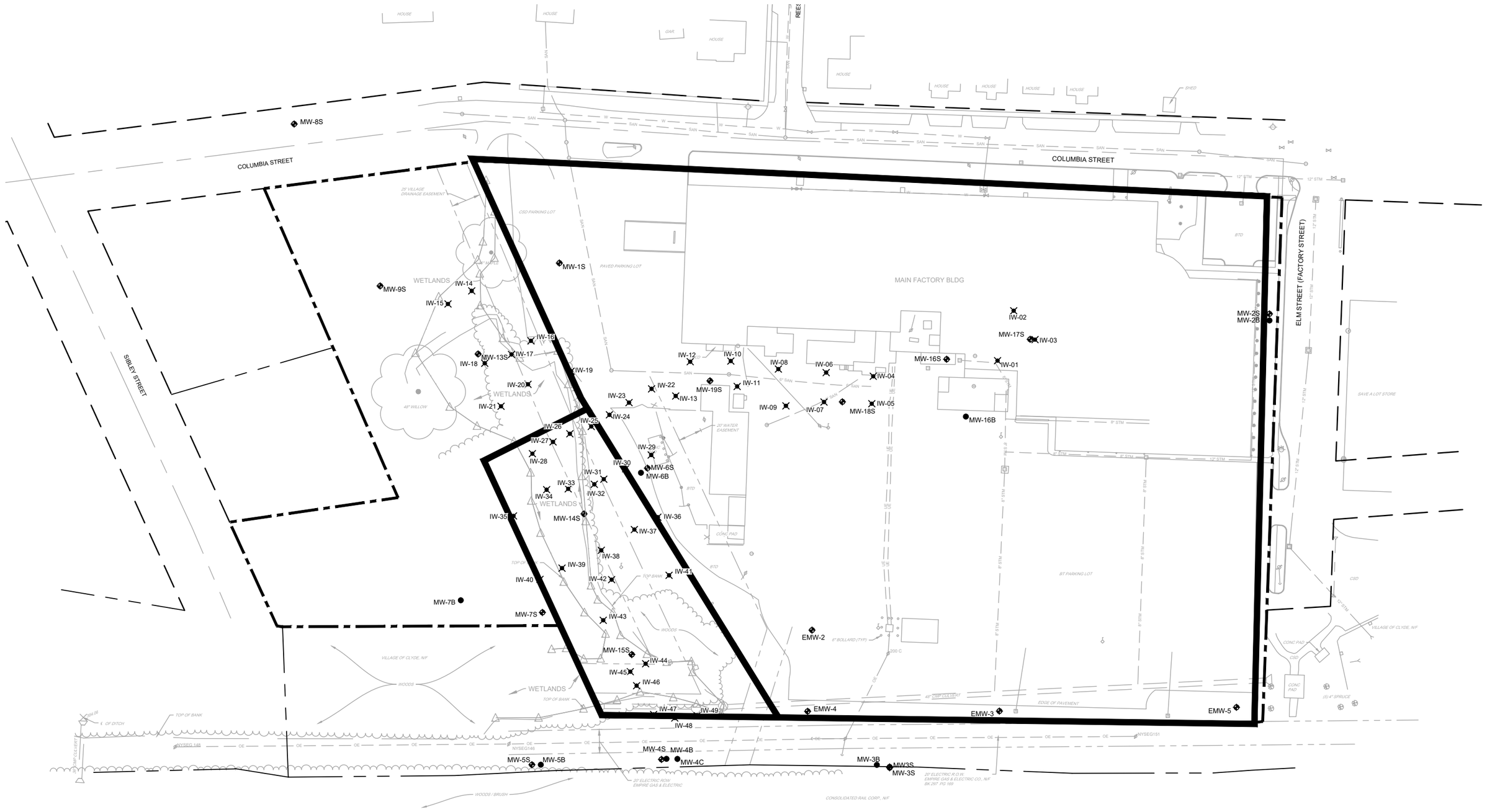
SURFACE SOIL COVER AND STORMWATER PIPE EXTENSION LOCATIONS

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 3.1

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 3.1.dwg
Plot Date: 12 November 2021 - 12:43 PM

Source:



LEGEND:

- IW-48 — INJECTION WELL
- MW-3S — OVERBURDEN MONITORING WELL
- MW-3B — BEDROCK MONITORING WELL
- WETLAND BOUNDARY
- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY

N

0 80'

GHD

OLD ERIE CANAL SITE

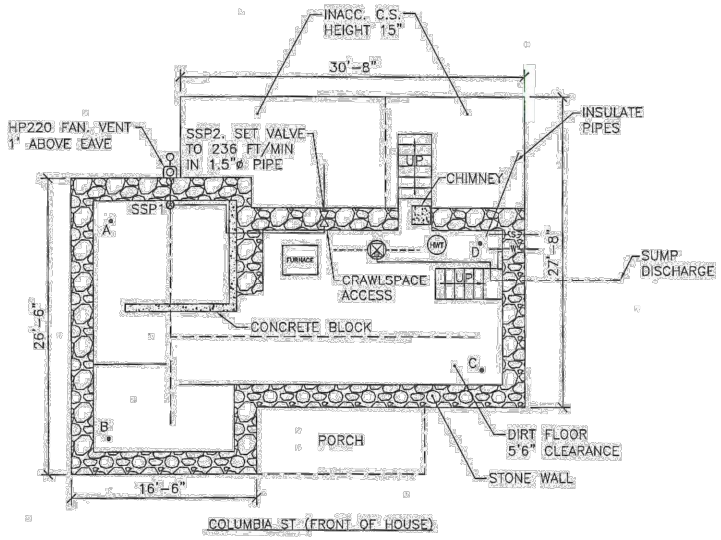
MONITORING AND INJECTION WELL LOCATIONS

Project No. **35048**
Report No. **009**
Date **NOV 21**

FIGURE 3.2

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 3.2.dwg
Plot Date: 12 November 2021 - 12:44 PM

Source:



BASEMENT FLOOR PLAN

SCALE: 1/8" = 1'-0"

N

GENERAL NOTES:

1. DIMENSIONS SHOWN ON FIGURE ARE APPROXIMATE INSTALLATION LOCATIONS AND SHALL BE FIELD VERIFIED BY INSTALLATION CREW.
2. INSTALLATION CREW SHALL GROUT AND/OR CAULK ALL MAJOR CRACKS AND OPENINGS THAT WOULD IMPAIR VENTILATION SYSTEM PERFORMANCE.
3. INSTALLATION CREW SHALL VERIFY ELECTRICAL TIE-IN LOCATION.
4. INSTALLATION CREW SHALL SECURE EQUIPMENT AND PIPING TO PREVENT ANY MOVEMENT.
5. INSTALL BLADEX VALVES ON ALL SYSTEM SUCTION POINTS.

SERVICE: O'BRIEN & GERE HOUSE #5 OPERATION + MAINTENANCE PLAN NOVEMBER 2007

CRAWLSPACE: 334 cu. ft.

ASBUILT XX/XX/XX

FIGURE 1

LEGEND

- S — SEWER
- G — NATURAL GAS
- W — WATER
- E — ELECTRICAL
- HVAC — HVAC DUCT
- G — PIPE/DUCT DOWN
- O — PIPE/DUCT UP
- EXISTING WALL
- WINDOW
- DOOR
- STAIRWAY
- HOT WATER TANK (HWT)
- BOILER
- FURNACE
- J — JUNCTION BOX
- S — FAN SWITCH
- CIRCUIT BREAKER PANEL
- SUMP PUMP
- FLOOR DRAIN
- COMMUNICATION TEST SUCTION HOLE (CTSH)
- COMMUNICATION TEST SUCTION HOLE AND SYSTEM SUCTION POINT
- SYSTEM SUCTION POINT (SSP)
- COMMUNICATION TEST POINT (CTP)
- O — NEW EXHAUST RISER PIPE
- NEW EXHAUST PIPE

PARKER HANNIFIN MITIGATION PROGRAM

BASEMENT FLOOR PLAN

155 COLUMBIA STREET STRUCTURE 001

8 0 8

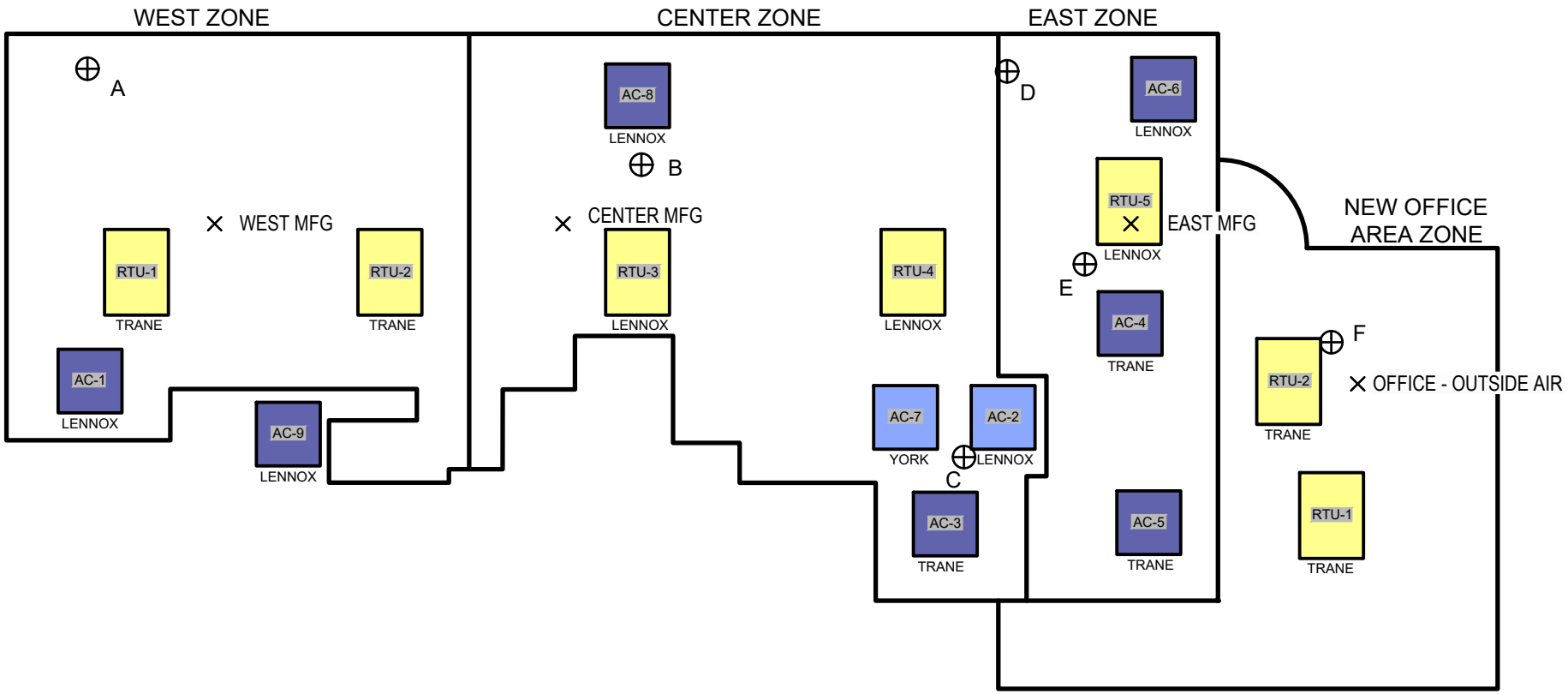
1/8"=1'-0"

OLD ERIE CANAL SITE

OFF-SITE SUB-SLAB DEPRESSURIZATION SYSTEM LAYOUT

Project No. **35048**
Report No. **009**
Date **AUG 18**

FIGURE 3.3



LEGEND:

⊕ A SUBSLAB MANOMETER
× INDOOR AIR MONOMETER

GHD

OLD ERIE CANAL SITE

INDOOR AIR AND SUB-SLAB PRESSURE MONITORING LOCATIONS

Project No. **35048**
Report No. **009**
Date **AUG 18**

FIGURE 4.1

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure 4.1.dwg
Plot Date: 12 November 2021 - 12:45 PM

Source:

Tables

Table 1.1
Site Contacts
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

Notifications

NYSDEC Project Manager/ Environmental Engineer	Danielle Miles	danielle.miles@dec.ny.gov	585-226-5349
NYSDEC Regional HW Engineer	David Pratt	david.pratt@dec.ny.gov	585-226-5449

General Site Contacts

Contact	Name	e-mail	Phone
NYSDEC Project Manager	Danielle Miles	danielle.miles@dec.ny.gov	T - 585-226-5349
Site Contact	James Kalinski	james.kalinski@advancedatomization.com	T - 315-902-5238
	Sr. Engineering Technician/Maintenance Coordinator		M - 315-573-0034
Owner Contact	Lewis Streeter	Lewis.Streeter@ge.com	T - 518-388-7552
	General Electric Company		M - 518-225-4727
Owner Contact	Cassie Johnson	cassie.johnson@parker.com	M - 608-558-6795
	Parker Hannifin Corporation		
Owner Contact	Martha Connell	mconnell@parker.com	T - 216-896-2710
	Parker Hannifin Corporation		M - 216-502-1306
Project Consultant	Katherine Galanti	katherine.galanti@ghd.com	T - 716-362-8839
	GHD		M - 716-583-5720
NYSDEC Spills Hotline	NA	NA	800-457-7362
National Response Center	NA	NA	800-424-8802
Utility Mark Outs	Dig Safely NY	NA	800-962-7962

* Note: Notifications are subject to change and will be updated as necessary.

Table 2.1
Site Lithology
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

Soil Boring No.	Date Completed	Ground Elevation	Boring Depth	End of Boring Elevation	Depth To Glacial Till	Top of Glacial Till Elevation	Depth To Bedrock	Top of Bedrock Elevation
MW-1S	5/30/2002	394.6	8.0	386.6	7.0	387.6	----	----
MW-2S	5/21/2002	398.5	11.7	386.8	---	---	----	----
MW-2B	5/29/2002	398.4	28.5	369.9	12.3	386.1	16.5	381.9
MW-3S	5/21/2002	394.0	11.5	382.5	10.5	383.5	----	----
MW-3B	11/16/2006	394.2	39.0	355.2	10.5	383.7	25.0	369.2
MW-4S	5/22/2002	393.3	20.3	373.0	20.0	373.3	----	----
MW-4B	5/28/2002	393.3	38.9	354.4	20.0	373.3	26.0	367.3
MW-4C	11/17/2006	393.3	50.0	343.3	20.0	373.3	26.0	367.3
MW-5S	5/21/2002	393.1	11.4	381.7	10.0	383.1	----	----
MW-5B	11/16/2006	393.2	39.0	354.2	10.0	383.2	25.9	367.3
MW-6S	5/30/2002	395.0	15.0	380.0	15.0	380.0	----	----
MW-6B	11/15/2006	395.1	39.0	356.1	10.0	385.1	25.9	369.2
MW-7S	5/24/2002	394.9	17.0	377.9	16.3	378.6	----	----
MW-7B	5/28/2002	397.4	39.5	357.9	1.0	396.4	28.2	369.2
MW-8S	5/29/2002	390.3	22.0	368.3	----	----	21.5	368.8
MW-9S	5/22/2002	391.8	17.5	374.3	17.0	374.8	----	----
MW-10B	11/25/2002	391.2	42.7	348.5	17.5	373.7	29.0	362.2
MW-11S	11/20/2002	390.4	12.0	378.4	11.0	379.4	----	----
MW-11B	11/25/2002	389.8	44.0	345.8	11.0	378.8	30.8	359.0
MW-12S	11/22/2002	391.1	10.0	381.1	10.0	381.1	----	----
MW-12B	11/22/2002	391.4	45.0	346.4	10.0	381.4	31.0	360.4
MW-13S	11/2/2006	389.7	20.0	369.7	17.5	372.2	----	----
MW-14S	11/6/2006	389.3	22.5	366.8	22.5	366.8	----	----
MW-15S	11/7/2006	388.4	14.0	374.4	14.0	374.4	----	----
MW-16S	11/2/2006	398.0	10.0	388.0	4.0	394.0	----	----
MW-16B	11/15/2006	398.2	44.0	354.2	9.0	389.2	31.0	367.2
EMW-1	10/14/1994	394.6	32.0	362.6	10.0	384.6	25.2	369.4
EMW-2	10/17/1994	395.0	12.0	383.0	8.0	387.0	----	----
EMW-3	10/14/1994	394.2	12.3	381.9	----	----	----	----
EMW-4	10/18/1994	392.9	12.0	380.9	8.5	384.4	----	----
EMW-5	10/17/1994	393.0	12.0	381.0	10.5	382.5	----	----
GP-1	4/24/2002	397.6	6.5	391.1	5.0	392.6	----	----
GP-2	4/24/2002	397.7	6.5	391.2	6.3	391.5	----	----
GP-3	4/24/2002	397.7	4.0	393.7	3.5	394.2	----	----
GP-4	4/23/2002	391.7	18.0	373.7	17.0	374.7	----	----
GP-5	4/24/2002	393.7	8.0	385.7	7.0	386.7	----	----
GP-6	4/24/2002	396.2	6.0	390.2	5.0	391.2	----	----
GP-7	4/24/2002	397.9	4.0	393.9	3.5	394.4	----	----
GP-8	4/23/2002	389.5	10.5	379.0	9.8	379.7	----	----
GP-9	4/25/2002	395.6	9.0	386.6	6.0	389.6	----	----
GP-10	4/23/2002	389.7	18.5	371.2	17.5	372.2	----	----
GP-11	4/26/2002	390.5	10.0	380.5	7.5	383.0	----	----
GP-12	4/25/2002	396.0	11.0	385.0	7.0	389.0	----	----
GP-13	4/29/2002	389.3	20.0	369.3	----	----	19.0	370.3
GP-14	4/25/2002	394.6	13.5	381.1	10.5	384.1	----	----
GP-15	4/24/2002	396.8	11.0	385.8	7.0	389.8	----	----

Table 2.1
Site Lithology
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

Soil Boring No.	Date Completed	Ground Elevation	Boring Depth	End of Boring Elevation	Depth To Glacial Till	Top of Glacial Till Elevation	Depth To Bedrock	Top of Bedrock Elevation
GP-16	4/24/2002	398.2	12.0	386.2	7.8	390.4	----	----
GP-17	4/24/2002	398.0	4.0	394.0	3.5	394.5	----	----
GP-18	4/23/2002	391.1	13.0	378.1	12.0	379.1	----	----
GP-19	4/29/2002	389.3	20.0	369.3	15.5	373.8	19.0	370.3
GP-20	5/1/2002	395.0	16.0	379.0	15.0	380.0	----	----
GP-21	4/25/2002	397.4	10.5	386.9	6.0	391.4	----	----
GP-22	4/24/2002	397.8	4.0	393.8	3.8	394.0	----	----
GP-23	4/24/2002	398.1	8.0	390.1	7.0	391.1	----	----
GP-24	4/23/2002	393.7	20.0	373.7	19.0	374.7	----	----
GP-25	4/26/2002	389.2	22.0	367.2	----	----	21.0	368.2
GP-26	4/26/2002	395.4	16.0	379.4	13.0	382.4	----	----
GP-27	4/25/2002	396.6	10.0	386.6	6.5	390.1	----	----
GP-28	4/30/2002	394.2	24.0	370.2	22.5	371.7	----	----
GP-29	4/25/2002	395.8	12.0	383.8	9.5	386.3	----	----
GP-30	4/25/2002	396.9	8.0	388.9	3.7	393.2	----	----
GP-31	4/23/2002	394.9	17.0	377.9	16.5	378.4	----	----
GP-32	4/23/2002	389.4	22.0	367.4	21.5	367.9	----	----
GP-33	4/30/2002	394.4	16.0	378.4	15.0	379.4	----	----
GP-34	5/1/2002	395.2	29.2	366.0	----	----	29.2	366.0
GP-35	5/22/2002	393.3	11.0	382.3	10.0	383.3	----	----
GP-36	4/22/2002	393.2	24.0	369.2	23.0	370.2	----	----
GP-37	4/22/2002	393.8	20.0	373.8	16.5	377.3	----	----
GP-38	4/22/2002	394.1	12.0	382.1	11.0	383.1	----	----
GP-39	4/22/2002	393.5	12.0	381.5	10.2	383.3	----	----
GP-40	5/1/2002	398.2	7.0	391.2	3.0	395.2	----	----
GP-41	5/1/2002	398.1	4.0	394.1	2.0	396.1	----	----
GP-42	5/1/2002	391.8	20.0	371.8	17.0	374.8	----	----
GP-43	5/2/2002	391.0	20.5	370.5	----	----	20.5	370.5
GP-44	5/2/2002	395.4	8.0	387.4	3.0	392.4	----	----
GP-45	11/19/2002	398.0	9.0	389.0	8.6	389.4	----	----
GP-46	11/19/2002	398.1	8.5	389.6	8.5	389.6	----	----
GP-47	11/19/2002	398.5	5.0	393.5	4.6	393.9	----	----
GP-48	11/20/2002	396.2	10.2	386.0	6.5	389.7	----	----
GP-49	11/19/2002	397.9	10.5	387.4	5.0	392.9	----	----
GP-50	11/19/2002	398.3	6.0	392.3	6.0	392.3	----	----
GP-51	11/20/2002	396.2	10.1	386.1	8.0	388.2	----	----
GP-52	11/19/2002	397.9	10.5	387.4	4.0	393.9	----	----
GP-53	11/19/2002	398.1	7.0	391.1	7.0	391.1	----	----
GP-54	11/19/2002	398.0	6.0	392.0	6.0	392.0	----	----
GP-55	11/19/2002	398.1	8.2	389.9	4.7	393.4	----	----
GP-56	11/20/2002	396.2	12.6	383.6	9.5	386.7	----	----
GP-57	11/20/2002	397.7	6.0	391.7	4.0	393.7	----	----
GP-58	11/20/2002	398.2	7.5	390.7	5.2	393.0	----	----
GP-59	11/20/2002	393.1	10.0	383.1	8.0	385.1	----	----
GP-60	11/20/2002	393.3	17.0	376.3	16.8	376.5	----	----
GP-61	11/20/2002	393.7	11.5	382.2	6.0	387.7	----	----

Table 2.1
Site Lithology
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

Soil Boring No.	Date Completed	Ground Elevation	Boring Depth	End of Boring Elevation	Depth To Glacial Till	Top of Glacial Till Elevation	Depth To Bedrock	Top of Bedrock Elevation
GP-1A	8/2/2004	390.0	20.0	370.0	15.0	375.0	----	----
GP-2A	8/2/2004	391.8	20.0	371.8	----	----	----	----
GP-3A	8/2/2004	391.0	12.0	379.0	----	----	----	----
GP-4A	8/2/2004	391.7	8.0	383.7	5.0	386.7	----	----
GP-5A	8/2/2004	395.4	5.0	390.4	2.0	393.4	----	----
GP-6A	8/2/2004	397.6	7.0	390.6	5.5	392.1	----	----
GP-7A	8/2/2004	397.7	8.0	389.7	7.8	389.9	----	----
SSB-1	1/14/2005	398.11	6	392.1	4.1	394.0	----	----
SSB-2	1/14/2005	398.11	5.7	392.4	4.3	393.8	----	----
SSB-3	1/14/2005	398.11	7.9	390.2	7.9	390.2	----	----
SSB-4	1/14/2005	398.11	5.8	392.3	5.8	392.3	----	----
SSB-5	1/14/2005	398.11	7.3	390.8	4.5	393.6	----	----
SSB-6	1/13/2005	398.11	7.8	390.3	7.1	391.0	----	----
SSB-7	1/12/2005	398.11	9.3	388.8	9.3	388.8	----	----
SSB-8	1/13/2005	398.11	9.3	388.8	9.3	388.8	----	----
SSB-9	1/13/2005	398.11	6.2	391.9	5	393.1	----	----
SSB-10	1/13/2005	398.11	6.8	391.3	4.2	393.9	----	----
SSB-11	1/13/2005	398.11	5.8	392.3	4.2	393.9	----	----
TMW-1	11/3/2006	398.09	14.0	384.1	13.0	385.1	----	----
TMW-2	11/3/2006	398.82	6.0	392.8	5.5	393.3	----	----

Notes:

1. All depths in feet below ground surface.
2. All elevations in feet above mean sea level and measured in NGVD 1929.
3. "---" indicates not encountered.

Table 2.2
Groundwater Elevations
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

Well ID	Measuring Point Elevation (AMSL)	Spring 2018 (Feet BMP)	Spring 2018 (AMSL)
MW-1S	394.16	3.60	390.56
MW-3S	393.64	8.87	384.77
MW-3B	393.91	21.82	372.09
MW-4S	393.02	4.85	388.17
MW-4B	392.97	5.31	387.66
MW-4C	392.81	0.50	392.31
MW-5S	392.86	4.20	388.66
MW-5B	392.85	6.74	386.11
MW-6S	394.25	3.50	390.75
MW-6B	394.23	6.55	387.68
MW-7S	396.92	8.72	388.20
MW-7B	399.10	10.82	388.28
MW-8S	389.91	1.10	388.81
MW-9S	391.19	4.70	386.49
MW-13S	391.53	2.83	388.70
MW-14S	391.39	3.10	388.29
MW-15S	390.12	1.90	388.22
MW-16S	397.30	2.32	394.98
MW-16B	397.69	3.10	394.59
MW-17S	397.48	3.45	394.03
MW-18S	397.63	3.00	394.63
MW-19S	396.09	2.87	393.22
EMW-2	394.32	1.80	392.52
EMW-3	393.49	5.05	388.44
EMW-4	392.22	4.32	387.90
EMW-5	393.33	4.45	388.88

Notes:

1. The Spring 2018 event was conducted on 5/9/2018.
2. Source: Arcadis Design & Consultancy, "Final Engineering Report, Old Erie Canal Site, Clyde, New

Table 2.3
Remaining Contaminant Concentrations Exceeding Unrestricted Use Soil Cleanup Objectives in Soil
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

		Sample Location:	GP-16	GP-20	GP-20	GP-25	GP-26	GP-32	GP-33	SSB-3	SSB-3	SSB-5	SSB-6	SSB-7	SSB-8	SSB-9
		Sample Depth (ft. bgs):	8-12	12-16	12-16	8-12	12-14	12-16	12-16	4-6	4-6	4-6	4-6	8.3-9.3	8.9.3	2-4
		Sample Date:	5/2/2002	5/1/2002	5/1/2002 Duplicate	4/26/2002	4/30/2002	4/23/2002	4/30/2002	1/2005	1/2005 Duplicate	1/2005	1/2005	1/2005	1/2005	1/2005
Compound	UNRESTRICTED USE	Units														
VOCs																
Acetone	50	µg/Kg	-	-	-	-	-	-	-	630 J	570	130	-	-	-	320
cis-1,2-Dichloroethene	250	µg/Kg	1400	8900	14000	700 J	-	2400		1600 J	1300	-	1200 J	10000 J	680	-
Methylene chloride	50	µg/Kg	-	-	-	-	89	180 J	200	-	-	-	-	-	-	-
Toluene	700	µg/Kg	-	4300 B	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	470	µg/Kg	2100	-	590 J	4700	-	-	-	-	-	-	-	130000 J	6200 J	-
Vinyl chloride	20	µg/Kg	-	460 J	1200 J	-	84	200 J	25 J	560 J	120 J	-	210	-	-	-
SVOCs																
Benzo(b)fluoranthene	1000	µg/Kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	1000	µg/Kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	500	µg/Kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pesticides																
4,4'DDD	3.3	µg/Kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'DDE	3.3	µg/Kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4,4'-DDT	3.3	µg/Kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																

Table 2.4
Remaining Contaminant Concentrations Exceeding Industrial Use Soil Cleanup Objectives in Soil
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

		Sample Location:	SED 06	SED 07	SED 6-NORTH	SED 6-SOUTH	SED 6-EAST
		Sample Date:	5/21/2002	5/21/2002	8/29/2014	8/29/2014	8/29/2014
Compound	Industrial Use	Units					
SVOCs							
Benzo(a)pyrene	1100	µg/Kg	-	-	-	-	1800
Metals							
Arsenic	16	mg/Kg	113 J	102 J	22	29	-
Cadmium	60	mg/Kg	85.7 J	60.1 J	-	-	-

Notes:
(1) 6 NYCRR Part 375 Industrial Use Soil Cleanup Objectives.
J Detected concentration is estimated.
- Result did not exceed criteria.

Table 2.5
Remaining Contaminant Concentrations Exceeding Groundwater Standards
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

	Sample Location:		MW-01S	MW-04B	MW-4S	MW-06B	MW-06S	MW-07S	MW-13S	MW-14S	MW-15S
	Sample Date:		05/10/18	08/31/17	05/10/18	05/11/18	05/11/18	05/10/18	05/09/18	05/10/18	05/09/18
Compound	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units									
VOCs											
1,1-Dichloroethane	5	ug/L	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	5	ug/L	7.2 [7.0]	82.3 J	-	73.3 J	-	-	-	-	-
cis-1,2-Dichloroethene	5	ug/L	1,140 [1,160]	81,800 D	-	50,300	28,300	83.3	10,100	35,800	5.5
Ethylbenzene	5	ug/L	-	125	-	-	35.1 J	-	-	-	-
m&p-Xylenes	5	ug/L	-	132	-	-	205	-	-	49.5 J	-
o-Xylene	5	ug/L	-	74.0 J	-	-	37.1 J	-	-	-	-
Tetrachloroethene	5	ug/L	28.7 [25.2]	-	-	-	-	-	-	-	-
Toluene	5	ug/L	-	383	-	-	7,910	-	-	864	-
Total Xylenes	5	ug/L	-	206	-	-	242	-	-	49.5 J	-
trans-1,2-Dichloroethene	5	ug/L	72.2 [68.5]	267	-	156	107	-	30.7	96.1 J	-
trans-1,3-Dichloropropene	0.4	ug/L	-	-	-	-	-	-	-	-	-
Trichloroethene	5	ug/L	697 [695]	97.3 J	-	41.8 J	-	-	8.1 J	600	-
Vinyl chloride	2	ug/L	111 [107]	9,850	15.3	3,850	34,800	112	531	5,970	166

Notes:

1. Only results that exceed criteria are shown. The most recent monitoring data for each well is presented.
2. MW-4B was unable to be sampled during the first quarterly monitoring round due to elevated levels of injection fluid still present in the well.

"-" Result did not exceed criteria.
[123] Duplicate sample results.
D Diluted.
J Estimated value.

Table 2.5
Remaining Contaminant Concentrations Exceeding Groundwater Standards
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

		Sample Location:	MW-16S	MW-17S	MW-18S	MW-19S
		Sample Date:	08/31/17	05/10/18	05/11/18	05/09/18
	NYSDEC TOGS 1.1.1 (GA GROUNDWATER)	Units				
Compound						
VOCs						
1,1-Dichloroethane	5	ug/L	-	-	-	16.7
1,1-Dichloroethene	5	ug/L	-	-	-	-
cis-1,2-Dichloroethene	5	ug/L	-	62.6	174	630
Ethylbenzene	5	ug/L	-	-	-	-
m&p-Xylenes	5	ug/L	-	-	-	-
o-Xylene	5	ug/L	-	-	-	-
Tetrachloroethene	5	ug/L	-	-	-	6.9
Toluene	5	ug/L	-	-	-	-
Total Xylenes	5	ug/L	-	-	-	-
trans-1,2-Dichloroethene	5	ug/L	-	-	-	7.4
trans-1,3-Dichloropropene	0.4	ug/L	-	-	-	-
Trichloroethene	5	ug/L	-	-	-	240
Vinyl chloride	2	ug/L	1.8 [2.1]	58.3	15.5	133

:
Only results that exceed criteria are shown. The most recent mo
MW-4B was unable to be sampled during the first quarterly monit
Result did not exceed criteria.
Duplicate sample results.
Diluted.
Estimated value.

Table 2.6
Sub-Slab Soil Vapor and Indoor Air Sampling
Old Erie Canal Site #859015
Clyde, New York
March 2017

				Sample Location A Northwest Column 17A and 17		Sample Location B Center Near Main Aisle		Sample Location C Cafeteria		Sample Location D Northeast Column OB/ 1A and 1B		Sample Location E Near column OD		Sample Location F First Floor Offices		Outdoor Ambient Air
Compound	Units	OSHA PEL (ppm/µg/m^3)	NYSDOH Air Guideline Value (µg/m^3)	SV-04	IA-04	SV-05	IA-05/06	SV-06	IA-07	SV-03	IA-03	SV-02	IA-02	SV-01	IA-01	Ambient
1,1-Dichloroethene	ug/m^3	NC	NC	ND 0.79	ND 0.79	ND 18	ND 0.79/ND 0.79	ND 19	ND 0.79	ND 18	ND 0.99	ND 32	ND 0.79	ND 0.79	ND 0.79	ND 0.79
trans-1,2-Dichloroethene	ug/m^3	200 * / 790,000 *	NC	12	93.2	321	424/468	424	8.7	12J	34	21J	23	0.71 J	4	1.3
cis-1,2-Dichloroethene	ug/m^3	200 * / 790,000 *	NC	6.3	0.52J	599	0.71J/0.63J	5750	0.4	ND 18	0.63J	2511	0.44J	0.14J	0.44J	ND 0.79
Toluene	ug/m^3	200 / 750,000	NC	3.5	4.1	40.3	4.9/6	ND 18	3.8	16J	5.7	ND 30	4.5	5.7	4.5	1.8
Trichloroethene	ug/m^3	100 / 530,000	2	107	0.47	7310	0.64/0.59	33200	0.64	2630	0.64	5030	0.52	0.28	0.54	ND 0.21
Vinyl chloride	ug/m^3	1 / 2,500	NC	ND 0.10	ND 0.10	7.7	ND 0.10/ND 0.10	ND 2.5	ND 0.10	ND 2.3	ND 0.13	ND 4.1	ND .10	ND .10	ND .10	ND 0.10
m.p-Xylene	ug/m^3	100 $^+$ / 435,000 $^+$	NC	3.5	4.3	367	4.3/5.2	ND 21	4.8	36	4.3	ND 35	4.8	6.1	4.3	1.4
o-Xylene	ug/m^3	100 $^+$ / 435,000 $^+$	NC	1.9	1.7	137	1.8/1.9	ND 21	1.8	12J	1.7	ND 35	1.8	1.9	1.5	ND 0.87
Total chlorinated VOCs (cVOCs) detected[1]				125.75	94.64	8246.70	447.74	39384.75	10.19	2661.15	35.83	7580.05	24.41	1.58	5.43	
% Trans-1,2-DCE				9.54	98.48	3.89	99.61	1.08	85.42	0.45	94.89	0.28	94.24	0.45	73.73	

Notes:

µg/m^3 Micrograms per cubic meter
ppm Parts per million
NC No Criteria
ND Not detected at associated value
* OSHA PEL listed for total 1,2-dichloroethene
$^+$ OSHA PEL listed for total xylenes
[1] When calculating total cVOCs, 1/2 of the detection limit was used for non detect results. The average result was used for duplicate results.

Table 4.1
Positive Pressure System Monitoring Requirements and Schedule
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

Remedial System Component	Monitoring Parameter	Operating Range	Monitoring Schedule
Manometers	Indoor air pressure	Varies, typially 0.0002-inch to 0.1-inch water column	Monthly
Concrete Floors and Walls	Condition/integrity	Intact with no open cracks or holes; Ensure epoxy sealant is in good condition (e.g., no flaking) and no new unsealed floor penetrations are present	Annual

Table 4.2
Off-Site Sub Slab Depressurization System Monitoring Requirements and Schedule
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

Remedial System Component	Monitoring Parameter	Operating Range	Monitoring Schedule
Fan	Operation	Operating with no noise or vibration, and securely mounted	Annual
Piping	Condition	Sealed at penetrations	Annual
Concrete Floors and Walls	Condition/integrity	Intact with no open cracks or holes	Annual

Table 4.3
Groundwater Monitoring Program
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

Well ID	Type	Hydraulic Monitoring	VOCs	Natural Attenuation Parameters	Field Parameters	C^{13} Compound Specific Isotope Analysis (CSIA)	Dehalococcoides (Dhc) by Polymerase Chain Reaction (PCR)	vcr-A by PCR
MW-1S	Program	S	Q	Q	Q	-	-	-
MW-4B	Program	S	Q	Q	Q	A	Y1	Y1
MW-4S	Program	S	Q	Q	Q	-	-	-
MW-6B	Program	S	Q	Q	Q	A	Y1	Y1
MW-6S	Program	S	Q	Q	Q	A	Y1	Y1
MW-7S	Program	S	Q	Q	Q	-	-	-
MW-13S	Program	S	Q	Q	Q	-	-	-
MW-14S	Program	S	Q	Q	Q	A	Y1	Y1
MW-15S	Program	S	Q	Q	Q	A	Y1	Y1
MW-17S	Program	S	Q	Q	Q	A	Y1	Y1
MW-18S	Program	S	Q	Q	Q	-	-	-
MW-19S	Program	S	Q	Q	Q		Y1	Y1
EMW-2	Perimeter	S	A		A	-	-	-
EMW-4	Perimeter	S	A		A	-	-	-
MW-3B	Perimeter	S	A		A	-	-	-
MW-3S	Perimeter	S	A		A	-	-	-
MW-4C	Perimeter	S	A		A	-	-	-
MW-5B	Perimeter	S	A		A	-	-	-
MW-5S	Perimeter	S	A		A	-	-	-
MW-7B	Perimeter	S	A		A	-	-	-
MW-9S	Perimeter	S	A		A	-	-	-
MW-16B	Perimeter	S	A		A	-	-	-
MW-16S	Perimeter	S	A		A	-	-	-
EMW-3	General	S	-		-	-	-	-
EMW-5	General	S	-		-	-	-	-
MW-2B	General	S	-		-	-	-	-
MW-2S	General	S	-		-	-	-	-
MW-8S	General	S	-		-	-	-	-
Canal Upstream	-	-	A		-	-	-	-
Canal Downstream	-	-	A		-	-	-	-

Notes:

0

Program Impacted well within treatment area.
Perimeter Sentinel wells to monitor plume migration (below or 'at' standard).
General Sitewide and off-site wells.
A Annual frequency in summer.
Q Quartelry frequency in spring summer, fall, and winter.
S Semiannual frequency in spring and fall.
Y1 Additional Dhc and vcr-A sampling conducted after Year 1 only.

Table 4.4
Monitoring Well Construction Detail
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

Well No.	Date Completed	Latitude	Longitude	PVC Measuring Point Elevation	Ground Elevation	Screen Length	Screen Depth		Screen Elevation		Sand Pack Depth		Sand Pack Elevation	
							Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
MW-1S	5/30/2002	43.0846	76.8774	394.16	394.6	5.0	2.3	7.3	392.3	387.3	2.1	8.0	392.5	386.6
MW-2S	5/21/2002	43.0839	76.8754	397.91	398.5	10.0	1.6	11.6	396.9	386.9	1.6	11.7	396.9	386.8
MW-2B	5/29/2002	43.0838	76.8754	398.08	398.4	10.0	18.5	28.5	379.9	369.9	16.0	28.5	382.4	369.9
MW-3S	5/21/2002	43.0832	76.877	393.64	394.0	10.0	1.3	11.3	392.7	382.7	1.3	11.5	392.7	382.5
MW-3B	11/16/2006	43.0832	76.8771	393.91	394.2	10.0	28.8	38.8	365.4	355.4	27.0	39.0	367.2	355.2
MW-4S	5/22/2002	43.0834	76.8777	393.02	393.3	10.0	10.3	20.3	383.0	373.0	8.3	20.3	385.0	373.0
MW-4B	5/28/2002	43.0834	76.8777	392.97	393.3	10.0	28.9	38.9	364.4	354.4	26.9	38.9	366.4	354.4
MW-4C	11/17/2006	43.0834	76.8776	392.81	393.3	10.0	38.7	48.7	354.6	344.6	38.0	50.0	355.3	343.3
MW-5S	5/21/2002	43.0835	76.8781	392.86	393.1	10.0	1.2	11.2	391.9	381.9	1.1	38.9	392.0	354.2
MW-5B	11/16/2006	43.0835	76.8781	392.85	393.2	10.0	29.3	39.3	363.9	353.9	27.0	39.0	366.2	354.2
MW-6S	5/30/2002	43.084	76.8774	394.66	395.0	10.0	5.0	15.0	390.0	380.0	3.0	15.0	392.0	380.0
MW-6B	11/15/2006	43.084	76.8774	396.99	395.1	10.0	29.4	39.4	365.7	355.7	27.0	39.4	368.1	355.7
MW-7S	5/24/2002	43.0838	76.8779	396.92	394.9	10.0	6.5	16.5	388.4	378.4	5.0	17.5	389.9	377.4
MW-7B	5/28/2002	43.0839	76.8781	399.10	397.4	10.0	28.9	38.9	368.5	358.5	26.9	38.9	370.5	358.5
MW-8S	5/29/2002	43.0851	76.8781	389.91	390.3	10.0	12.0	22.0	378.3	368.3	10.0	22.0	380.3	368.3
MW-9S	5/22/2002	43.0847	76.878	391.39	391.8	10.0	7.4	17.4	384.4	374.4	5.4	17.5	386.4	374.3
MW-10B	11/25/2002	43.0828	76.8793	390.99	391.2	10.0	32.7	42.7	358.5	348.5	30.2	42.7	361.0	348.5
MW-11S	11/20/2002	43.0826	76.8786	390.04	390.4	7.0	5.0	12.0	385.4	378.4	4.0	12.0	386.4	378.4
MW-11B	11/25/2002	43.0826	76.8786	389.75	389.8	10.0	34.0	44.0	355.8	345.8	31.0	44.0	358.8	345.8
MW-12S	11/22/2002	43.0823	76.8777	390.43	391.1	5.0	5.0	10.0	386.1	381.1	4.0	10.0	387.1	381.1
MW-12B	11/22/2002	43.0823	76.8777	391.32	391.4	10.0	34.0	44.0	357.4	347.4	31.0	44.0	360.4	347.4
MW-13S	11/2/2006	43.0844	76.8778	391.53	389.7	5.0	11.9	16.9	377.8	372.8	11.0	17.5	378.7	372.2
MW-14S	11/6/2006	43.084	76.8776	391.39	389.3	5.0	16.4	21.4	372.8	367.8	15.0	22.5	374.3	366.8
MW-15S	11/7/2006	43.0836	76.8777	390.12	388.4	5.0	7.7	12.7	380.7	375.7	6.0	14.0	382.4	374.4
MW-16S	11/2/2006	43.084	76.8764	397.30	398.0	5.0	4.6	9.6	393.4	388.4	3.5	10.0	394.5	388.0
MW-16B	11/15/2006	43.0839	76.8764	397.69	398.2	10.0	33.6	43.6	364.6	354.6	32.0	44.0	366.2	354.2
MW-17S	8/10/2017	43.08405	76.8761	397.48	397.9	5.0	3.8	8.8	394.1	389.1	3.3	8.8	394.6	389.1
MW-18S	8/11/2017	43.08407	76.8778	397.63	397.8	5.0	3.0	8.0	394.8	389.8	2.5	8.0	395.3	389.8
MW-19S	8/8/2017	43.08423	76.8771	396.09	396.4	5.0	3.5	8.5	392.9	387.9	2.5	8.5	393.9	387.9
EMW-2	10/17/1994	43.0836	76.8771	394.72	395.0	5.0	6.0	11.0	389.0	384.0	5.0	12.0	390.0	383.0
EMW-3	10/14/1994	43.0832	76.8766	396.94	394.2	5.0	6.0	11.0	388.2	383.2	4.0	12.3	390.2	381.9
EMW-4	10/18/1994	43.0834	76.8772	395.51	392.9	5.0	6.0	11.0	386.9	381.9	5.0	12.0	387.9	380.9
EMW-5	10/17/1994	43.083	76.8759	395.53	393.0	5.0	6.0	11.0	387.0	382.0	5.0	12.0	388.0	381.0

Notes:

1. All depths in feet below ground surface.
2. All elevations in feet above mean sea level and measured in NGVD 1929.

Table 7.1
Reporting Requirements
Old Erie Canal Site, NYSDEC Site #859015
Clyde, New York

Task/Report	Frequency	Reporting Frequency*
Positive Indoor Air Pressure Monitoring	Monthly	Annually with Periodic Review Report
Groundwater Monitoring Data	Quarterly	Quarterly
Annual Site-Wide Inspection	Annually	Annually with Periodic Review Report
Off--Site SSDS inspection	Annually	Annually with Periodic Review Report
Periodic Review Report	Annually	Annually

* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC.

Appendices

Appendix A
Environmental Easement/Notice/Deed Restriction

Do Not Detach

Wayne County Clerk's Office

Recording Page

Receipt Number: 21-5203

Easements

Instrument Number: R9230997

Date/Time: 04/07/2021 01:37 PM

First OR: ADVANCED ATOMIZATION TECHNOLOGIES LLC

First EE: PEOPLE OF THE STATE OF NEW YORK

Town: GALEN TOWN OF
Town: CLYDE VILLAGE

Pages: 10
Employee Id: rd
Serial Number:

Transfer Tax Number: 2110

-FEES-	
Recording and Filing	$95.00
Transfer Tax	$0.00
Basic Tax	
Local Tax	
Additional Tax	
Special Tax	
Withheld	
Total	$95.00
-MORTGAGE TAX-	$0.00
Amount Taxed	
-TRANSFER TAX-	
Consideration Amount	$0.00

State of New York
County of Wayne

***** WARNING - This sheet constitutes the Clerks endorsement required by Section 319 of the Real Property Law of the State of New York.**

Michael Jankowski
Wayne County Clerk

DO NOT DETACH
THIS IS NOT A BILL

ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36 OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW

THIS INDENTURE made this 6th day of April, 2021, between Owner Advanced Atomization Technologies LLC (f/k/a Gas Turbine Fuel Systems Clyde LLC, having an office at 124 Columbia Street, Clyde, New York 14433, County of Wayne, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee"), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

WHEREAS, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

WHEREAS, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

WHEREAS, Grantor, is the owner of real property located at the address of 124 Columbia Street in the Village of Clyde, County of Wayne and State of New York, known and designated on the tax map of the County Clerk of Wayne as tax map parcel number: Section 74112 Block 13 Lots 193379, being a portion of the property conveyed to Grantor by deed dated September 28, 2012 and recorded in the Wayne County Clerk's Office in Instrument No. R9143923; and

WHEREAS, Grantor, is the owner of real property located at the address of Sibley Street in the Village of Clyde, County of Wayne and State of New York, known and designated on the tax map of the County Clerk of Wayne as tax map parcel number: Section 74112 Block 13 Lot 158377, being the same as that property conveyed to Grantor by deed dated May 28, 2014 and recorded in the Wayne County Clerk's Office in Instrument No. R9161489.

WHEREAS, the property subject to this Environmental Easement (the "Controlled Property") comprises approximately 6.532 +/- acres, and is hereinafter more fully described in the Land Title Survey dated August 17, 2018 and last revised on August 26, 2019 prepared by Timothy

R. Voellinger L.L.S., which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

WHEREAS, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Order on Consent Index Number: B8-0533-98-06, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

1. Purposes. Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. Institutional and Engineering Controls. The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

Industrial as described in 6 NYCRR Part 375-1.8(g)(2)(iv)

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Wayne County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential, Restricted Residential or Commercial purposes as defined in 6NYCRR 375-1.8(g)(i), (ii) and (iii), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, New York 12233
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

This property is subject to an Environmental Easement

held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation Law.

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to:

Site Number: 859015
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation
NYSDEC
625 Broadway
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and

communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

11. Consistency with the SMP. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, regarding matters specifically addressed by the SMP, the terms of the SMP will control.

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IN WITNESS WHEREOF, Grantor has caused this instrument to be signed in its name.

Advanced Atomization Technologies LLC:

By: _____

Print Name: Jay Reilly

Title: General Manager Date: 3/26/21

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF)

On the 26th day of March, in the year 20 21, before me, the undersigned, personally appeared Jay Reilly, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

_____ Michael Tobin Feldstein
Notary Public - State of New York

MICHAEL TOBIN FELDSTEIN
Notary Public - State of New York
NO. 01FE6411835
Qualified in Monroe County
My Commission Expires Dec 7, 2024

THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK, Acting by and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: _____
Michael J. Ryan, Director
Division of Environmental Remediation

Grantee's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF ALBANY)

On the 6th day of April, in the year 20__, before me, the undersigned, personally appeared Michael J. Ryan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public - State of New York

Dale Thiel
Notary Public, State of New York
No. 01TH6414394
Qualified in Columbia County
Commission Expires Feb. 22, 2025

SCHEDULE "A"
SURVEY DESCRIPTION OF ENVIRONMENTAL EASEMENT

ALL THAT TRACT OR PARCEL OF LAND SITUATE IN: Village of Clyde, County of Wayne and State of New York, bounded and described as follows:

Beginning at a drill hole marking the intersection of the west line of Factory Street, with the south line of Columbia Street, and running thence;

1) S 22-53-50 W, along the west line of Factory Street and along the west line of land now or formerly owned by Village of Clyde, for a distance of 446.18 feet to an iron pin in the north line of land now or formerly owned by Village of Clyde, thence the following courses and distances along land now or formerly owned by said Village of Clyde;

2) N 76-44-30 W, for a distance of 11.02 feet to a point,

3) N 68-37-20 W, for a distance of 400.12 feet to an iron pin,

4) N 68-37-20 W, for a distance of 150.57 feet to an iron pin,

5) N 04-03-30 W, for a distance of 85.43 feet to an iron pin,

6) N 04-03-30 E, for a distance of 154.52 feet to an iron pin,

7) N 84-07-00 E, for a distance of 99.90 feet to an iron pin and

8) N 01-42-00 W, for a distance of 226.52 feet to a point in the south line of Columbia Street, thence the following courses and distances along the south line of Columbia Street;

9) S 75-55-20 E, for a distance of 8.96 feet to a point and

10) S 65-21-10 E, for a distance of 218.80 feet to an iron pin and

11) S 67-06-10 E, for a distance of 449.30 feet to the point and place of beginning, comprising an area of 6.532 acres, according to a survey prepared by Greene Land Surveying, PLLC dated August 20, 2018 being Job No. 12-2538 R and Last Revised August 26, 2019.

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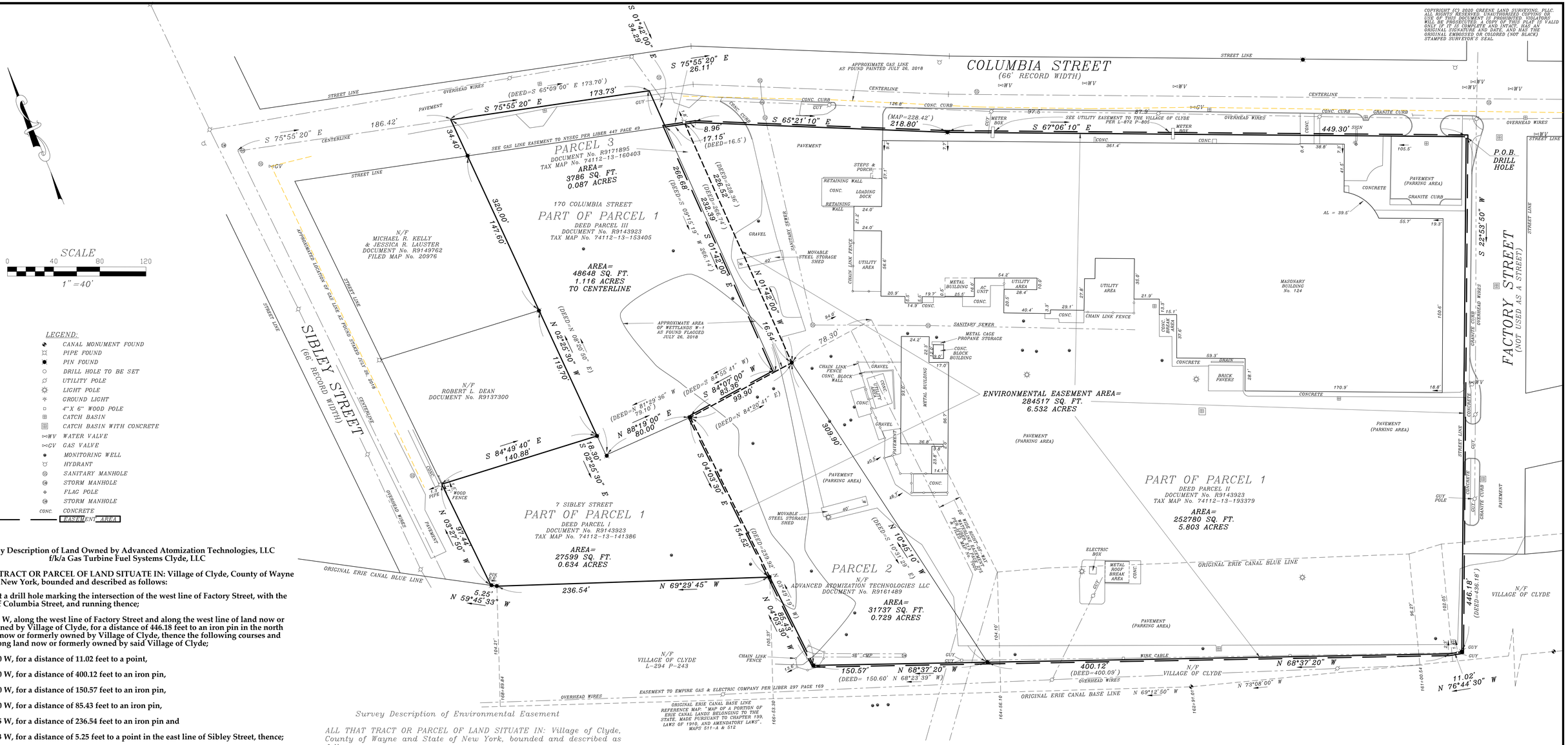
ALL RIGHTS RESERVED. UNAUTHORIZED COPYING OR USE OF THIS DOCUMENT IS PROHIBITED. VIOLATORS WILL BE PROSECUTED. A COPY OF THIS PLAT IS VALID ONLY IF IT IS COMPLETE AND INTACT, HAS AN ORIGINAL SIGNATURE AND DATE, AND HAS THE ORIGINAL EMBOSSED OR COLORED (NOT BLACK) STAMPED SURVEYOR'S SEAL



Survey Description of Land Owned by Advanced Atomization Technologies, LLC f/k/a Gas Turbine Fuel Systems Clyde, LLC

ALL THAT TRACT OR PARCEL OF LAND SITUATE IN: Village of Clyde, County of Wayne and State of New York, bounded and described as follows:

Beginning at a drill hole marking the intersection of the west line of Factory Street, with the south line of Columbia Street, and running thence;

1) S 22-53-50 W, along the west line of Factory Street and along the west line of land now or formerly owned by Village of Clyde, for a distance of 446.18 feet to an iron pin in the north line of land now or formerly owned by Village of Clyde, thence the following courses and distances along land now or formerly owned by said Village of Clyde;

2) N 76-44-30 W, for a distance of 11.02 feet to a point,

3) N 68-37-20 W, for a distance of 400.12 feet to an iron pin,

4) N 68-37-20 W, for a distance of 150.57 feet to an iron pin,

5) N 04-03-30 W, for a distance of 85.43 feet to an iron pin,

6) N 69-29-45 W, for a distance of 236.54 feet to an iron pin and

7) N 59-45-33 W, for a distance of 5.25 feet to a point in the east line of Sibley Street, thence;

8) N 03-27-50 W, along the east line of Sibley Street, for a distance of 97.44 feet to a point marking the southwest corner of land now or formerly owned by Robert L. Dean, and recorded as Document No. R9137300, thence;

9) S 84-49-40 E, along the south line of land now or formerly owned by said Dean, for a distance of 140.88 feet to an iron pin marking the southeast corner of land now or formerly owned by said Dean, thence;

10) N 02-25-30 W, along the east line of land now or formerly owned by said Dean 119.70 feet to an iron pin marking the south east corner of land now or formerly owned by Michael R. Kelly and Jessica R. Lauster, and recorded as Document No. R9149762, and continuing on the same course along the east line of said Kelly and Lauster 147.60 feet to an iron pin on the south line of Columbia Street, and continuing 34.40 feet, comprising a total distance of 320.00 feet to a point in the centerline of Colombia Street, thence;

11) S 75-55-20 E, along the centerline of Columbia Street, for a distance 173.73 feet to a point, thence;

12) S 01-42-00 E, for a distance of 34.29 feet to a point in the south line of Columbia Street, thence the following courses and distances along the south line of Columbia Street;

13) S 75-55-20 E, for a distance of 26.11 feet to a point and

14) S 65-21-10 E, for a distance of 218.80 feet to an iron pin and

15) S 67-06-10 E, for a distance of 449.30 feet to the point and place of beginning, comprising an area of 8.369 acres, according to a survey prepared by Greene Land Surveying, PLLC dated August 20, 2018 being Job No. 12-2538 R.

Being and intending to describe the same premises conveyed in the Following Three (3) Deeds:

Deed 1: Bargain and Sale Deed: Parker-Hannifin Corporation to Gas Turbine Fuel Systems Clyde, LLC, dated September 28, 2012 and recorded in the Office of the Wayne County Clerk as Document No. R9143923.

Deed 2: Quit Claim Village of Clyde to Advanced Atomization Technologies, LLC, dated May 28, 2014 and recorded in the Office of the Wayne County Clerk as Document No. R9161489.
Deed 3: Quit Claim Deed: Village of Clyde to Advanced Atomization Technologies, LLC, dated June 26, 2015 and recorded in the Office of the Wayne County Clerk as DOCUMENT No. R9171895.

Survey Description of Environmental Easement

ALL THAT TRACT OR PARCEL OF LAND SITUATE IN: Village of Clyde, County of Wayne and State of New York, bounded and described as follows:
Beginning at a drill hole marking the intersection of the west line of Factory Street, with the south line of Columbia Street, and running thence;

1) S 22-53-50 W, along the west line of Factory Street and along the west line of land now or formerly owned by Village of Clyde, for a distance of 446.18 feet to an iron pin in the north line of land now or formerly owned by Village of Clyde, thence the following courses and distances along land now or formerly owned by said Village of Clyde;

2) N 76-44-30 W, for a distance of 11.02 feet to a point,

3) N 68-37-20 W, for a distance of 400.12 feet to an iron pin,

4) N 68-37-20 W, for a distance of 150.57 feet to an iron pin and

5) N 04-03-30 W, for a distance of 85.43 feet to an iron pin, thence the following courses and distances through land now or formerly owned by Advanced Atomization Technologies, LLC

6) N 04-03-30 E, for a distance of 154.52 feet to an iron pin,

7) N 84-07-00 E, for a distance of 99.90 feet to an iron pin and

8) N 01-42-00 W, for a distance of 226.52 feet to a point in the south line of Columbia Street, thence the following courses and distances along the south line of Columbia Street;

9) S 75-55-20 E, for a distance of 8.96 feet to a point and

10) S 65-21-10 E, for a distance of 218.80 feet to an iron pin and

11) S 67-06-10 E, for a distance of 449.30 feet to the point and place of beginning, comprising an area of 6.532 acres, according to a survey prepared by Greene Land Surveying, PLLC dated August 20, 2018 being Job No. 12-2538 R and Last Revised August 26, 2019.

(PARCEL 1) REFERENCES:

BARGIN AND SALE DEED: PARKER-HANNIFIN CORPORATION TO GAS TURBINE FUEL SYSTEMS CLYDE LLC DATED SEPTEMBER 28, 2012 DOCUMENT R9143923

TITLE REPORT (DEED PARCEL II): LEGACY TITLE SERVICES, LLC FILE No. 18010291, DATED AUGUST 13, 2018

TITLE REPORT (DEED PARCELS I & III): LEGACY TITLE SERVICES, LLC FILE No. 18010292, DATED AUGUST 13, 2018

MAP (DEED PARCEL II): FILED MAP No. 7005

(DEED PARCEL I) TAX ACCOUNT No. 74112-13-141386

(DEED PARCEL II) TAX ACCOUNT NO. 74112-13-193379

(DEED PARCEL III) TAX ACCOUNT NO. 74112-13-153405

(DEED PARCEL II)
EASEMENT TO EMPIRE GAS & ELECTRIC COMPANY PER L-297 P-169

EASEMENT TO THE VILLAGE OF CLYDE PER L-872 P-805

(DEED PARCEL III) EASEMENT TO NYSEG PER L-447 P-49

NOTE: NO ABSTRACT OF TITLE PROVIDED AT TIME OF SURVEY. SUBJECT TO ANY EASEMENTS OR ENCUMBRANCES THAT AN UPDATED ABSTRACT OF TITLE MAY SHOW.

(PARCEL 2) REFERENCES:

QUIT CLAIM DEED: VILLAGE OF CLYDE TO ADVANCED ATOMIZATION TECHNOLOGIES, LLC. DATED MAY 28, 2014 DOCUMENT R9161489

TAX ACCOUNT No. 74112-13-158377

NOTE: NO ABSTRACT OF TITLE PROVIDED AT TIME OF SURVEY. SUBJECT TO ANY EASEMENTS OR ENCUMBRANCES THAT AN UPDATED ABSTRACT OF TITLE MAY SHOW.

(PARCEL 3) REFERENCES:

QUIT CLAIM DEED: VILLAGE OF CLYDE TO ADVANCED ATOMIZATION TECHNOLOGIES, LLC. DATED JUNE 26, 2015 DOCUMENT R9171895

TAX ACCOUNT No. 74112-13-160403

NOTE: NO ABSTRACT OF TITLE PROVIDED AT TIME OF SURVEY. SUBJECT TO ANY EASEMENTS OR ENCUMBRANCES THAT AN UPDATED ABSTRACT OF TITLE MAY SHOW.

NOTE:

UTILITIES SHOWN ARE APPROXIMATE PER SURFACE LOCATIONS OF POLES, MANHOLES, ETC. AND THOSE THAT MAY HAVE BEEN PLOTTED FROM RECORD MAPS. ALL UTILITY COMPANIES SHOULD BE CONTACTED FOR EXACT LOCATION OF BURIED UTILITIES PRIOR TO ANY EXCAVATIONS (800-962-7962).

"This property is subject to an environmental easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the New York Environmental Conservation Law. The engineering and institutional controls for this Easement are set forth in more detail in the Site Management Plan (SMP). A copy of the SMP must be obtained by any party with an interest in the property. The SMP can be obtained from NYS Department of Environmental Conservation, Division of Environmental Remediation, Site Control Section, 625 Broadway, Albany, NY 12233 or at derweb@dec.ny.gov".

CERTIFICATE:

THIS IS TO CERTIFY THAT THIS MAP WAS COMPLETED BY GREENE LAND SURVEYING, PLLC ON AUGUST 17, 2018 FROM THE NOTES OF AN INSTRUMENT SURVEY COMPLETED IN THE FIELD ON JULY 26, 2018 AND FROM THE REFERENCE MATERIAL SHOWN HEREON.

1) NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
2) GAS TURBINE FUEL SYSTEMS CLYDE LLC
3) PARKER-HANNIFIN CORPORATION
4) GENERAL ELECTRIC COMPANY

SIGNED:
TIMOTHY R. VOELLINGER L.S. No. 49986

TOTAL AREA= 364550 SQ. FT. 8.369 ACRES

REVISED 2/5/20 TO HIGHLIGHT AREA OF ENVIRONMENTAL EASEMENT
REVISED 8/26/19 TO REDUCE AREA OF ENVIRONMENTAL EASEMENT

BOUNDARY & ENVIRONMENTAL EASEMENT

PLAN OF LAND
OWNED BY
ADVANCED ATOMIZATION TECHNOLOGIES, LLC
F/K/A GAS TURBINE FUEL SYSTEMS CLYDE, LLC

DRAWN BY	TV
CHECKED	JG
SCALE	1" =40'
KEY	

124 & 170 COLUMBIA STREET & 7 SIBLEY STREET
IN
VILLAGE OF CLYDE
WAYNE COUNTY NEW YORK
AUGUST 17, 2018 JOB NO. 12-2538 R1

GREENE LAND SURVEYING, PLLC 315-331-3999

Appendix B
Owner and Remedial **Party** Responsibilities

Appendix B

Owner and Remedial Party Responsibilities

Site Management Plan

Old Erie Canal Site, Site No. 859015

The responsibilities for implementing the Site Management Plan ("SMP") for the Old Erie Canal Site (the "site"), number 859015, are divided between the site owner(s) and a Remedial Party, as defined below. The owner is currently listed as:

Advanced Atomization Technologies (the "owner")
124 Columbia
Street Clyde, New York 14433
Contact: James Kalinski
Senior Engineering Technician/Maintenance Coordinator
Phone – 315-902-5238
james.kalinski@advancedatomization.com
Contact: Matt Cichocki
General Manager
Phone – 315-923-2311
mcichocki@parker.com

Solely for the purposes of this document and based upon the facts related to the site and the remedial program being carried out, the term Remedial Party ("RP") refers to any of the following:

Parker-Hannifin Corporation
Contact: Martha Connell
Corporate Environmental Manager
Parker-Hannifin Corporation
6035 Parkland Blvd.
Cleveland, Ohio 44124-4141
Phone: 216-896-2052
mconnell@parker.com

and

General Electric Company
Contact: Lewis Streeter
Senior Project Manager
1 River Road
Building 5 - 7W
Schenectady, NY 12345
Phone: 518-388-7552
lewis.streeter@ge.com

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the site.

Site Owner's Responsibilities:

1) The owner shall follow the provisions of the SMP as they relate to future construction and excavation at the site.

2) In accordance with a periodic time frame as established in the SMP, the owner shall periodically certify, in writing, that all Institutional Controls set forth in the Environmental Easement remain in place and continue to be complied with. The owner shall provide a written certification to the RP, upon the RP's request, in order to allow the RP to include the certification in the site's Periodic Review Report (PRR) certification to the NYSDEC.

3) In the event the site is delisted, the owner remains bound by the Environmental Easement, unless the Easement is removed with the approval of the NYSDEC, and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement is still in place and has been complied with.

4) The owner shall grant access to the site to the RP and the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.

5) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the site's RP and the NYSDEC in accordance with the timeframes indicated in Section 1.3-Notifications.

6) In the event some action or inaction by the owner adversely impacts the site, the owner must notify the site's RP and the NYSDEC in accordance with the time frame indicated in Section 1.4 of the SMP - Notifications and coordinate the performance of necessary corrective actions with the RP.

7) The owner must notify the RP and the NYSDEC of any change in ownership of the site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the site property. 6 NYCRR Part 375 contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 1.4 of the SMP. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

8) The owner will operate and maintain the positive air pressure condition within the manufacturing building and the engineering controls necessary to maintain it.

9) Until such time as the NYSDEC deems the vapor mitigation system located at 155 Columbia Street, Clyde, New York is unnecessary, the owner shall ensure system operability, pay for the utilities for the system's operation, and report any maintenance issues to the RP and the NYSDEC.

10) In accordance with the tenant notification law, within 15 days of receipt, the owner must supply a copy of any vapor intrusion data, that is produced with respect to structures and that exceeds NYSDOH or OSHA guidelines on the site, whether produced by the NYSDEC, RP, or owner, to the tenants on the property. The owner must otherwise comply with the tenant and occupant notification provisions of Environmental Conservation Law Article 27, Title 24.

11) The owner shall provide all necessary information requested by the RP so that the RP can timely submit periodic review reports and other submissions to the NYSDEC.

Remedial Party Responsibilities

1) The RP must follow the SMP provisions regarding any construction and/or excavation it undertakes at the site.

2) The RP shall report to the NYSDEC all activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.

3) Before accessing the site property to undertake a specific activity, the RP shall provide the owner advance notification that shall include an explanation of the work expected to be completed. The RP shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the SMP, a copy of any data generated during the site visit and/or any final report produced.

4) If the NYSDEC determines that an update of the SMP is necessary, the RP shall update the SMP and, after consultation with the site owner, obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the RP shall submit a copy of the approved SMP to the owner(s).

5) The RP shall notify the NYSDEC and the owner of any changes in RP ownership and/or control and of any changes in the party/entity responsible under this Division of Responsibilities document. The RP shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to the NYSDEC. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

6) The RP shall notify the NYSDEC of any damage to or modification of the systems as required under Section 1.4 Notifications of the SMP.

7) The owner is responsible for the proper maintenance of the installed vapor intrusion mitigation system associated with the site located at 155 Columbia Street, Clyde, New York, as required in Section 5.2 of the SMP. The RP will report any issues with the mitigation system in the periodic review reports.

8) Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, the RP shall submit an amended SMP to the NYSDEC for approval.

9) Any change in use, change in ownership, change in site classification (*e.g.*, delisting), reduction or expansion of remediation, and other significant changes related to the site may result in a change in responsibilities and, therefore, necessitate an update to the SMP and/or updated legal documents. The RP shall contact the Department to discuss the need to update such documents.

Change in RP ownership and/or control and/or site ownership does not affect the RP's obligations with respect to the site unless a legally binding document executed by the NYSDEC releases the RP of its obligations.

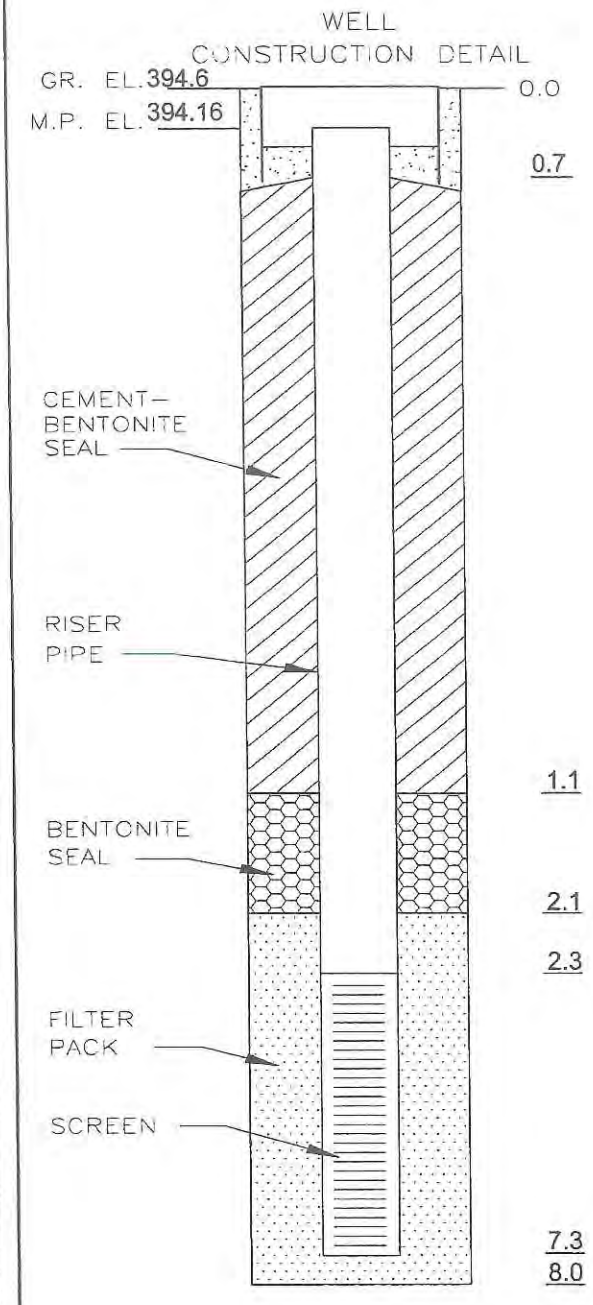
Future site owners and RPs and their successors and assigns are subject to the Environmental Easement and required to carry out the activities set forth above.

Appendix C
Monitoring Well Construction Logs

WELL COMPLETION LOG

Well ID: MW-1S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/30/2002
Project No.:	31117.004.401	**Date Developed:**	6/4/2002



Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 4.22 Date: 6/4/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 6.90'

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 2.0' Continuous

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 1.9' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 2.1 - 8.0'

Seal(s):

Type: Cement-Bentonite Interval: 0.7 - 1.1'
Type: Bentonite Pellets Interval: 1.1 - 2.1'
Type: Interval:

Locking Casing: [X] Yes [ ] No

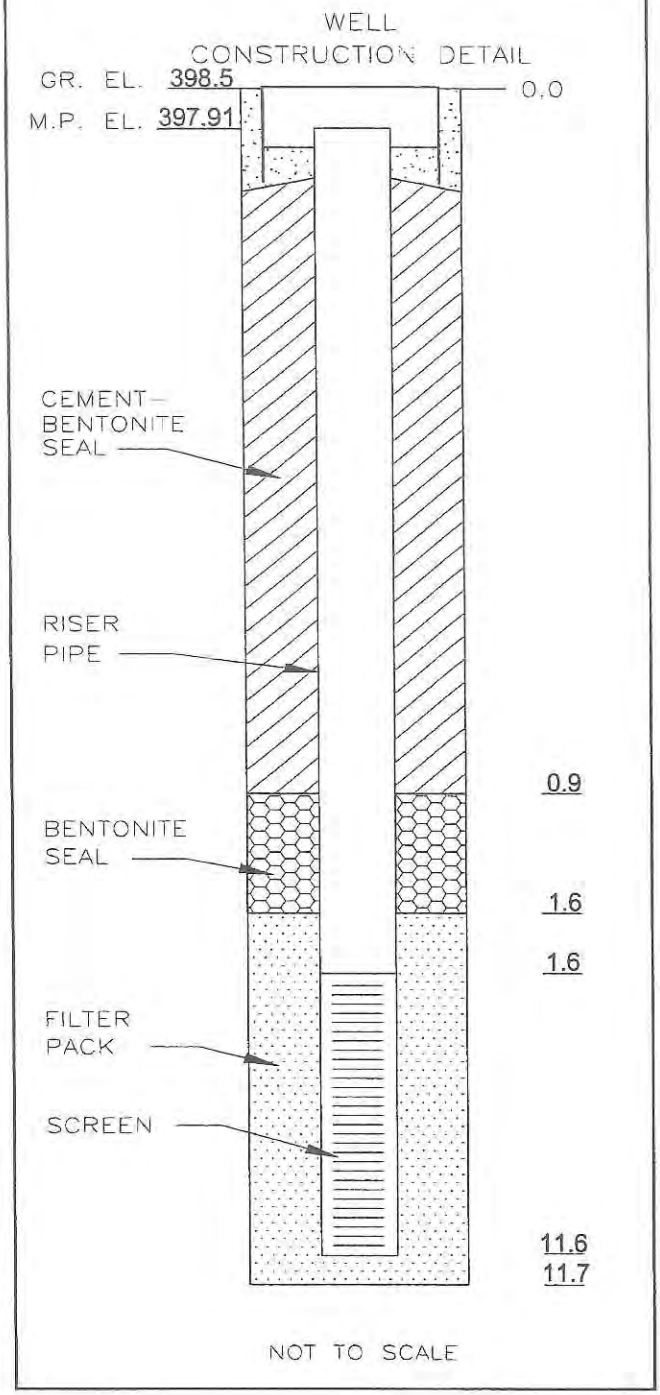
O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG

Well ID: MW-2S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/21/2002
Project No.:	31117.004.401	**Date Developed:**	6/4/2002



Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 2.7 Date: 6/4/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 11.00

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: NA Diameter: NA
Weight: NA Fall: NA
Interval: None

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 1.0' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 1.6 - 11.7'

Seal(s):

Type: Bentonite Pellets Interval: 0.9 - 1.6'
Type: Interval:
Type: Interval:

Locking Casing: [X] Yes [ ] No

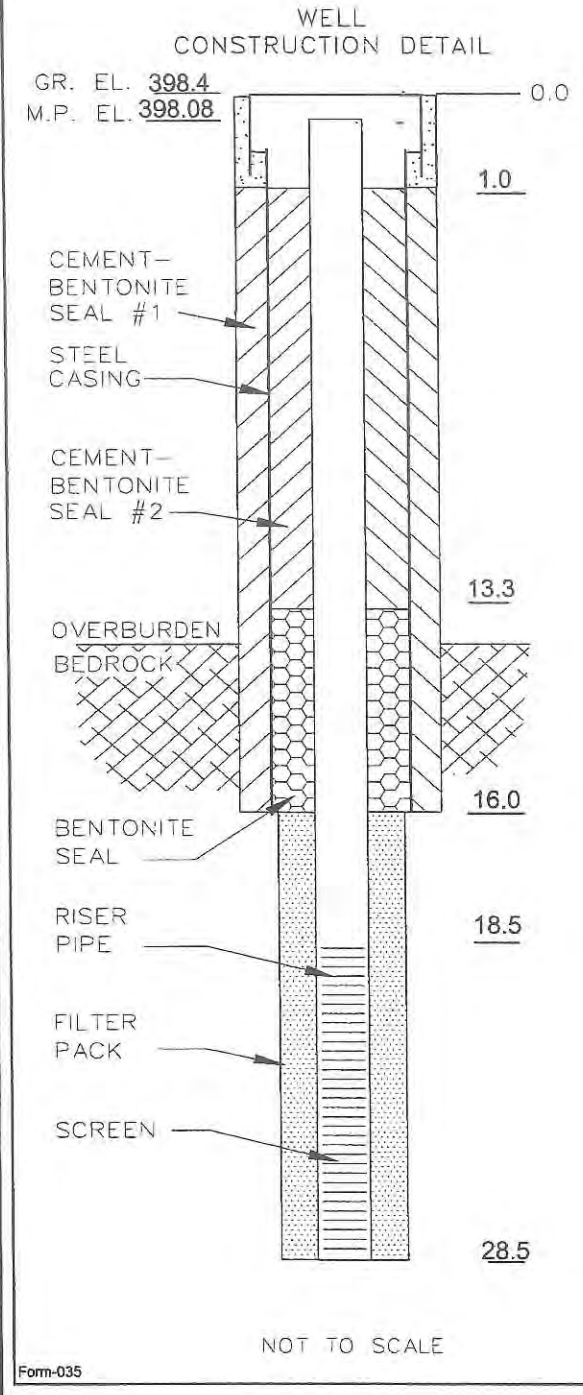
O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG

Well ID: MW-2B

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/29/2002
Project No.:	31117.004.401	**Date Developed:**	6/4/2002



Form-035

Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 2.66 Date: 6/4/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 28.20'

Drilling Method - Overburden:

Type: HSA Diameter: 6 1/4"
Casing: NA

Sampling Method - Overburden:

Type: Split Spoon Diameter: 2 1/4" OD
Weight: 140# Fall: 30"
Interval: 2.0' Continuous

Drilling Method - Bedrock:

Type: Core Diameter: 4 1/4"
Casing: NA

Sampling Method - Bedrock:

Type: Core Diameter: 2 1/2"
Interval: 5.0'

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 18.2' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 16.0 - 28.5'

Seal(s):

Type: Cement-Bentonite Grout #1 Interval: 1.0 - 16.0'
Type: Cement-Bentonite Grout #2 Interval: 1.0 - 13.3'
Type: Bentonite Pellet Seal Interval: 13.8 - 16.0'

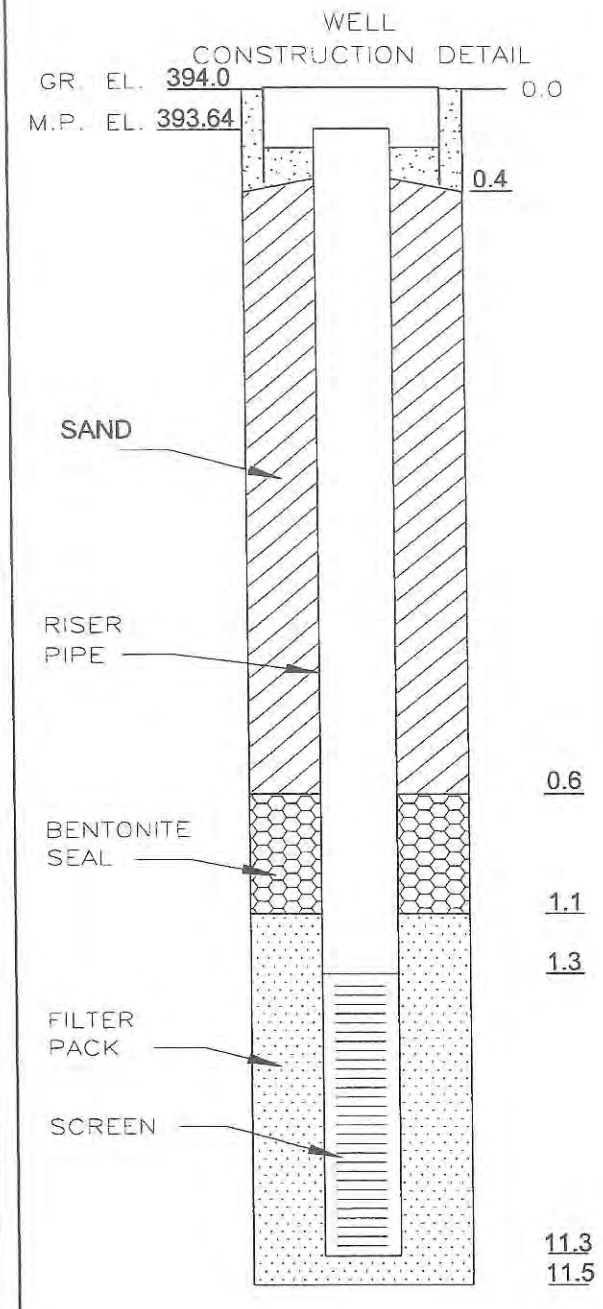
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

WELL COMPLETION LOG

Well ID: MW - 3S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/21/2002
Project No.:	31117.004.401	**Date Developed:**	6/3/2002



Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 4.09 Date: 6/3/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 10.90

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 2.0' Continuous

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 0.9' Joint Type Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 1.1 - 11.5'

Seal(s):

Type:	Sand	Interval:	0.4 - 0.6'
Type:	Bentonite Pellets	Interval:	0.6 - 1.1'
Type:		Interval:	

Locking Casing: [X] Yes [ ] No

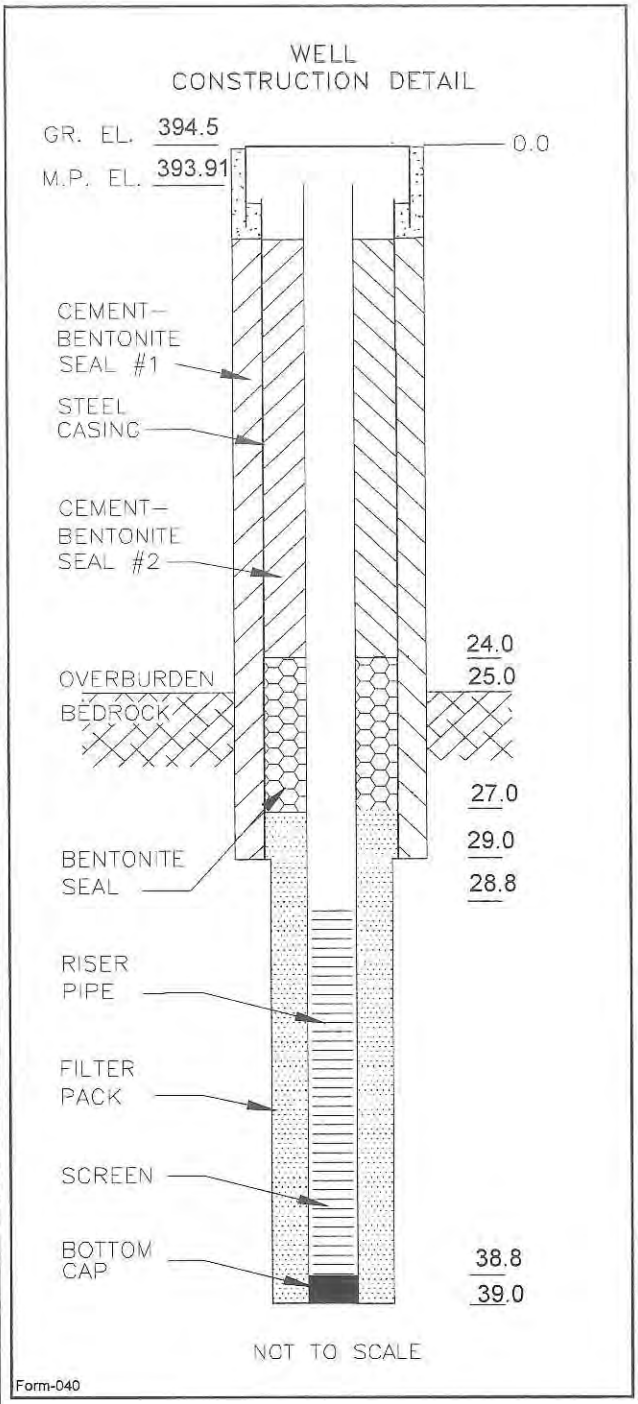
O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG

Well ID: MW-3B

Project:	Old Erie Canal Supplemental FS	**Client:**	Parker-Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/16/2006
Project No.:	39892.001.102	**Date Developed:**	11/17 - 21/06



Form-040

Inspection Notes:

Inspector: P. D'Annibale
Drilling Contractor: Parratt-Wolff, Inc.
Type of Well: Monitoring Well

Static Water Level (ft bmp): 8.19 Date: 11/28/06
Measuring Point: TOC
Total Depth of Well (ft bmp): 38.54

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4" ID
Casing: 4" Steel

Sampling Method - Overburden:

Type: Split Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 12.0' - 26.0'

Drilling Method - Bedrock:

Type: HX diamond bit Diameter: 3 3/4" OD
Casing: NA

Sampling Method - Bedrock:

Type: HX Core Diameter: 3 3/4" OD
Interval: 29.0' - 39.0'

Riser Pipe Left in Place:

Material: Sch. 40 PVC Diameter: 2" ID
Length: 28.5' Joint Type: Flush Thread

Screen:

Material: Sch. 40 PVC Diameter: 2" ID
Slot Size: 0.010 Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: # 0 Morie
Interval: 27.0' - 39.0'

Seal(s):

Type: Cement-Bentonite Seal #1 Interval: 0.0' - 29.0'
Type: Bentonite Seal Interval: 24.0'-27.0'
Type: Interval:

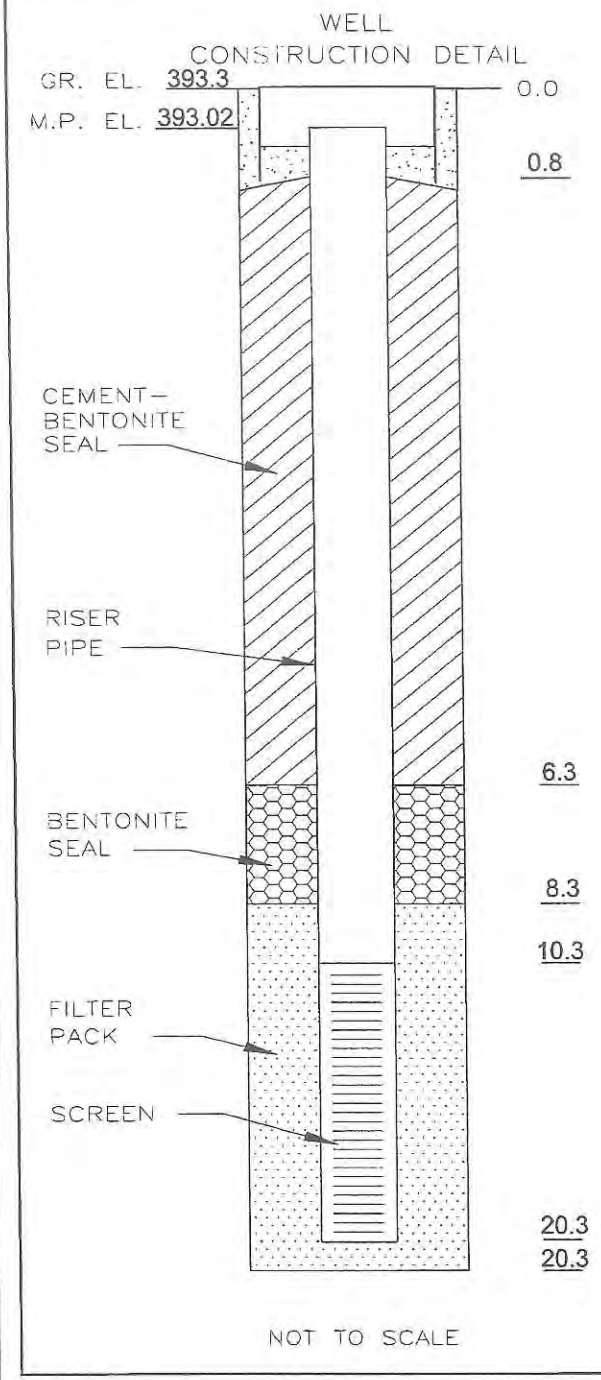
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

WELL COMPLETION LOG

Well ID: MW - 4S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/22/2002
Project No.:	31117.004.401	**Date Developed:**	6/4/2002



Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 5.15 Date: 6/4/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 20.00

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: NA Diameter: NA
Weight: NA Fall: NA
Interval: NA

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 10.0' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 8.3 - 20.3'

Seal(s):

Type:	Cement-Bentonite	Interval:	0.8 - 6.3'
Type:	Bentonite Pellets	Interval:	6.3 - 8.3'
Type:		Interval:	

Locking Casing: [X] Yes [ ] No

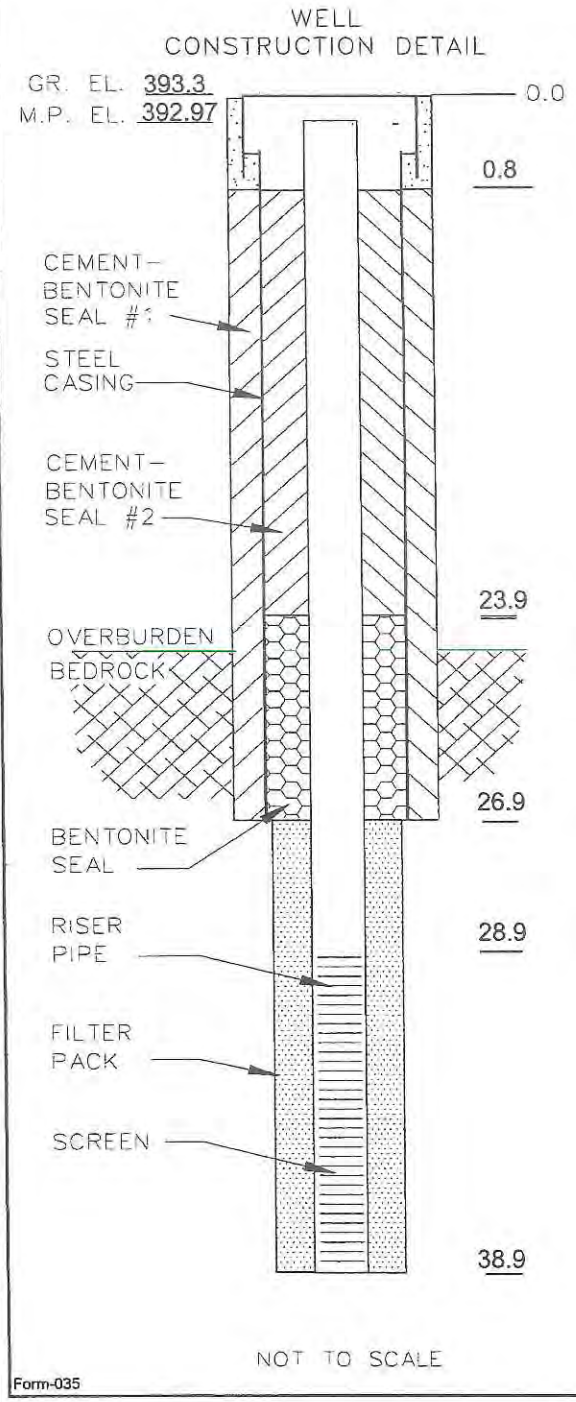
O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG

Well ID: MW - 4B

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/28/2002
Project No.:	31117.004.401	**Date Developed:**	6/4/2002



Form-035

Inspection Notes:

Inspector:	G. Sleeman
Drilling Contractor:	Parratt Wolff
Type of Well:	Environmental Monitoring Well
Static Water Level (ft bmp):	6.37 Date: 6-4-02
Measuring Point:	Top of PVC
Total Depth of Well (ft bmp):	38.60

Drilling Method - Overburden:

Type:	HSA	Diameter:	6 1/4"
Casing:	NA		

Sampling Method - Overburden:

Type:	NA	Diameter:	NA
Weight:	NA	Fall:	NA
Interval:	NA		

Drilling Method - Bedrock:

Type:	Core	Diameter:	4 1/4"
Casing:	NA		

Sampling Method - Bedrock:

Type:	Core	Diameter:	2 1/2"
Interval:	5.0'		

Riser Pipe Left in Place:

Material:	Sch 40 PVC	Diameter:	2" ID
Length:	28.6'	Joint Type:	Flush Thread

Screen:

Material:	Sch 40 PVC	Diameter:	2" ID
Slot Size:	0.010"	Joint Type:	Flush Thread

Filter Pack:

Type:	Sand	Grade:	#0
Interval:	26.9 - 38.9'		

Seal(s):

Type:	Cement-Bentonite Grout #1	Interval:	0.8 - 26.9'
Type:	Cement-Bentonite Grout #2	Interval:	0.8 - 23.9'
Type:	Bentonite Pellet Seal	Interval:	23.9 - 26.9'

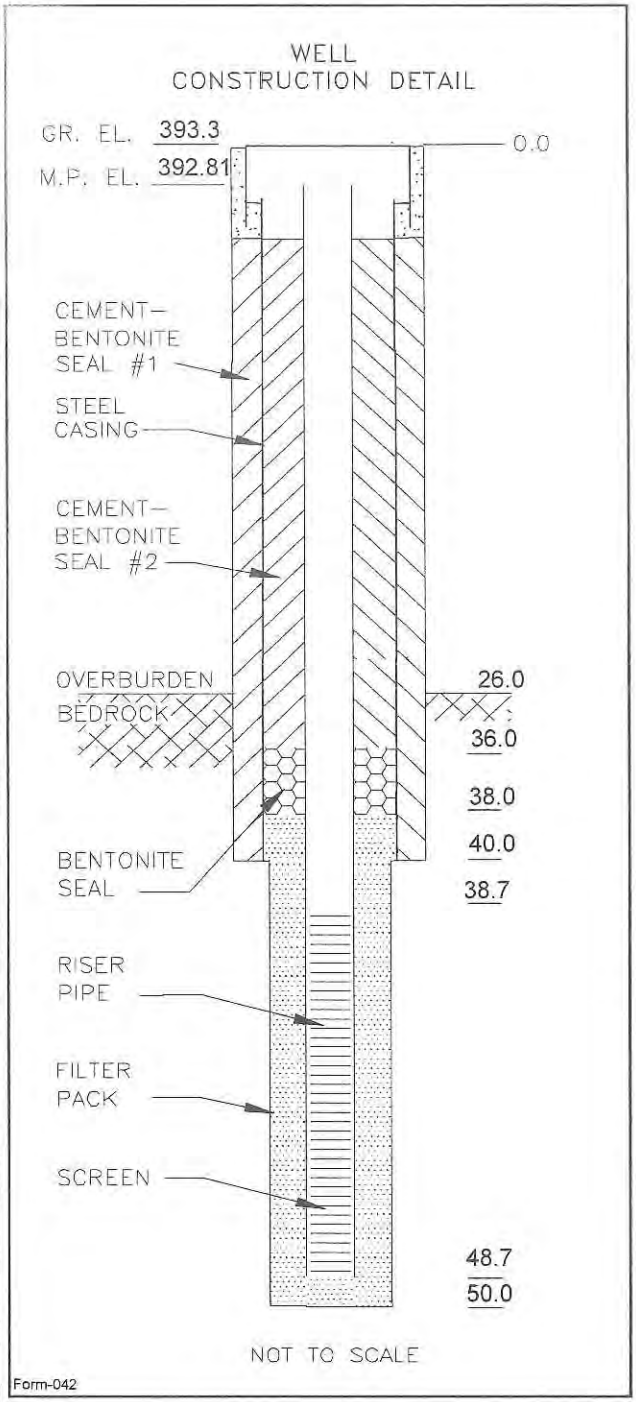
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

WELL COMPLETION LOG

Well ID: MW-4C

Project:	Old Erie Canal Supplemental FS	**Client:**	Parker-Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/17/2006
Project No.:	39892.001.102	**Date Developed:**	11/20/2006



Form-042

Inspection Notes:

Inspector:	P. D'Annibale		
Drilling Contractor:	Parratt-Wolff, Inc.		
Type of Well:	Monitoring Well		
Static Water Level (ft bmp):	-1.06	Date:	11/28/06
Measuring Point:	TOC		
Total Depth of Well (ft bmp):	48.23		

Drilling Method - Overburden:

Type:	HSA	Diameter:	4 1/4" ID
Casing:	4" Steel		

Sampling Method - Overburden:

Type:	NA	Diameter:	NA
Weight:	NA	Fall:	NA
Interval:	NA		

Drilling Method - Bedrock:

Type:	HX diamond bit	Diameter:	3 3/4" OD
Casing:	NA		

Sampling Method - Bedrock:

Type:	HX Core	Diameter:	3 3/4" OD
Interval:	40.0' - 50.0'		

Riser Pipe Left in Place:

Material:	Sch. 40 PVC	Diameter:	2" ID
Length:	38.2'	Joint Type:	Flush Thread

Screen:

Material:	Sch. 40 PVC	Diameter:	2" ID
Slot Size:	0.010	Joint Type:	Flush Thread

Filter Pack:

Type:	Sand	Grade:	# 0 Morie
Interval:	38.0 - 50.0'		

Seal(s):

Type:	Cement-Bentonite Seal #1	Interval:	0.0' - 40.0'
Type:	Bentonite Seal	Interval:	36.0'-38.0'
Type:		Interval:	

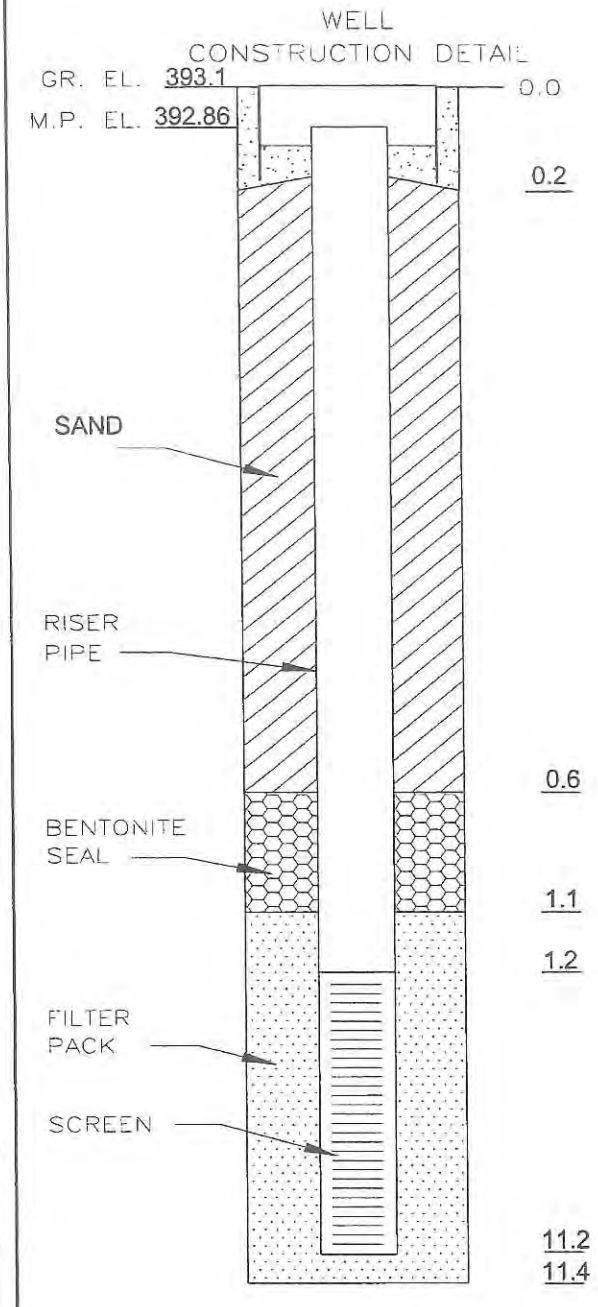
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

WELL COMPLETION LOG

Well ID: MW - 5S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/21/2002
Project No.:	31117.004.401	**Date Developed:**	6/3/2002



Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 4.10 Date: 6/3/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 11.00

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 2.0' Continuous

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 1.0' Joint Type Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 1.1 - 11.4'

Seal(s):

Type:	Sand	Interval:	0.2 - 0.6'
Type:	Bentonite Pellets	Interval:	0.6 - 1.1'
Type:		Interval:	

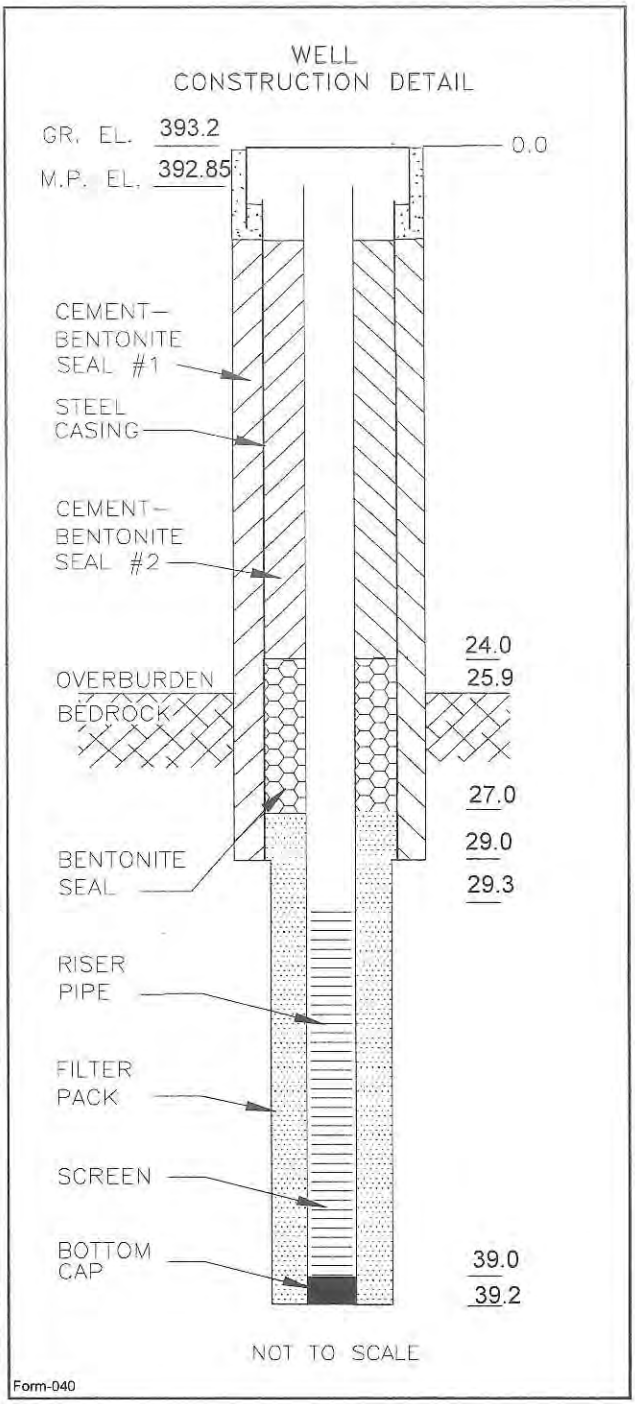
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG — Well ID: MW-5B

Project:	Old Erie Canal Supplemental FS	**Client:**	Parker-Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/16/2006
Project No.:	39892.001.102	**Date Developed:**	11/20 - 21/06



Form-040

Inspection Notes:

Inspector:	P. D'Annibale
Drilling Contractor:	Parratt-Wolff, Inc.
Type of Well:	Monitoring Well
Static Water Level (ft bmp):	NA Date:
Measuring Point:	TOC
Total Depth of Well (ft bmp):	38.91

Drilling Method - Overburden:

Type:	HSA	Diameter:	4 1/4" ID
Casing:	4" Steel		

Sampling Method - Overburden:

Type:	Split Spoon	Diameter:	2" OD
Weight:	140 #	Fall:	30"
Interval:	12.0' - 26.0'		

Drilling Method - Bedrock:

Type:	HX diamond bit	Diameter:	3 3/4" OD
Casing:	NA		

Sampling Method - Bedrock:

Type:	HX Core	Diameter:	3 3/4" OD
Interval:	29.0' - 39.2'		

Riser Pipe Left in Place:

Material:	Sch. 40 PVC	Diameter:	2" ID
Length:	28.9'	Joint Type:	Flush Thread

Screen:

Material:	Sch. 40 PVC	Diameter:	2" ID
Slot Size:	0.010	Joint Type:	Flush Thread

Filter Pack:

Type:	Sand	Grade:	# 0 Morie
Interval:	27.0' - 39.2'		

Seal(s):

Type:	Cement-Bentonite Seal #1	Interval:	0.0' - 29.0'
Type:	Bentonite Seal	Interval:	24.0'-27.0'
Type:		Interval:	

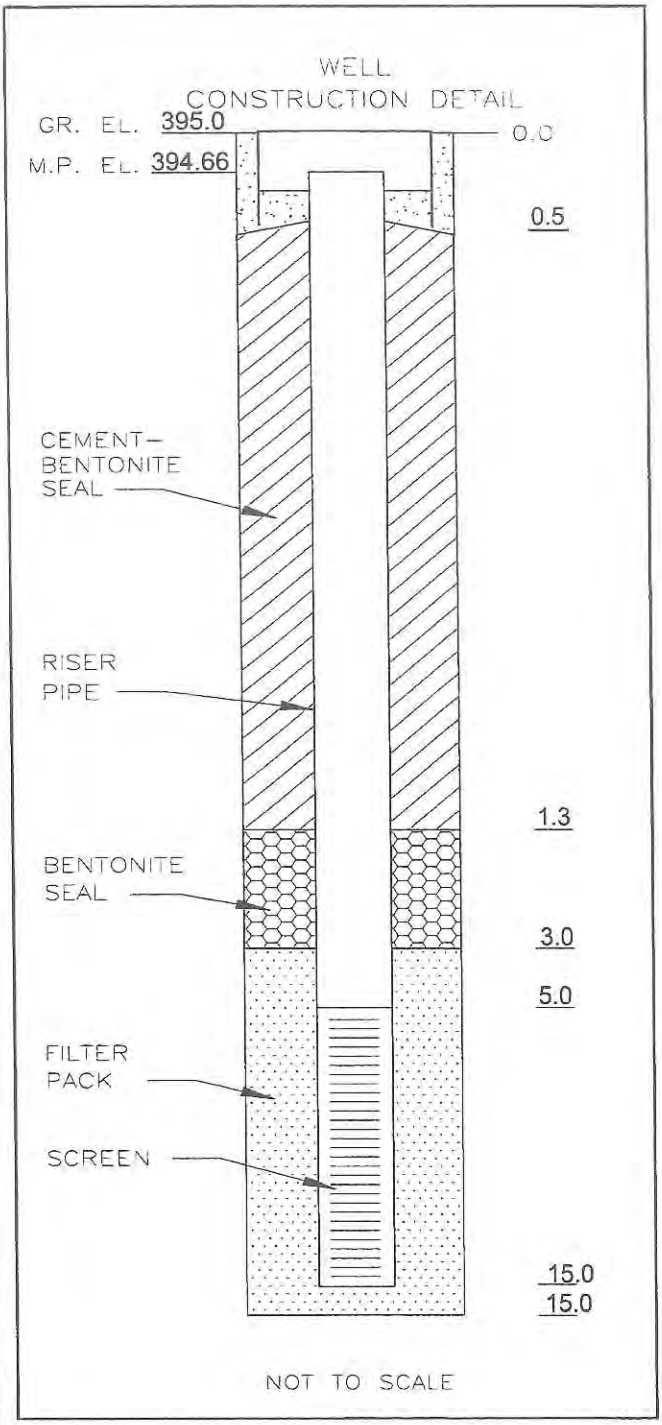
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

WELL COMPLETION LOG

Well ID: MW-6S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/30/2002
Project No.:	31117.004.401	**Date Developed:**	6/4/2002



Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 3.60 Date: 6/4/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 14.70'

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: NA Diameter: NA
Weight: NA Fall: NA
Interval: NA

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 4.7' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 3.0 - 15.0'

Seal(s):

Type: Cement-Bentonite Interval: 0.5 - 1.3'
Type: Bentonite Pellets Interval: 1.3 - 3.0'
Type: Interval:

Locking Casing: [X] Yes [ ] No

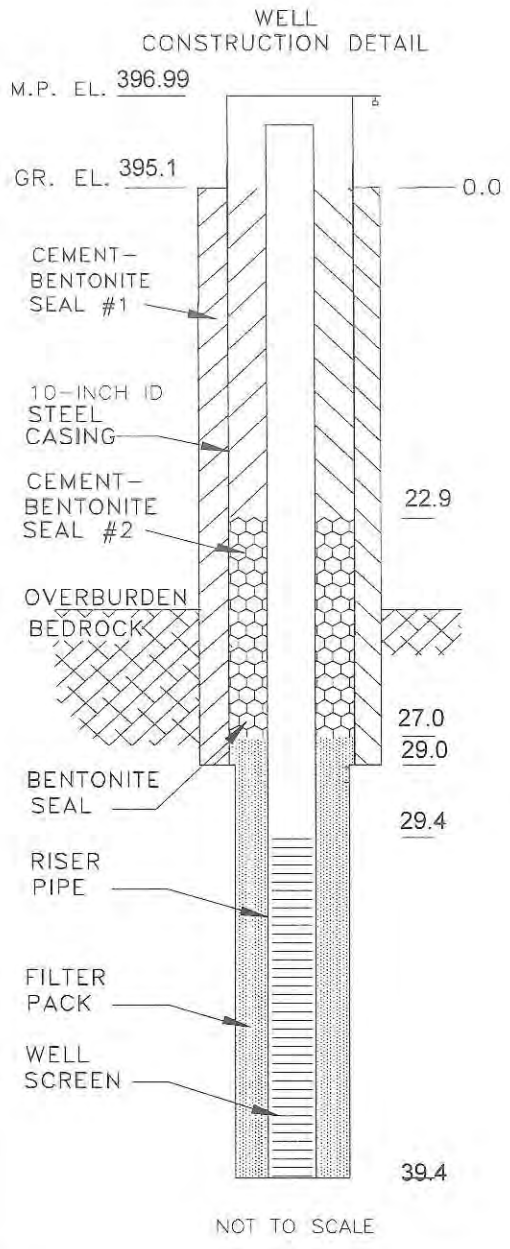
O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG

Well ID: MW-6B

Project:	Old Erie Canal Supplemental FS	**Client:**	Parker-Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/15/2006
Project No.:	39892.001.102	**Date Developed:**	11/16/2006



Form-033

Inspection Notes:

Inspector: P. D'Annibale
Drilling Contractor: Parratt- Wolff, Inc.
Type of Well: Monitoring Well

Static Water Level (ft bmp): 9.00 Date: 11/28/06
Measuring Point: TOC
Total Depth of Well (ft bmp): 41.26

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4" ID
Casing: 4" Steel

Sampling Method - Overburden:

Type: Split Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 0.0' - 26.0'

Drilling Method - Bedrock:

Type: HX diamond bit Diameter: 3 3/4" OD
Casing: NA

Sampling Method - Bedrock:

Type: HX Core Diameter: 3 3/4" OD
Interval: 29.0' - 39.4'

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 31.3' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010 Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: # 0 Morie
Interval: 27.0' - 39.3'

Seal(s):

Type: Cement-Bentonite Seal #1 Interval: 0.0'-29.0'
Type: Bentonite Seal Interval: 22.9'-27.0'
Type: Interval:

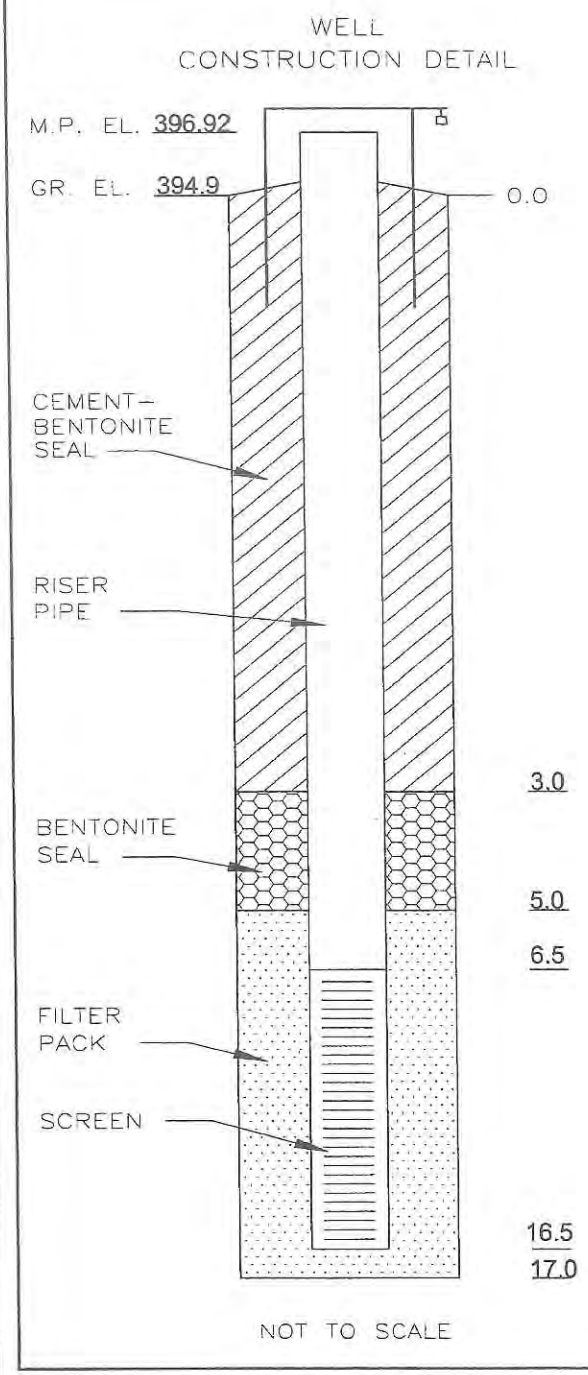
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

WELL COMPLETION LOG

Well ID: MW - 7S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/24/2002
Project No.:	31117.004.401	**Date Developed:**	5/31/2002



Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 8.66 Date: 5/31/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 18.50

Drilling Method - Overburden:

Type: HSA Diameter: 4¼" ID
Casing: NA

Sampling Method - Overburden:

Type: NA Diameter: NA
Weight: NA Fall: NA
Interval: NA

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 8.5' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 5.0 - 17.0'

Seal(s):

Type: Cement-Bentonite Interval: 0.0 - 3.0'
Type: Bentonite Pellets Interval: 3.0 - 5.0'
Type: Interval:

Locking Casing: [X] Yes [ ] No

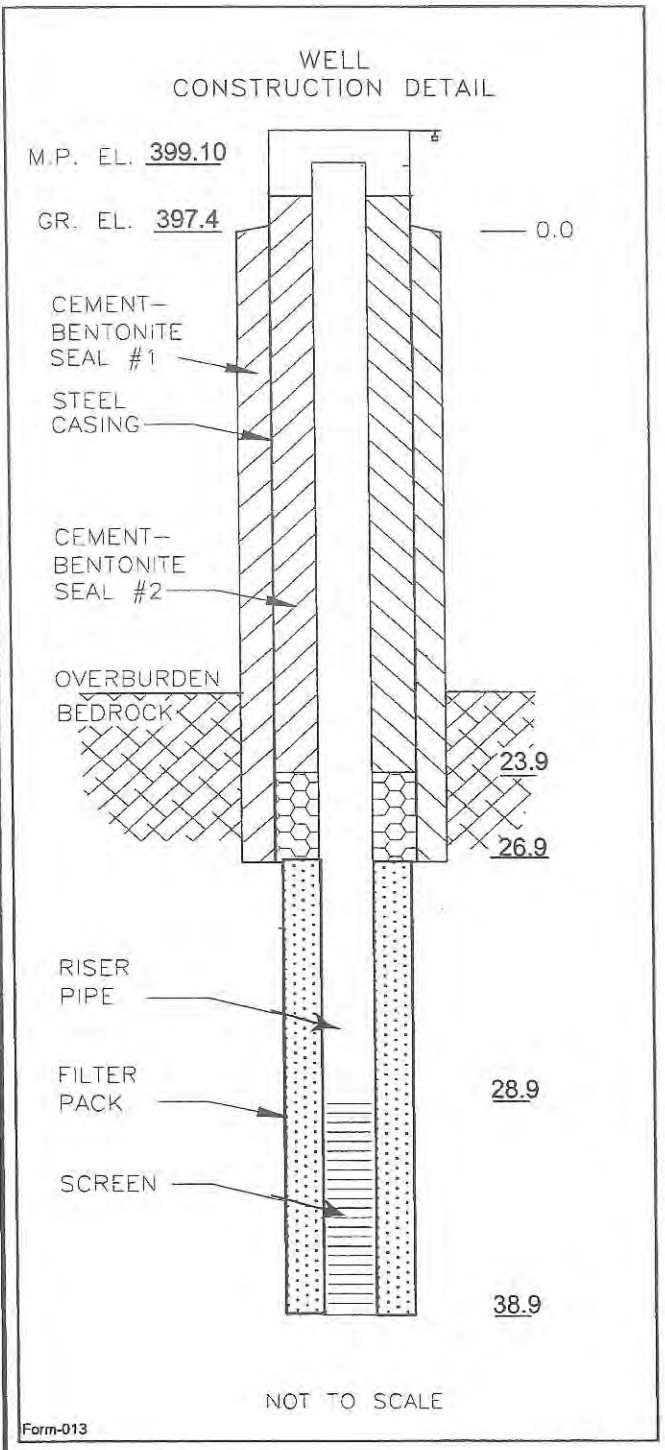
O'BRIEN & GERE ENGINEERS, INC.

Form 001

WELL COMPLETION LOG

Well ID: MW - 7B

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/28/2002
Project No.:	31117.004.401	**Date Developed:**	5/31/2002



Form-013

Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 10.33' Date: 5-31-02
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 40.60'

Drilling Method - Overburden:

Type: HSA Diameter: 6 1/4"
Casing: NA

Sampling Method - Overburden:

Type: Split Spoon Diameter: 2" OD
Weight: 140# Fall: 30"
Interval: 2.0' Continuous

Drilling Method - Bedrock:

Type: Core Diameter: 4 1/4"
Casing: NA

Sampling Method - Bedrock:

Type: Core Diameter: 2 1/2"
Interval: 5.0'

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 30.6' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 26.9 - 38.9'

Seal(s):

Type: Cement-Bentonite Grout # 1 Interval: 0.0 - 26.9'
Type: Bentonite-Cement #1 Interval: 0.0 - 23.9'
Type: Bentonite Interval: 23.6 - 26.9'

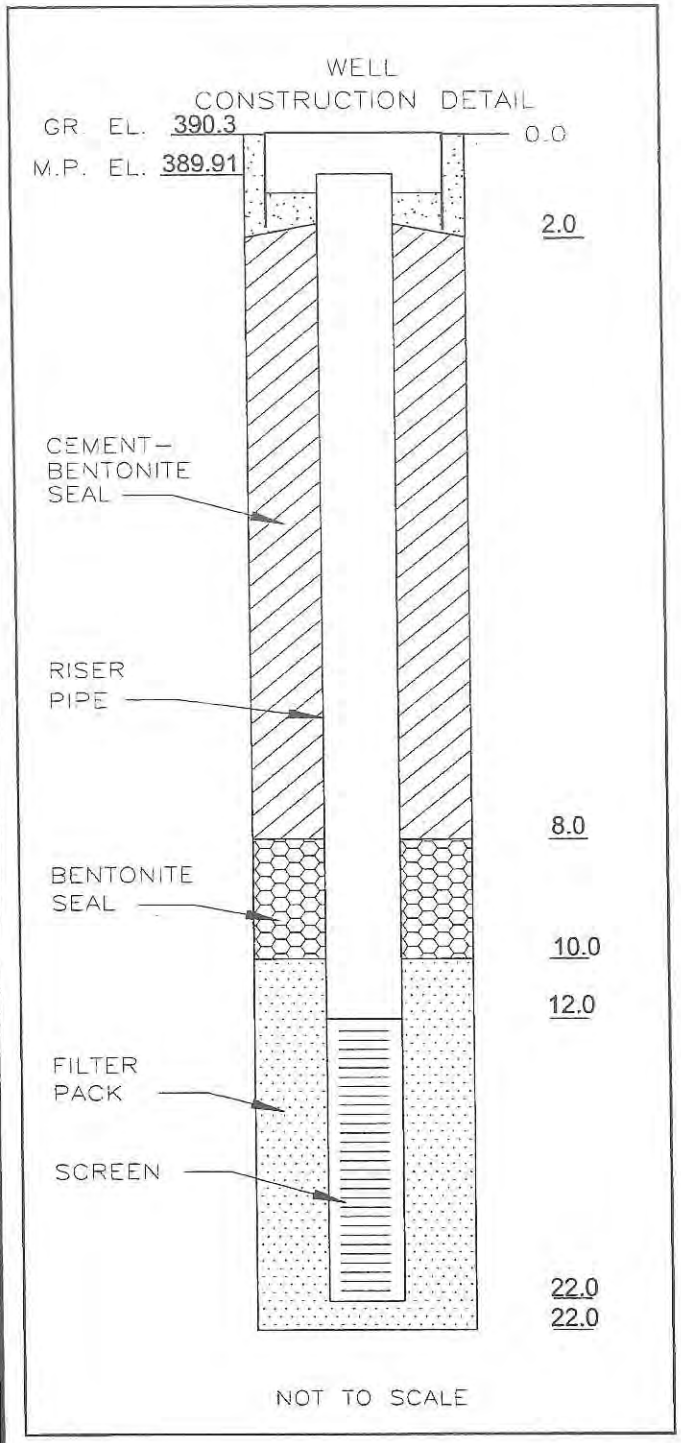
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

WELL COMPLETION LOG

Well ID: MW - 8S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/29/2002
Project No.:	31117.004.401	**Date Developed:**	6/3/2002



Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 0.50 Date: 6/3/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 21.65'

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 2.0' Continuous

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 11.6 Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 10.0 - 22.0'

Seal(s):

Type: Cement-Bentonite Interval: 2.0 - 8.0'
Type: Bentonite Pellets Interval: 8.0 - 10.0'
Type: Interval:

Locking Casing: [X] Yes [ ] No

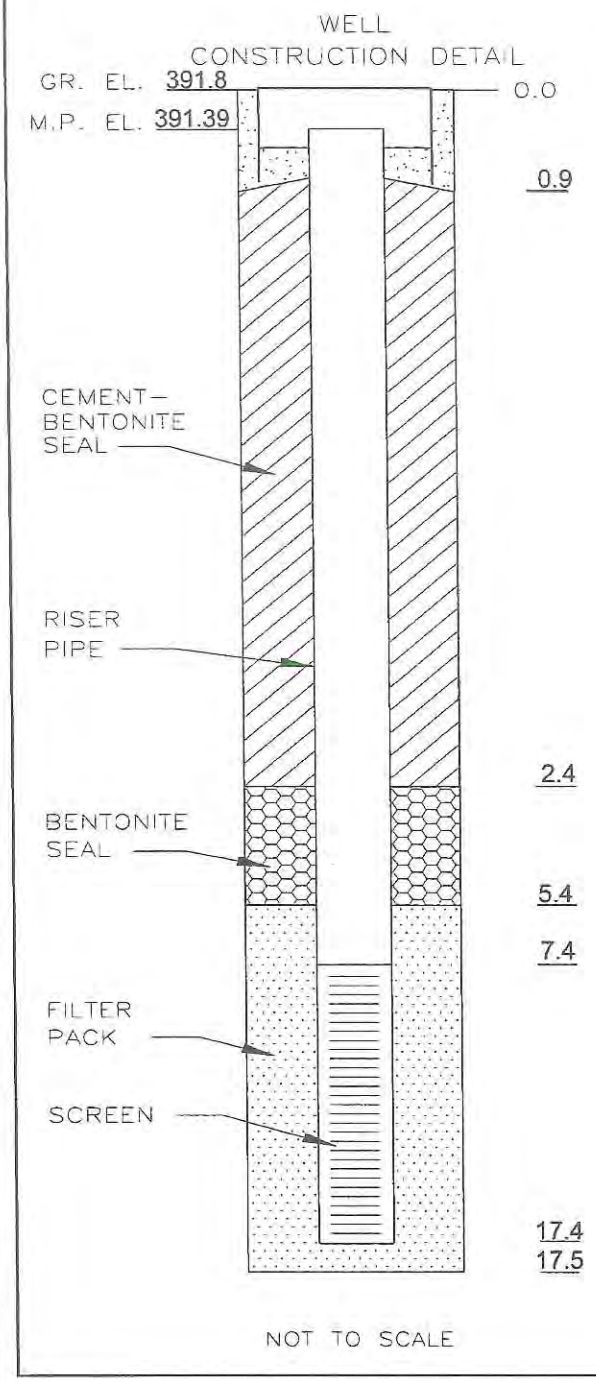
O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG

Well ID: MW-9S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, NY	**Date Drilled:**	5/21/2002
Project No.:	31117.004.401	**Date Developed:**	5/31/2002



Inspection Notes:

Inspector: G. Sleeman
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 2.10 Date: 5/31/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 17.00

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 2.0' Continuous

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 6.5' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 5.4 - 17.5'

Seal(s):

Type:	Sand	Interval:	0.9 - 2.4'
Type:	Bentonite Pellets	Interval:	2.4 - 5.4'
Type:		Interval:	

Locking Casing: [X] Yes [ ] No

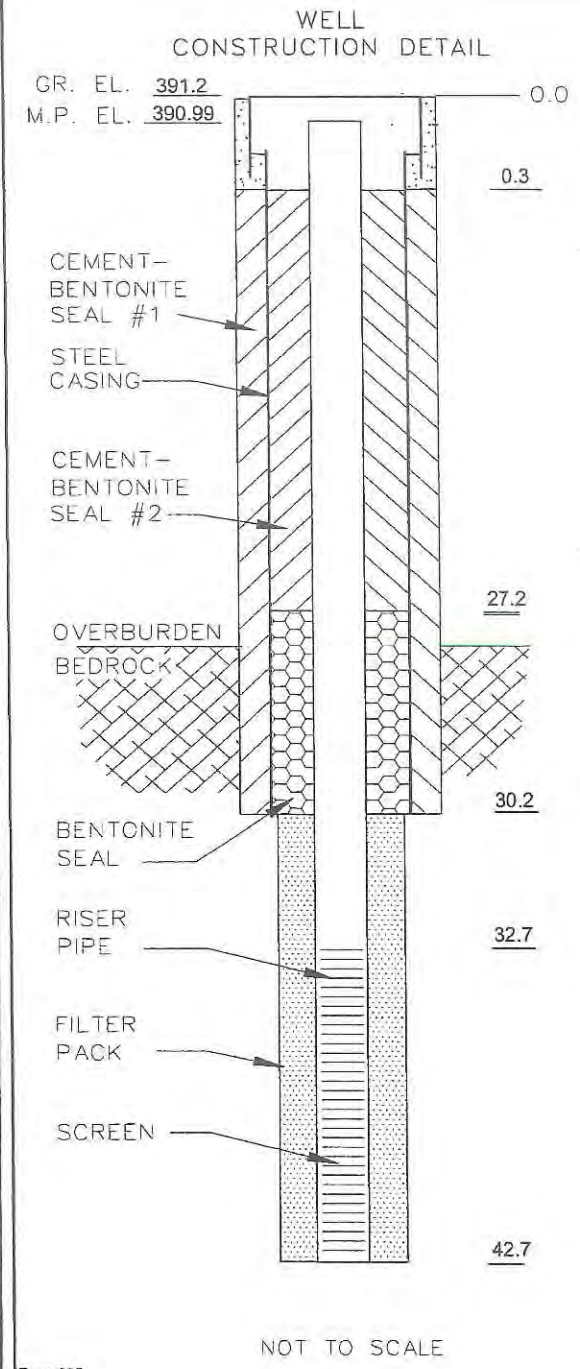
O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG

Well ID: MW-10B

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/18/2002
Project No.:	31117	**Date Developed:**	11/26/2002



Form-035

Inspection Notes:

Inspector: Chawn O'Dell
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 0.53 Date: 12-16-02
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 42.46'

Drilling Method - Overburden:

Type: HSA Diameter: 6 1/2"
Casing: NA

Sampling Method - Overburden:

Type: Split - Spoon Diameter: 2 1/4" OD
Weight: 140 # Fall: 30"
Interval: 2.0' Continous

Drilling Method - Bedrock:

Type: Core Diameter: 4 1/4"
Casing: NA

Sampling Method - Bedrock:

Type: Core Diameter: 2 1/2"
Interval: 5.0'

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 32.5' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 30.2 - 42.7'

Seal(s):

Type: Cement-Bentonite Grout #1 Interval: 0.3 - 30.2'
Type: Cement-Bentonite Grout #2 Interval: 0.3 - 27.2'
Type: Bentonite Pellet Seal Interval: 27.2 - 30.2'

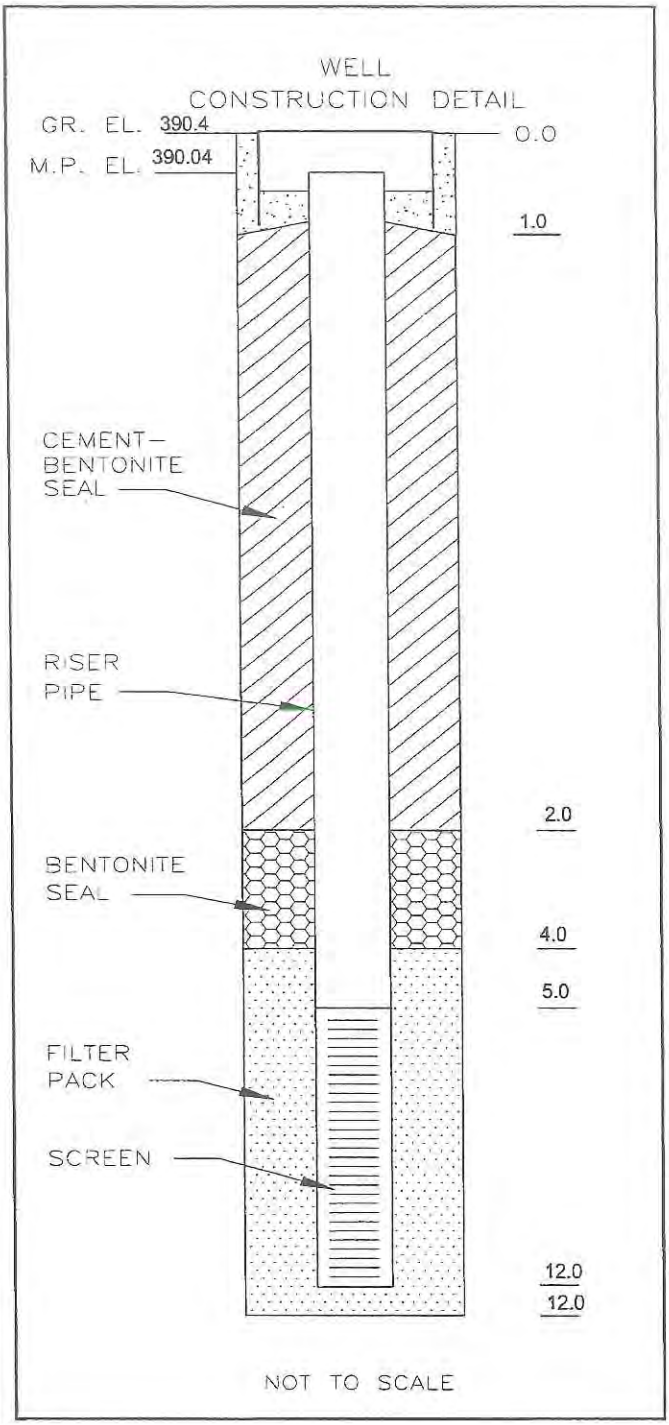
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE
ENGINEERS, INC.

WELL COMPLETION LOG

Well ID: MW-11S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/20/2002
Project No.:	31117	**Date Developed:**	11/26/2002



Inspection Notes:

Inspector: Chawn O'Dell
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 3.61 Date: 12/16/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 11.60'

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: NA Diameter: NA
Weight: NA Fall: NA
Interval: NA

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 4.6' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 4.0 - 12.0'

Seal(s):

Type:	Cement-Bentonite	Interval:	1.0 - 2.0'
Type:	Bentonite Pellets	Interval:	2.0 - 4.0'
Type:		Interval:	

Locking Casing: [X] Yes [ ] No

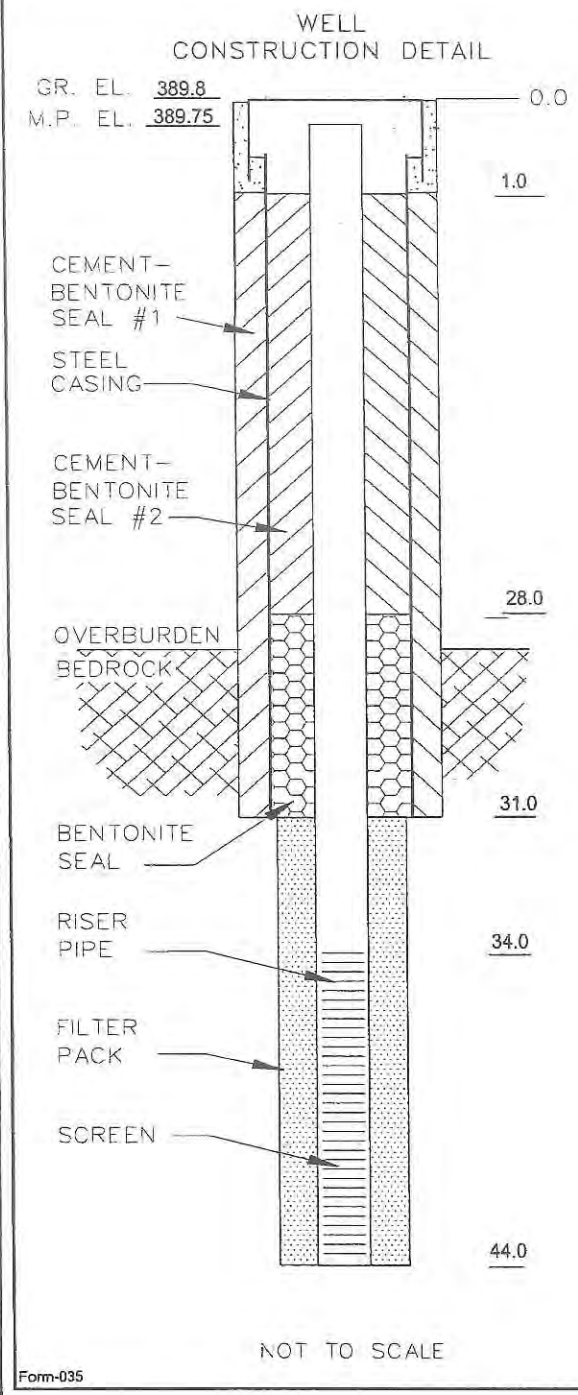
O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG

Well ID: MW-11B

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/19/2002
Project No.:	31117	**Date Developed:**	11/26/2002



Form-035

Inspection Notes:

Inspector: Chawn O'Dell
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): -0.14 Date: 12-10-02
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 43.93

Drilling Method - Overburden:

Type: HSA Diameter: 6 1/2"
Casing: NA

Sampling Method - Overburden:

Type: Split - Spoon Diameter: 2 1/4" OD
Weight: 140 # Fall: 30"
Interval: 2.0' Continous

Drilling Method - Bedrock:

Type: Core Diameter: 4 1/4"
Casing: NA

Sampling Method - Bedrock:

Type: Core Diameter: 2 1/2"
Interval: 5.0'

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 33.9' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 31.0 - 44.0'

Seal(s):

Type:	Cement-Bentonite Grout #1	Interval:	1.0 - 31.0'
Type:	Cement-Bentonite Grout #2	Interval:	1.0 - 28.0'
Type:	Bentonite Pellet Seal	Interval:	28.0 - 31.0'

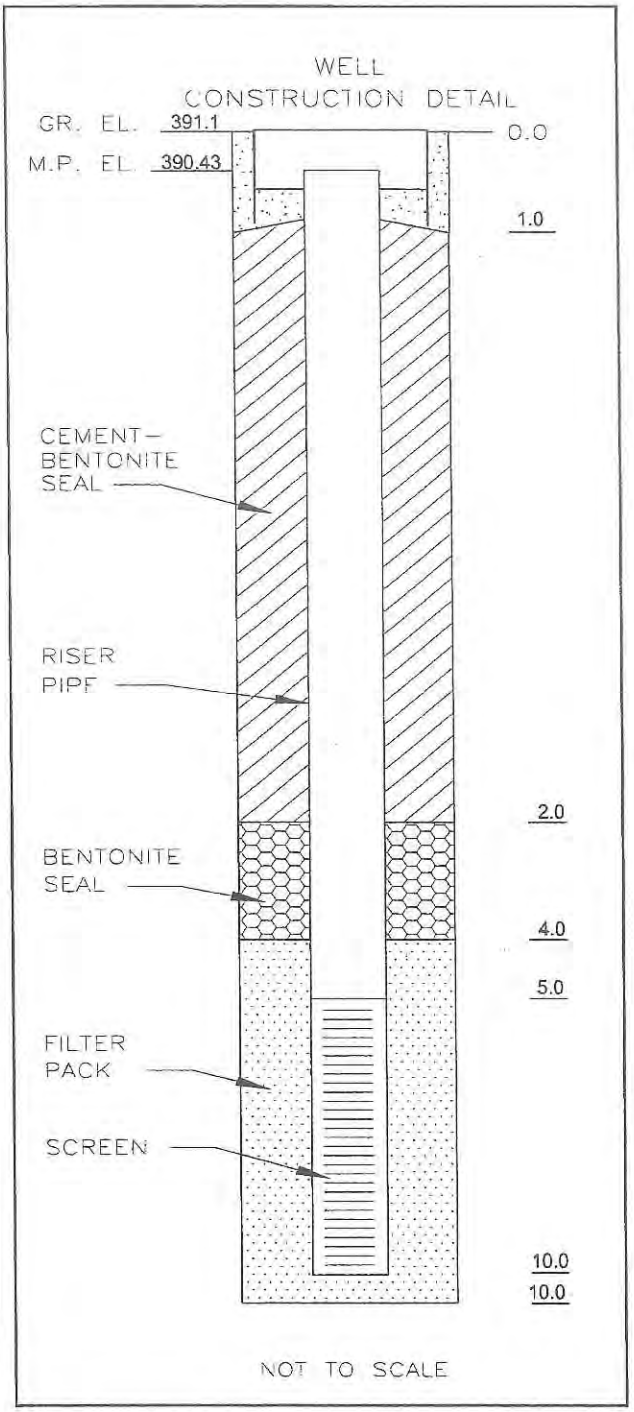
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

WELL COMPLETION LOG

Well ID: MW-12S

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/20/2002
Project No.:	31117	**Date Developed:**	11/26/2002



Inspection Notes:

Inspector: Chawn O'Dell
Drilling Contractor: Parratt Wolff
Type of Well: Environmental Monitoring Well

Static Water Level (ft bmp): 8.56 Date: 12/16/2002
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 9.38'

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: NA Diameter: NA
Weight: NA Fall: NA
Interval: NA

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 4.4' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010" Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: #0
Interval: 4.0 - 10.0'

Seal(s):

Type: Cement-Bentonite Interval: 1.0' - 2.0'
Type: Bentonite Pellets Interval: 2.0' - 4.0'
Type: Interval:

Locking Casing: [X] Yes [ ] No

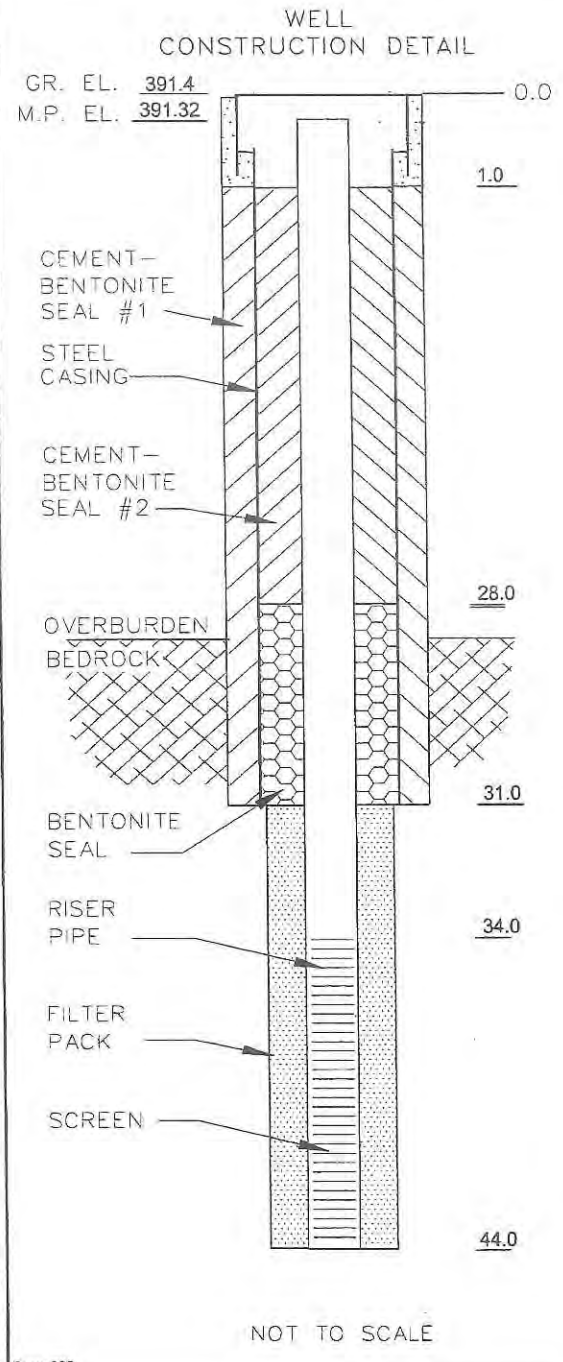
O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG

Well ID: MW-12B

Project:	Old Erie Canal Site	**Client:**	Parker Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/20/2002
Project No.:	31117	**Date Developed:**	11/26/2002



Form-035

Inspection Notes:

Inspector:	Chawn O'Dell
Drilling Contractor:	Parratt Wolff
Type of Well:	Environmental Monitoring Well
Static Water Level (ft bmp):	1.86 Date: 12-16-02
Measuring Point:	Top of PVC
Total Depth of Well (ft bmp):	43.97

Drilling Method - Overburden:

Type:	HSA	Diameter:	6 1/4"
Casing:	NA		

Sampling Method - Overburden:

Type:	Split - Spoon	Diameter:	2 1/4" OD
Weight:	140 #	Fall:	30"
Interval:	2.0' Continuous		

Drilling Method - Bedrock:

Type:	Core	Diameter:	4 1/4"
Casing:	NA		

Sampling Method - Bedrock:

Type:	Core	Diameter:	2 1/2"
Interval:	5.0' Continuous		

Riser Pipe Left in Place:

Material:	Sch 40 PVC	Diameter:	2" ID
Length:	33.9'	Joint Type:	Flush Thread

Screen:

Material:	Sch 40 PVC	Diameter:	2" ID
Slot Size:	0.010"	Joint Type:	Flush Thread

Filter Pack:

Type:	Sand	Grade:	#0
Interval:	31.0' - 44.0'		

Seal(s):

Type:	Cement-Bentonite Grout #1	Interval:	1.0 - 31.0'
Type:	Cement-Bentonite Grout #2	Interval:	1.0 - 28.0'
Type:	Bentonite Pellet Seal	Interval:	28.0 - 31.0'

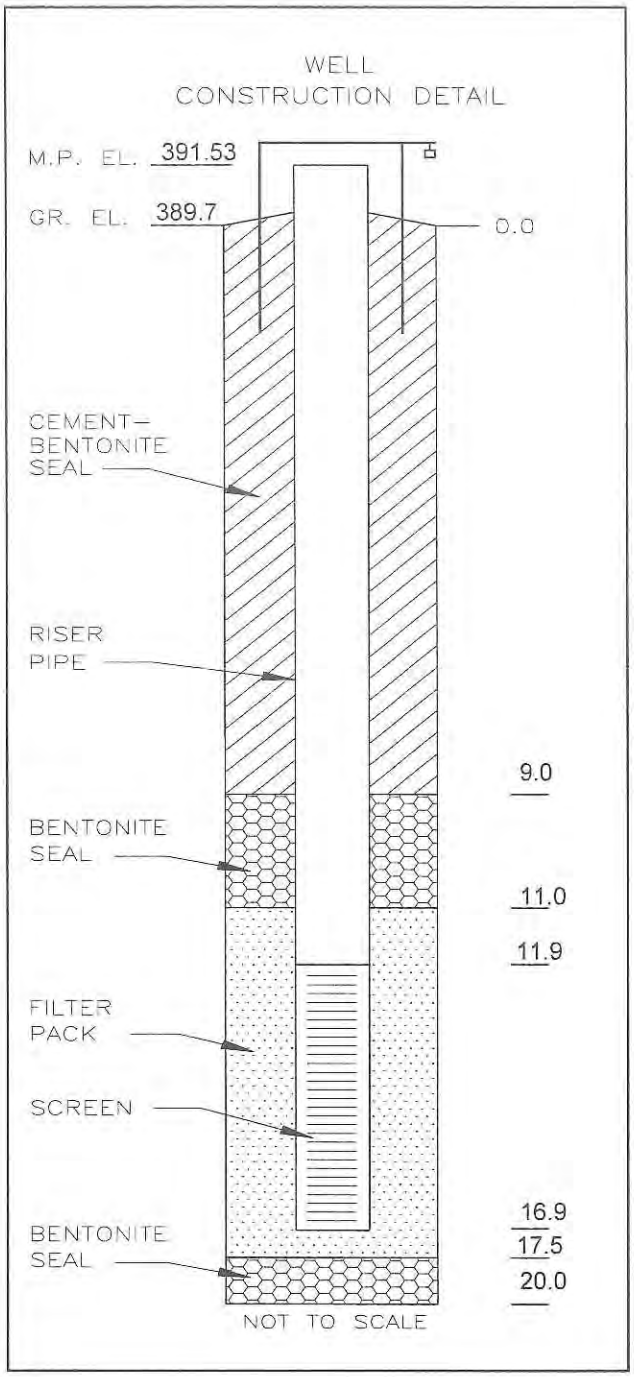
Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

WELL COMPLETION LOG

Well ID: MW-13S

Project:	Old Erie Canal Supplemental GW	**Client:**	Parker-Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/2/2006
Project No.:	39892.001.102	**Date Developed:**	11/14/2006



Inspection Notes:

Inspector: P. D'Annibale
Drilling Contractor: Parratt-Wolff, Inc
Type of Well: Monitoring Well

Static Water Level (ft bmp): 3.05 Date: 11/8/06
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 18.71

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 0.0'-20.0'

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 13.7' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010 Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: # 0 Morie
Interval: 11.0'-17.5'

Seal(s):

Type:	Cement-Bentonite	Interval:	0.0'-2.5'
Type:	Bentonite Pellets	Interval:	9.0'-11.0'
Type:	Bentonite Pellets	Interval:	17.5'-20.0'

Locking Casing: [X] Yes [ ] No

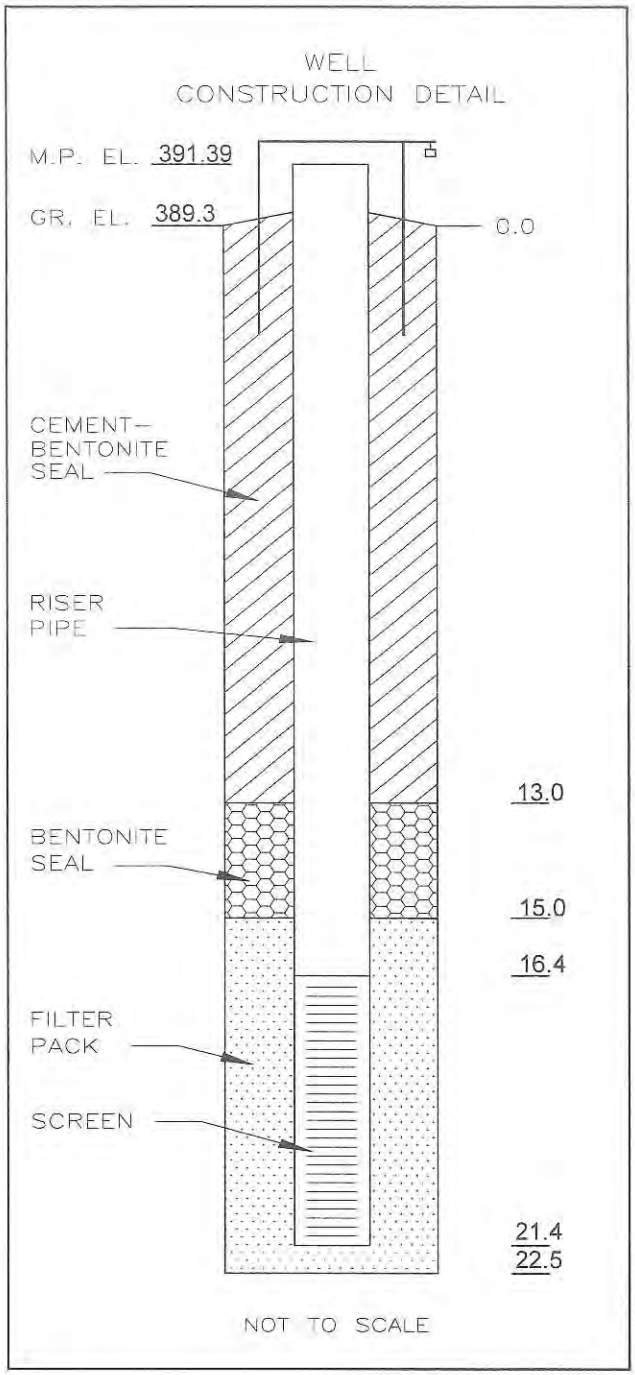
O'BRIEN & GERE ENGINEERS, INC.

Form 002

WELL COMPLETION LOG

Well ID: MW-14S

Project:	Old Erie Canal Supplemental GW	**Client:**	Parker-Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/6/2006
Project No.:	39892.001.102	**Date Developed:**	11/15/2006



Inspection Notes:

Inspector: P. D'Annibale
Drilling Contractor: Parratt-Wolff, Inc.
Type of Well: Monitoring Well

Static Water Level (ft bmp): 5.51 Date: 11/8/06
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 23.55

Drilling Method - Overburden:

Type: HSA Diameter: 4¼" ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 0.0'-22.5'

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 18.5' Joint Type Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010 Joint Type Flush Thread

Filter Pack:

Type: Sand Grade: #0 Morie
Interval: 15.0'-22.5'

Seal(s):

Type: Cement-Bentonite Interval: 0.0'-13.0'
Type: Bentonite Pellets Interval: 13.0'-15.0'
Type: Interval:

Locking Casing: [X] Yes [ ] No

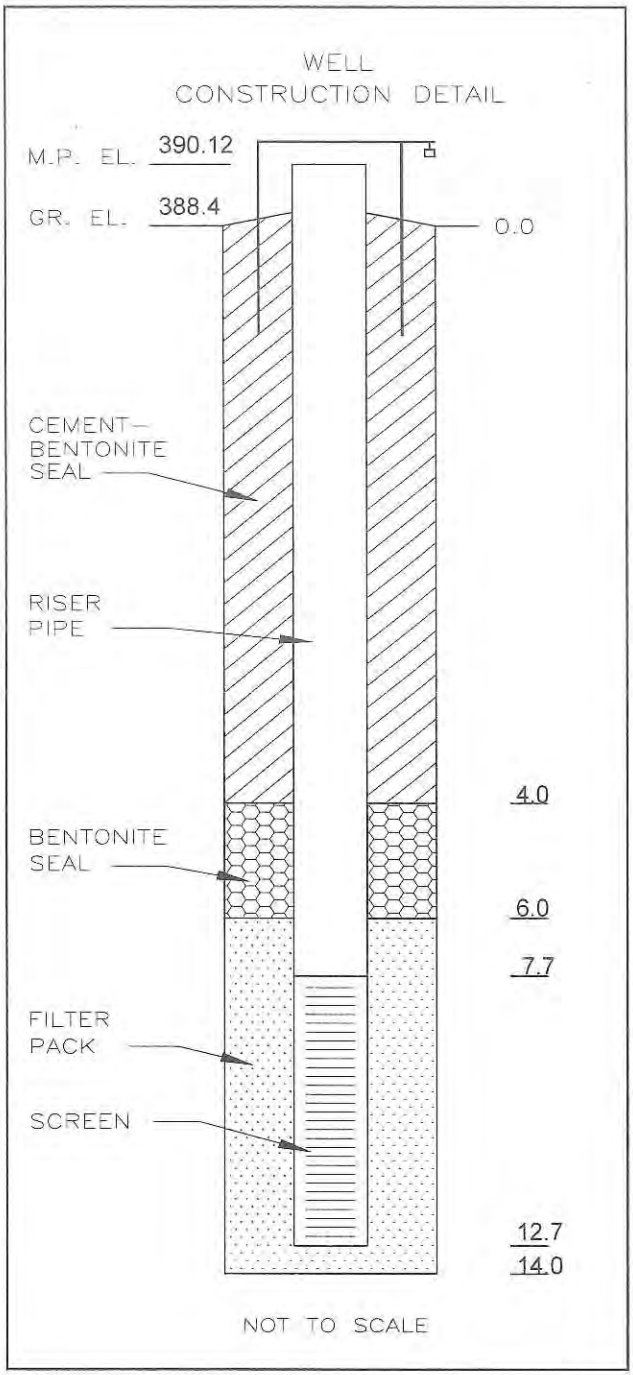
O'BRIEN & GERE ENGINEERS, INC.

Form 001

WELL COMPLETION LOG

Well ID: MW-15S

Project:	Old Erie Canal Supplemental GW	**Client:**	Parker-Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/7/2006
Project No.:	39892.001.102	**Date Developed:**	11/15/2006



Inspection Notes:

Inspector: P. D'Annibale
Drilling Contractor: Parratt-Wolff, Inc.
Type of Well: Monitoring Well

Static Water Level (ft bmp): 2.19 Date: 11/8/06
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 14.42

Drilling Method - Overburden:

Type: HSA Diameter: 4¼" ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 0.0'-14.0'

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 9.4' Joint Type Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010 Joint Type Flush Thread

Filter Pack:

Type: Sand Grade: #0 Morie
Interval: 6.0'-14.0'

Seal(s):

Type: Cement-Bentonite Interval: 0.0' - 4.0'
Type: Bentonite Pellets Interval: 4.0' - 6.0'
Type: Interval:

Locking Casing: [X] Yes [ ] No

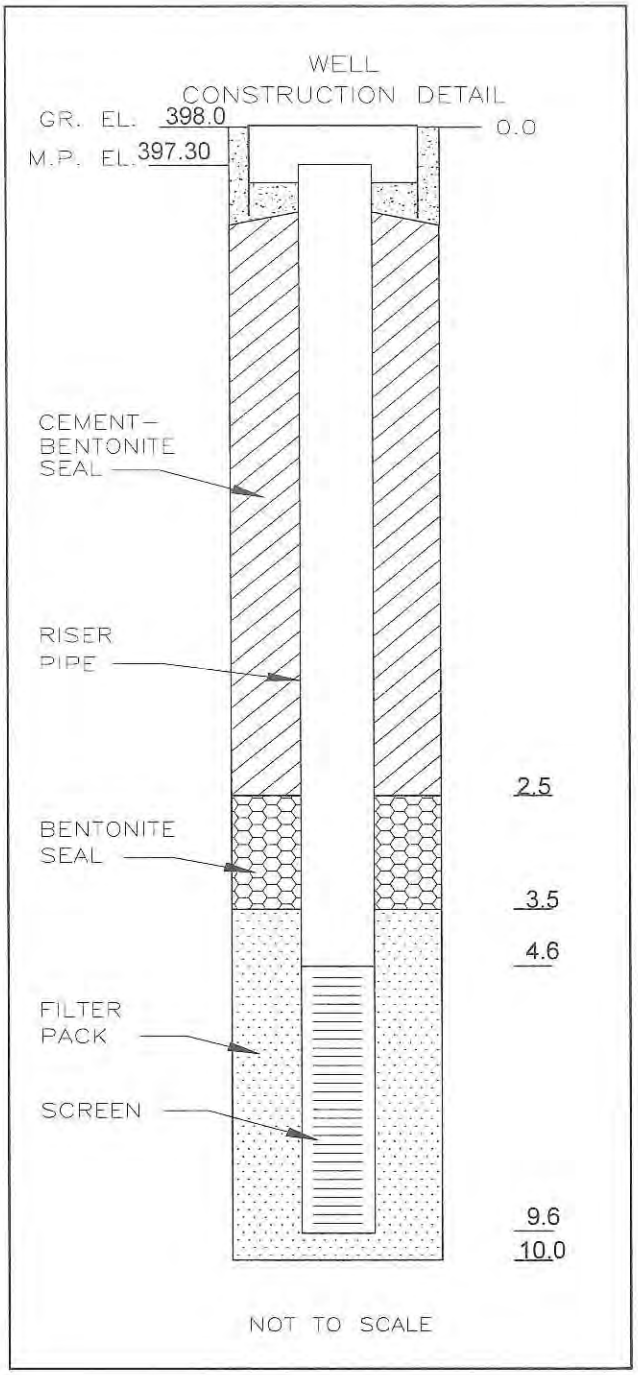
O'BRIEN & GERE ENGINEERS, INC.

Form 001

WELL COMPLETION LOG

Well ID: MW-16S

Project:	Old Erie Canal Supplemental GW	**Client:**	Parker-Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/2/2006
Project No.:	39892.001.102	**Date Developed:**	11/14/2006



Inspection Notes:

Inspector: P. D'Annibale
Drilling Contractor: Parratt-Wolff, Inc.
Type of Well: Monitoring Well

Static Water Level (ft bmp): 2.97 Date: 11/8/06
Measuring Point: Top of PVC
Total Depth of Well (ft bmp): 8.92

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4 " ID
Casing: NA

Sampling Method - Overburden:

Type: Split-Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 0.0'-10.0'

Riser Pipe Left in Place:

Material: Sch 40 PVC Diameter: 2" ID
Length: 3.9' Joint Type: Flush Thread

Screen:

Material: Sch 40 PVC Diameter: 2" ID
Slot Size: 0.010 Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: # 0 Morie
Interval: 3.5'-10.0'

Seal(s):

Type: Cement-Bentonite Interval: 0.0' - 2.5'
Type: Bentonite Pellets Interval: 2.5' - 3.5'
Type: Interval:

Locking Casing: [X] Yes [ ] No

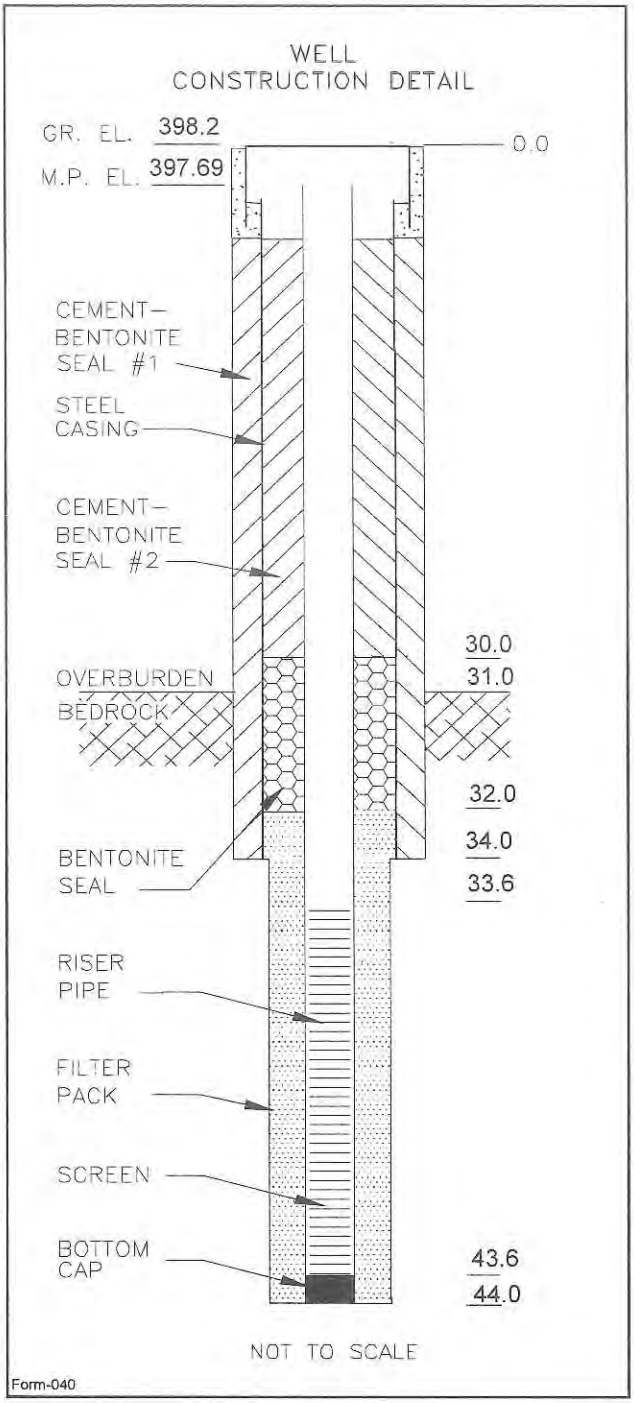
O'BRIEN & GERE ENGINEERS, INC.

Form 005

WELL COMPLETION LOG

Well ID: MW-16B

Project:	Old Erie Canal Supplemental FS	**Client:**	Parker-Hannifin
Location:	Clyde, New York	**Date Drilled:**	11/15/2006
Project No.:	39892.001.102	**Date Developed:**	11/16, 21/06



Form-040

Inspection Notes:

Inspector: P. D'Annibale
Drilling Contractor: Parratt-Wolff, Inc.
Type of Well: Monitoring Well

Static Water Level (ft bmp): 3.88 Date: 11/28/06
Measuring Point: TOC
Total Depth of Well (ft bmp): 43.13

Drilling Method - Overburden:

Type: HSA Diameter: 4 1/4" ID
Casing: 4" Steel

Sampling Method - Overburden:

Type: Split Spoon Diameter: 2" OD
Weight: 140 # Fall: 30"
Interval: 9.0' - 31.0'

Drilling Method - Bedrock:

Type: HX diamond bit Diameter: 3 3/4" OD
Casing: NA

Sampling Method - Bedrock:

Type: HX Core Diameter: 3 3/4" OD
Interval: 34.0' - 44.0'

Riser Pipe Left in Place:

Material: Sch. 40 PVC Diameter: 2" ID
Length: 33.1' Joint Type: Flush Thread

Screen:

Material: Sch. 40 PVC Diameter: 2" ID
Slot Size: 0.010 Joint Type: Flush Thread

Filter Pack:

Type: Sand Grade: # 0 Morie
Interval: 32.0' - 44.0'

Seal(s):

Type: Cement-Bentonite Seal #1 Interval: 0.0' - 34.0'
Type: Bentonite Seal Interval: 30.0'-32.0'
Type: Interval:

Locking Casing: [X] Yes [ ] No

O'BRIEN & GERE ENGINEERS, INC.

Date Start/Finish:	8/10/2017	**Northing:**	1123846.818	**Well/Boring ID:**	**MW-17S**
Drilling Company:	Arcadis	**Easting:**	741981.842	**Client:**	General Electric and Parker Haniffin
Driller's Name:	Doug Richmond	**Casing Elevation:**	397.48' AMSL	**Location:**	124 Columbia ST Clyde, NY
Drilling Method:	Direct Push	**Borehole Depth:**	8.8' bgs		
Sampling Method:	Macrocore Liner (4 feet)	**Surface Elevation:**	397.91' AMSL		
Rig Type:	Track-mounted Geoprobe	**Descriptions By:**	Josh Miller		

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery	PID Headspace (ppm)	Geologic Column	Stratigraphic Description	Well/Boring Construction
	400							
0							CONCRETE.	Neat cement (0-2.6' bgs)
		1	0-4	2.3	0.0		Brown to dark brown fine to medium GRAVEL, some fine to medium Sand, loose, soft, non-plastic.	Bentonite seal (2.6-3.3' bgs)
	395							
5		2	4-8	2.6	0.0		Gray Silty CLAY, moderately stiff, low plasticity, wet.	Sand pack filter (3.3-8.8' bgs)
	390							1-inch diameter Schedule 40 PVC Screen (3.8-8.8' bgs)
		3	8-8.8	0.8	0.0		Reddish-brown SILT, little fine Gravel, trace Clay and Sand, stiff, non-plastic, wet. [TILL]	
							Refusal at 8.8' bgs. End of boring.	
10								
	385							
15								

ARCADIS Design & Consultancy for natural and built assets

Remarks: ags = above ground surface; bgs = below ground surface; NA = not available; AMSL = above mean sea level; PID = photoionization detector; ppm = parts per million.

Date Start/Finish:	8/11/2017	**Northing:**	1123854.440	**Well/Boring ID:**	**MW-18S**
Drilling Company:	Arcadis	**Easting:**	741809.743	**Client:**	General Electric and Parker Haniffin
Driller's Name:	Doug Richmond	**Casing Elevation:**	397.63' AMSL	**Location:**	124 Columbia ST Clyde, NY
Drilling Method:	Direct Push	**Borehole Depth:**	8.0' bgs		
Sampling Method:	Macrocore Liner (4 feet)	**Surface Elevation:**	397.80' AMSL		
Rig Type:	Track-mounted Geoprobe	**Descriptions By:**	Josh Miller		

DEPTH / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery	PID Headspace (ppm)	Geologic Column	Stratigraphic Description	Well/Boring Construction
400							
0						ASPHALT.	Neat cement (0-2.5' bgs)
						Brown fine SAND, little fine to medium Gravel, moderatel stiff, non-plastic, moist.	Bentonite seal (2-2.5' bgs)
395	1	0-4	3.5	0.0		Dark brown SILT, little fine to medium Gravel, little miscellaneous Fill (Brick, Asphalt, Ciinder), soft, non-plastic, wet.	
5						Reddish brown SILT, little fine Gravel, trace to little fine Sand and Clay, stiff to very stiff, non-plastic, moist to wet. [TILL]	Sand pack filter (2.5-8' bgs)
390	2	4-8	2.6	0.0			1-inch diameter Schedule 40 PVC Screen (3-8' bgs)
						Refusal at 8' bgs. End of boring.	
10							
385							
15							

ARCADIS Design & Consultancy for natural and built assets

Remarks: ags = above ground surface; bgs = below ground surface; NA = not available; AMSL = above mean sea level; PID = photoionization detector; ppm = parts per million.

Date Start/Finish:	8/8/2017	**Northing:**	1123911.657	**Well/Boring ID:**	**MW-19S**
Drilling Company:	Arcadis	**Easting:**	741712.673	**Client:**	General Electric and Parker Haniffin
Driller's Name:	Doug Richmond	**Casing Elevation:**	396.09' AMSL	**Location:**	124 Columbia ST Clyde, NY
Drilling Method:	Direct Push	**Borehole Depth:**	9.0' bgs		
Sampling Method:	Macrocore Liner (4 feet)	**Surface Elevation:**	396.35' AMSL		
Rig Type:	Track-mounted Geoprobe	**Descriptions By:**	Josh Miller		

DEPTH	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery	PID Headspace (ppm)	Geologic Column	Stratigraphic Description	Well/Boring Construction
0	395	1	0-4	3.8	NA		ASPHALT. Brown SILT, little fine to medium Gravel, little miscellaneous Fill (Brick, Glass, Cinder, Asphalt), loose, non-plastic, moist, slight petroleum-like odor.	Neat cement (0-2.5' bgs) Bentonite seal (2-2.5' bgs)
5	390	2	4-8	3.6	NA		Greenish-brown SILT, little Clay, trace fine Gravel, soft to sliighly stiff, non-plastic to slightly plastic, wet. Reddish-brown SILT, little fine Gravel, trace Sand and Clay, stiff to very stiff, non-plastic, moist. [TILL]	Sand pack filter (3.5-8.5' bgs) 1-inch diameter Schedule 40 PVC Screen (3.5-8.5' bgs)
		3	8-9	1.0	NA			Native collapse (8.8-9' bgs)
10	385						Refusal at 9' bgs. End of boring.	
15								

ARCADIS Design & Consultancy for natural and built assets

Remarks: ags = above ground surface; bgs = below ground surface; NA = not available; AMSL = above mean sea level; PID = photoionization detector; ppm = parts per million.

Appendix D
Excavation Work Plan

Appendix D
Excavation Work Plan

Old Erie Canal Site
NYSDEC Site No. 859015
124 Columbia Street
Clyde, New York 14433

Parker Hannifin Corporation

&

General Electric Company

GHD | 285 Delaware Avenue, Suite 500, Buffalo NY, 14202

035048| Report No 9 Appendix D | November 2021

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Figure 2.1 Soil Cover Locations

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Attachment Index

Attachment A Change of Use Form

Attachment B Request to Reuse Soil Form

1. Notifications & Change of Use

Notifications will be submitted by the property owner to the NYSDEC in accordance with NYSDEC guidance document DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the Order on Consent, 6NYCRR Part 375, and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan. Notification is to include:
    - A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site regrading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated, and any work that may impact an engineering control;
    - A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
    - A schedule for the work, detailing the start and completion of all intrusive work;
    - A summary of the applicable components of this EWP;
    - A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
    - A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix F of this SMP;
    - Identification of disposal facilities for potential waste streams; and
    - Identification of sources of any anticipated backfill, along with all required chemical testing results.
- Notice within 48-hours of any damage or defect to the foundation, structures, or engineering controls (ECs) that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the site or in the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change using the *60-day Advance Notification of Site Change of Use, Transfer of Certificate of Completion, and/or Ownership Form* required by 6NYCRR part 375-1.11(d) and 375-1.9(f). This form can be found on the NYSDEC's website and is located in Attachment A. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the Order on Consent, and all approved work plans and reports, including this SMP.

- Within 15 days after the transfer of all or part of the site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

The definition and additional information about Change of Use can be found in Part 375 – 3.2(d) of NYSDEC's regulations. A list of Project Contacts is provided in Table 1.2. The information on this table will be updated as necessary to provide accurate contact information.

Table 1.1 - Notifications

Contact	Name	e-mail	Phone
NYSDEC Project Manager/Environmental Engineer	Danielle Miles	danielle.miles@dec.ny.gov	585-226-5349

Table 1.2 - Project Contacts

Contact	Name	e-mail	Phone
NYSDEC Project Manager	Danielle Miles	danielle.miles@dec.ny.gov	T - 585-226-5349
Site Contact	James Kalinski Sr. Engineering Technician/ Maintenance Coordinator	james.kalinski@advancedatomization.com	T - 315-902-5238 M - 315-573-0034
Site Contact	Matt Cichocki AATech General Manager	mcichocki@parker.com	T – 315-923-2311
Owner Contact	Lewis Streeter General Electric Company	Lewis.Streeter@ge.com	T - 518-862-2717 M - 518-527-2943

Contact	Name	e-mail	Phone
Owner Contact	Cassie Johnson, P.E. Parker Hannifin Corporation	cassie.johnson@parker.com	M – 608-558-6795
Owner Contact	Martha Connell Parker Hannifin Corporation	mconnell@parker.com	T – 216-896-2710 M – 216-502-1306
Project Consultant	Katherine Galanti GHD	katherine.galanti@ghd.com	T – 716-362-8839 M – 716-583-5720
NYSDEC Spills Hotline	NA	NA	800-457-7362
National Response Center (Pollution/Toxic Chemical/Oil Spills)	NA	NA	800-424-8802
Utility Mark Outs	Dig Safely NY	NA	800-962-7962

2. Excavation Work Plan

The following measures are to be taken during ground intrusive activities at the Site (i.e. underground utility repair; construction).

2.1 Soil Screening Methods

Visual, olfactory, and instrument-based soil screening (e.g., PID screening) will be performed by a qualified environmental professional during intrusive activities. Soil screening will be performed regardless of when the intrusive work is done and will include all excavation and intrusive work performed during development, such as excavations for foundations and utility work.

Soil or fill that is excavated will be characterized to determine the proper disposition (e.g., use as backfill, use as Site cover soil, off-Site disposal, etc.). Cover material (i.e., asphalt, concrete) shall be segregated and reused to the extent practicable.

For excavated soil/fill that requires testing, soil shall be placed in separate stockpiles. Soil samples will be collected for full suite analysis including Target Compound List (TCL) volatile organic compounds (VOCs) and petroleum hydrocarbons, TCL semi volatile organic compounds (SVOCs), Target Analyte List (TAL) metals, Polychlorinated biphenyls (PCBs), pesticides, herbicides, per- and polyfluoroalkyl substances (PFAS), and 1.4-dioxane based on the volume of material as shown below. Soils may be pre-characterized by collecting a representative number of samples from the designated work area and analyzing as described above. A sampling plan will be submitted to NYSDEC for review and approval for any pre-characterization sampling.

Table 2.1 – Soil Sample Quantity Guidelines

Soil Quantity (CY)	Sample Quantity for VOCs (discrete samples)	Sample Quantity for SVOCs and Metals (5-point composite samples)
0-50	1	1
50-100	2	1
100-200	3	1
200-300	4	2
300-400	4	2
400-500	5	2
500-800	6	2
800-1000	7	2
>1000	Add 2 samples for every 1000 CY	Add 1 sample for every1000 CY

Soil results must be compared to NYSDEC DER-10 Appendix 5 to determine whether soil can remain on-site or will require off-site disposal/treatment. Excess soil below regulatory thresholds that cannot be used as backfill will require off-Site disposal.

If the soil/fill material requires off-site disposal, analysis of additional parameters (e.g., PCBs and/or TCLP) may be required by the disposal facility.

2.2 Soil Staging Methods

Stockpiled soils will be placed on polyethylene sheeting to avoid potential contamination of underlying surfaces. Stockpiles will be continuously encircled with silt fence to prevent surface water run-off from the stockpiles and surface water run-on from the surrounding ground surface. Hay bales will be used as needed near catch basins, surface water bodies, and other discharge points.

Depending on the size of the stockpile, erosion measures may include tarps, commercially available erosion control mats/blankets, or seeding. The piles will be inspected at a minimum of once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC.

Any conditions identified that could prevent erosion control measures from serving the intended purpose will be addressed/corrected immediately.

2.3 Materials Excavation & Load-Out

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material determined to be unsuitable for reuse on-Site. The Site owner and its contractors are responsible for safe execution of all invasive and other work performed under this Plan. The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the Site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

Locations where vehicles enter or exit the Site shall be inspected daily for evidence of off-site soil tracking. The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the Site are clean of dirt and other materials derived from the Site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed by the contractor to maintain a clean condition with respect to Site-derived materials.

If work requires trucks to travel through unpaved areas, trucks/tires will be cleaned prior to leaving Site. The qualified environmental professional will be responsible for ensuring that all outbound trucks are clean before leaving the site until the activities performed under this section are complete.

2.4 Materials Transport Off-Site

All transport of excavated soil will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364, consistent with the material being hauled. Haulers will be appropriately licensed and trucks properly placarded.

Excavated soil transported by trucks exiting the Site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Unless a truck route is used that prevents the truck's tires and undercarriages from coming in contact with contaminated soil, trucks will be cleaned prior to leaving the Site.

The truck transport route is as follows:

- Upon exiting the Site, trucks shall travel east on Columbia Street to Route 414
- Route 414 is a designated truck route with direct access to Interstate I-90 and other local truck routes

All trucks loaded with Site materials will enter and exit the Site using only this approved truck route. This is the most appropriate route and takes into account:

1. Limiting transport through residential areas and past sensitive areas
2. Use of city mapped truck routes
3. Prohibiting off-Site queuing of trucks entering the facility
4. Limiting total distance to major highways
5. Promoting safety in access to highways
6. Overall safety in transport

Trucks will be prohibited from stopping and idling on the roadways surrounding the project Site. Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during the work. Queuing of trucks will be performed on-Site or in pre-designated areas in order to minimize off-Site disturbance.

2.5 Materials Disposal Off-Site

All material excavated and removed from the Site will be treated as contaminated and regulated material (unless otherwise determined through appropriate testing or knowledge) and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360), and Federal regulations. If, based on analytical testing, disposal of soil/fill from this Site is proposed for unregulated off-Site use (i.e., clean soil removed for development purposes); a request will be made to the NYSDEC. Unregulated off-Site management of materials from this Site will not occur without NYSDEC approval.

Off-Site disposal locations for excavated soil will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate (i.e., hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, construction/demolition recycling facility, etc.). Actual disposal quantities and associated documentation will be reported to the NYSDEC. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading, and facility receipts.

Non-hazardous historical fill and contaminated soil taken off-Site will be handled, at a minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Part 375 unrestricted soil cleanup objectives (SCOs) is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

2.6 Materials Reuse On-Site

Excavated soil will be segregated based on previous environmental data and screening results into material that requires testing and material for potential off-Site disposal, material that can be returned to the subsurface, and material that can be used as cover soil (the top 1-foot of material) based on sample results and in accordance with NYSDEC DER-10 - Section 5.4(e). Soil stockpiles will be managed in accordance with Section 4.2.

Proposed materials for reuse on-Site must be sampled for full suite analytical parameters (i.e., TCL VOCs and petroleum hydrocarbons, SVOCs, pesticides, herbicides, PCBs, and TAL metals, per- and polyfluoroalkyl substances (PFAS) and 1.4-dioxane). The sampling frequency will be in accordance with NYSDEC DER-10Table 5.4(e)10 unless prior approval is obtained from the NYSDEC project manager for modification of the sampling frequency. The analytical results of soil/fill material testing must meet the Site use criteria presented in NYSDEC DER-10 Appendix 5 - Allowable Constituent Levels for imported Fill or Soil for all constituents listed, and the NYSDEC Sampling, Analysis, and Assessment of Per and Polyfluoroalkyl Substances [January 2021] guidance values. Approvals for modifications to the analytical parameters must be obtained from the NYSDEC project manager prior to the sampling event.

The qualified environmental professional will ensure that procedures defined for material to be reused in this Plan are followed and that unacceptable material does not remain on-Site. Contaminated material, including historical fill and contaminated soil, that is acceptable for reuse on-Site will be placed below a demarcation layer or impervious surface, and will not be reused within a cover system as part of the remedy for the Site, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for re-use on-site will be sampled for asbestos and the results will be reported to NYSDEC for acceptance. Concrete crushing or processing on-Site will not be

performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site will not be reused on-Site.

2.7 Fluids Management

All liquids to be removed from the site, including but not limited to, excavation dewatering, decontamination waters, and groundwater monitoring well purge and development waters will be handled, transported, and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge, and development fluids will not be recharged back to the land surface or subsurface of the site, and will be managed off-site, unless prior approval is obtained from NYSDEC.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a State Pollution Discharge Elimination System (SPDES) permit.

2.8 Cover System Restoration

Two soil cover areas were constructed in the former barge turn around area (BTA) as shown on Figure 2.1. The cover consists of a demarcation layer, six inches of clean fill, and six inches of topsoil. If these areas are disturbed, the soil cover must be replaced in kind.

The remainder of the Site is covered with slab-on-grade structures, concrete sidewalks and asphalt paving, and grass and landscaping beds.

If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy. A figure showing the modified surface will be included in the subsequent PRR and the SMP will be updated.

2.9 Backfill from Off-Site Sources

All materials proposed for import onto the site will be approved by the NYSDEC prior to receipt at the site. A Request to Import/Reuse Fill or Soil form can be found on NYSDEC's website and is also located in Attachment B. This form will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported soils will meet the backfill and cover soil quality standards established in 6 NYCRR 375-6.7(d) and NYSDEC DER-10 Appendix 5. Based on an evaluation of the land use, protection of groundwater, and protection of ecological resources criteria, the resulting soil quality standards are listed in 6NYCRR Part 375-6.8(b). Soils that meet 'general' fill requirements under 6NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC project manager. Soil material will be sampled for the full suite of analytical parameters including Target Compound List (TCL) volatile organic compounds (VOCs) and petroleum hydrocarbons, TCL semi volatile organic compounds (SVOCs), Target Analyte List (TAL) metals, Polychlorinated biphenyls (PCBs), pesticides, herbicides, per- and polyfluoroalkyl substances (PFAS), and 1.4-dioxane. Solid waste will not be imported onto the site.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

2.10 Stormwater Pollution Prevention

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

2.11 Excavation Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment, and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles to include the NYSDEC STARS list of petroleum parameters, TCL pesticides and PCBs), unless the site history and previous sampling results provide sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

2.12 Health and Safety Plan & Community Air Monitoring Plan

The owner of the property and its contractors are solely responsible for safe execution of all work performed under this Plan. The contractor will prepare a Site-Specific Health and Safety Plan (HASP) for the work on the Site based on the contaminants likely to be encountered at the Site. The HASP shall document that all employees conducting intrusive work received the OSHA HAZCOM training and have been notified of the potential to encounter Site contaminants.

The Community Air Monitoring Plan (CAMP) requires real-time monitoring for VOCs and particulates (i.e., dust) at the Site property boundary downwind of each designated work area when intrusive and certain non-intrusive activities are in progress.

A copy of the HASP and CAMP will be kept on-Site during construction activities. Exceedances of action levels presented in the CAMP will be reported to the NYSDEC Project Manager.

The HASP including the CAMP is provided as Appendix E to the SMP.

2.13 Odor Control Plan

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include limiting the size of open excavations and intrusive activities. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the project's qualified environmental professional, and any measures that are implemented will be communicated to NYSDEC's Project Manager.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include limiting the area of open excavations and size of soil stockpiles, and shrouding open excavations with tarps and other covers.

If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include:

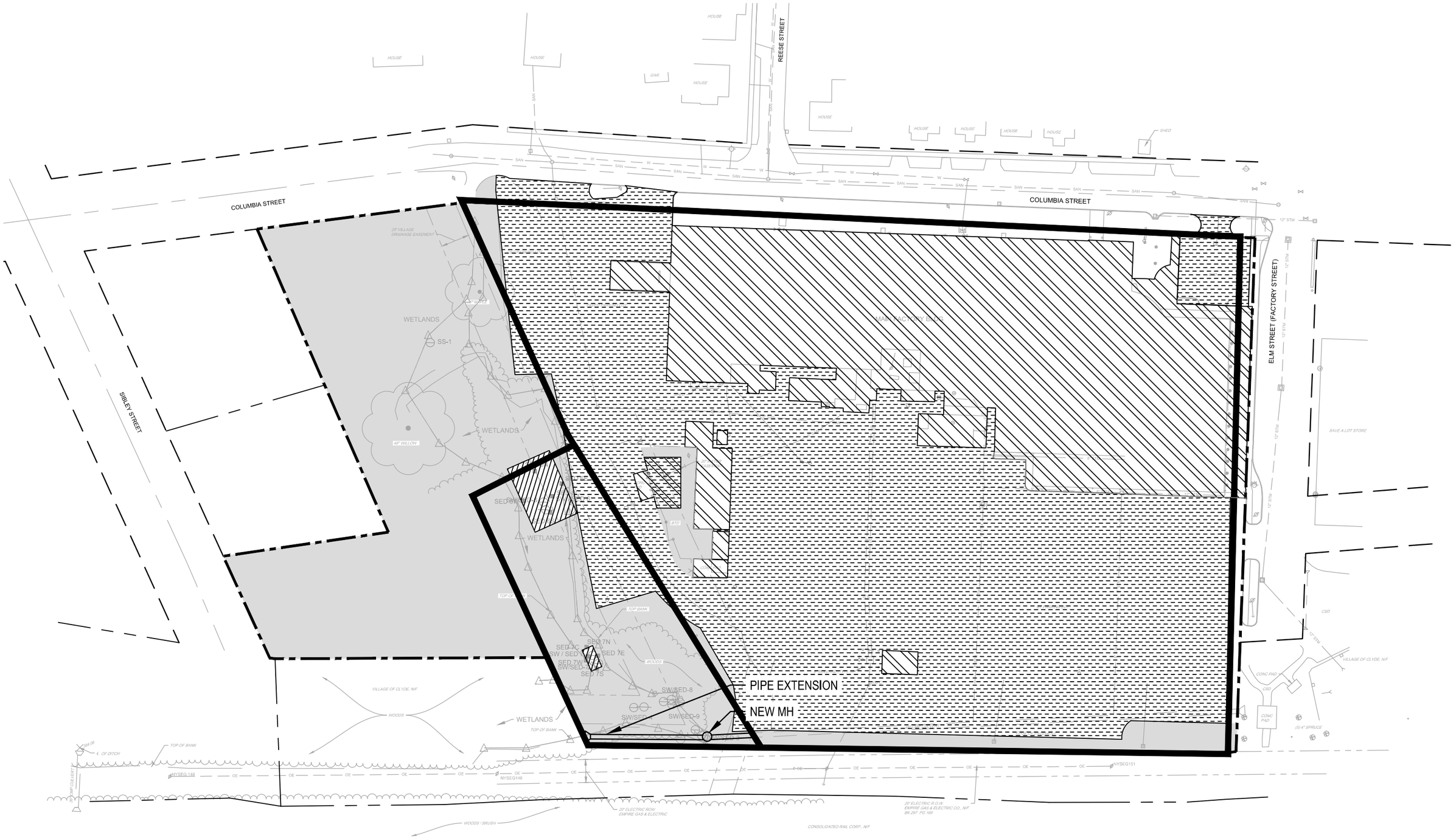
- Direct load-out of soils to trucks for off-site disposal
- Use of chemical odorants in spray or misting systems
- Using foams to cover exposed odorous soil
- Use of staff to monitor odors in surrounding neighborhoods

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

2.14 Dust Control Plan

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, non-vegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.
- Dust suppression will be achieved using a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.



LEGEND:

- SITE / ENVIRONMENTAL EASEMENT BOUNDARY
- PROPERTY BOUNDARY
- WETLAND BOUNDARY
- CONSTRUCTED SOIL COVER AREA
- PAVEMENT AREA
- BUILDINGS AND SIDEWALKS AREA
- VEGETATION AREA

N

0 80'

GHD

OLD ERIE CANAL SITE

COVER SYSTEMS

Project No. **35048**
Report No. **009**
Date **JUL 21**

FIGURE D-2.1

Filename: N:\US\Buffalo\Legacy\Drawings-NIA\Drawings\35000s\35048\35048-reports\35048-00(009)\CADD\Drawings\Figures\35048(009) - Figure D-2.1.dwg
Plot Date: 22 July 2021 - 3:36 PM

Source:

Attachment A

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

60-Day Advance Notification of Site Change of Use, Transfer of Certificate of Completion, and/or Ownership

Required by 6NYCRR Part 375-1.11(d) and 375-1.9(f)

To be submitted at least 60 days prior to change of use to:

Chief, Site Control Section
New York State Department of Environmental Conservation
Division of Environmental Remediation, 625 Broadway
Albany NY 12233-7020

I. Site Name: _____ **DEC Site ID No.** _____

II. Contact Information of Person Submitting Notification:

Name: _____

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

III. Type of Change and Date: Indicate the Type of Change(s) (check all that apply):

☐ Change in Ownership or Change in Remedial Party(ies)

☐ Transfer of Certificate of Completion (CoC)

☐ Other (e.g., any physical alteration or other change of use)

Proposed Date of Change (mm/dd/yyyy): ☐

IV. Description: Describe proposed change(s) indicated above and attach maps, drawings, and/or parcel information.

_____

_____

_____

If "Other," the description must explain and advise the Department how such change may or may not affect the site's proposed, ongoing, or completed remedial program (attach additional sheets if needed).

_____

_____

_____

_____

V. Certification Statement: Where the change of use results in a change in ownership or in responsibility for the proposed, ongoing, or completed remedial program for the site, the following certification must be completed (by owner or designated representative; see §375-1.11(d)(3)(i)):

I hereby certify that the prospective purchaser and/or remedial party has been provided a copy of any order, agreement, Site Management Plan, or State Assistance Contract regarding the Site's remedial program as well as a copy of all approved remedial work plans and reports.

Name: _____ _____
(Signature) (Date)

_____
(Print Name)

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

VI. Contact Information for New Owner, Remedial Party, or CoC Holder: If the site will be sold or there will be a new remedial party, identify the prospective owner(s) or party(ies) along with contact information. If the site is subject to an Environmental Easement, Deed Restriction, or Site Management Plan requiring periodic certification of institutional controls/engineering controls (IC/ECs), indicate who will be the certifying party (attach additional sheets if needed).

☐ Prospective Owner ☐ Prospective Remedial Party ☐ Prospective Owner Representative

Name: _____

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

Certifying Party Name: _____

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

VII. Agreement to Notify DEC after Transfer: If Section VI applies, and all or part of the site will be sold, a letter to notify the DEC of the completion of the transfer must be provided. If the current owner is also the holder of the CoC for the site, the CoC should be transferred to the new owner using DEC's form found at http://www.dec.ny.gov/chemical/54736.html. This form has its own filing requirements (see 6NYCRR Part 375-1.9(f)).

Signing below indicates that these notices will be provided to the DEC within the specified time frames. If the sale of the site also includes the transfer of a CoC, the DEC agrees to accept the notice given in VII.3 below in satisfaction of the notice required by VII.1 below (which normally must be submitted within 15 days of the sale of the site).

Within 30 days of the sale of the site, I agree to submit to the DEC:

1. the name and contact information for the new owner(s) (see §375-1.11(d)(3)(ii));
2. the name and contact information for any owner representative; and
3. a notice of transfer using the DEC's form found at http://www.dec.ny.gov/chemical/54736.html (see §375-1.9(f)).

Name: _____ _____
(Signature) (Date)

_____
(Print Name)

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

Continuation Sheet

☐ Prospective Owner/Holder ☐ Prospective Remedial Party ☐ Prospective Owner Representative

Name: _____

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

☐ Prospective Owner/Holder ☐ Prospective Remedial Party ☐ Prospective Owner Representative

Name: _____

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

☐ Prospective Owner/Holder ☐ Prospective Remedial Party ☐ Prospective Owner Representative

Name: _____

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

☐ Prospective Owner/Holder ☐ Prospective Remedial Party ☐ Prospective Owner Representative

Name: _____

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

☐ Prospective Owner/Holder ☐ Prospective Remedial Party ☐ Prospective Owner Representative

Name: _____

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

☐ Prospective Owner/Holder ☐ Prospective Remedial Party ☐ Prospective Owner Representative

Name: _____

Address1: _____

Address2: _____

Phone: _____ E-mail: _____

New York State Department of Environmental Conservation

Instructions for Completing the 60-Day Advance Notification of Site Change of Use, Transfer of Certificate of Completion (CoC), and/or Ownership Form

Submit to: Chief, Site Control Section, New York State Department of Environmental Conservation, Division of Environmental Remediation, 625 Broadway, Albany NY 12233-7020

Section I	**Description**
Site Name	Official DEC site name. (see http://www.dec.ny.gov/cfmx/extapps/derexternal/index.cfm?pageid=3)
DEC Site ID No.	DEC site identification number.

Section II	**Contact Information of Person Submitting Notification**
Name	Name of person submitting notification of site change of use, transfer of certificate of completion and/or ownership form.
Address1	Street address or P.O. box number of the person submitting notification.
Address2	City, state and zip code of the person submitting notification.
Phone	Phone number of the person submitting notification.
E-mail	E-mail address of the person submitting notification.

Section III	**Type of Change and Date**
Check Boxes	Check the appropriate box(s) for the type(s) of change about which you are notifying the Department. Check all that apply.
Proposed Date of Change	Date on which the change in ownership or remedial party, transfer of CoC, or other change is expected to occur.

Section IV	**Description**
Description	For each change checked in Section III, describe the proposed change. Provide all applicable maps, drawings, and/or parcel information. If "Other" is checked in Section III, explain how the change may affect the site's proposed, ongoing, or completed remedial program at the site. Please attach additional sheets, if needed.

Section V Certification Statement

This section must be filled out if the change of use results in a change of ownership or responsibility for the proposed, ongoing, or completed remedial program for the site. When completed, it provides DEC with a certification that the prospective purchaser has been provided a copy of any order, agreement, or State assistance contract as well as a copy of all approved remedial work plans and reports.

Name	The owner of the site property or their designated representative must sign and date the certification statement. Print owner or designated representative's name on the line provided below the signature.
Address1	Owner or designated representative's street address or P.O. Box number.
Address2	Owner or designated representative's city, state and zip code.
Phone	Owner or designated representative's phone number.
E-Mail	Owner or designated representative's E-mail.

Section VI Contact Information for New Owner, Remedial Party, and CoC Holder (if a CoC was issued)

Fill out this section only if the site is to be sold or there will be a new remedial party. Check the appropriate box to indicate whether the information being provided is for a Prospective Owner, CoC Holder (if site was ever issued a COC), Prospective Remedial Party, or Prospective Owner Representative. Identify the prospective owner or party and include contact information. A Continuation Sheet is provided at the end of this form for additional owner/party information.

Name	Name of Prospective Owner, Prospective Remedial Party or Prospective Owner Representative.
Address1	Street address or P.O. Box number for the Prospective Owner, Prospective Remedial Party, or Prospective Owner Representative.
Address2	City, state and zip code for the Prospective Owner, Prospective Remedial Party, or Prospective Owner Representative.
Phone	Phone number for the Prospective Owner, Prospective Remedial Party or Prospective Owner Representative.
E-Mail	E-mail address of the Prospective Owner, Prospective Remedial Party or Prospective Owner Representative.

If the site is subject to an Environmental Easement, Deed Restriction, or Site Management Plan requiring periodic certification of institutional controls/engineering controls (IC/EC), indicate who will be the certifying party(ies). Attach additional sheets, if needed.

Certifying Party	
Name	Name of Certifying Party.
Address1	Certifying Party's street address or P.O. Box number.
Address2	Certifying Party's city, state and zip code.
Phone	Certifying Party's Phone number.
E-Mail	Certifying Party's E-mail address.

Section VII Agreement to Notify DEC After Property Transfer/Sale

This section must be filled out for all property transfers of all or part of the site. If the site also has a CoC, then the CoC shall be transferred using DEC's form found at http://www.dec.ny.gov/chemical/54736.html

Filling out and signing this section of the form indicates you will comply with the post transfer notifications within the required timeframes specified on the form. If a CoC has been issued for the site, the DEC will allow 30 days for the post transfer notification so that the "Notice of CoC Transfer Form" and proof of it's filing can be included. Normally the required post transfer notification must be submitted within 15 day (per 375-1.11(d)(3)(ii)) when no CoC is involved.

Name	Current property owner must sign and date the form on the designated lines. Print owner's name on the line provided.
Address1	Current owner's street address.
Address2	Current owner's city, state and zip code.

Attachment B

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Request to Import/Reuse Fill or Soil

This form is based on the information required by DER-10, Section 5.4(e). Use of this form is not a substitute for reading the applicable Technical Guidance document.

SECTION 1 – SITE BACKGROUND

The allowable site use is: Choose an item

Have Ecological Resources been identified? Choose an item

Is this soil originating from the site? Choose an item

How many cubic yards of soil will be imported/reused? Choose an item

If greater than 1000 cubic yards will be imported, enter volume to be imported:

SECTION 2 – MATERIAL OTHER THAN SOIL

Is the material to be imported gravel, rock or stone? Choose an item

Does it contain less than 10%, by weight, material that would pass a size 80 sieve? Choose an item

Is this virgin material from a permitted mine or quarry? Choose an item

Is this material recycled concrete or brick from a DEC registered processing facility? Choose an item

SECTION 3 - SAMPLING

Provide a brief description of the number and type of samples collected in the space below:

Example Text: 5 discrete samples were collected and analyzed for VOCs. 2 composite samples were collected and analyzed for SVOCs, Inorganics & PCBs/Pesticides.

If the material meets requirements of DER-10 section 5.5 (other material), no chemical testing needed.

SECTION 3 CONT'D - SAMPLING

Provide a brief written summary of the sampling results or attach evaluation tables (compare to DER-10, Appendix 5):

Example Text: Arsenic was detected up to 17 ppm in 1 (of 5) samples; the allowable level is 16 ppm.

If Ecological Resources have been identified use the "If Ecological Resources are Present" column in Appendix 5.

SECTION 4 – SOURCE OF FILL

Name of person providing fill and relationship to the source:

Location where fill was obtained:

Identification of any state or local approvals as a fill source:

If no approvals are available, provide a brief history of the use of the property that is the fill source:

Provide a list of supporting documentation included with this request:

The information provided on this form is accurate and complete.

_____ _____

Signature Date

_____

Print Name

_____

Firm

Revised August 2014

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Health and Safety Plan

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1.0 Introduction

This Health and Safety Plan (HASP) describes the health and safety procedures and emergency response guidelines for activities that may be conducted during implementation of the Site Management Plan (SMP) at the Old Erie Canal Site (Site) in Clyde, New York. An Emergency Response Plan and Community Air Monitoring Plan are included as part of this HASP. This HASP shall be implemented and adhered to during all SMP activities. Figures presenting the Site Location and Site Plan are also included in the SMP.

This HASP will be provided to contractors performing work at the Site. The contractors will be required to develop and implement a HASP, which at a minimum meets all the requirements set forth in this document.

This HASP covers the following activities that may be conducted during implementation of the SMP:

i) Mobilization and demobilization of labor, materials, and equipment to and from the Site

ii) Surveying activities

iii) Installation of silt fencing

iv) Surface water sampling of the Erie Canal

v) Installation of groundwater monitoring wells

vi) Groundwater sampling activities

vii) Soil sampling activities

viii) Excavation and restoration activities

ix) The mixing and injection of In-Situ Enhanced Biodegradation Products

viii) Equipment and personnel decontamination activities

During a portion of these activities, personnel may come in contact with waste materials, chemicals, debris, soils, groundwater, surface water, sediment, and wash waters, which may contain hazardous substances. This HASP has been developed to minimize direct contact by project personnel with materials potentially having chemical presence by ensuring:

i) That project personnel are not adversely exposed to the compounds of concern

ii) That public health and the environment are not adversely impacted by materials with elevated chemical presence that may potentially migrate outside of the work zone during project activities at the Site

iii) Compliance with applicable governmental and non-governmental (American Conference of Governmental Industrial Hygienists [ACGIH]) regulations and guidelines. In particular, the

amended rules of the Occupational Safety and Health Administration (OSHA) for Part 1926, of Title 29 Code of Federal Regulations (CFR). Part 1926.65 will be implemented for all Site work where project personnel may come into contact with the health and safety hazards that are present at the Site

iv) Initiation of proper emergency response procedures to minimize the potential for any adverse impact to project personnel, the general public, or the environment

A vital element of the selected contractor's Health and Safety Program will be the implementation of a site-specific HASP for all project work activities. This HASP requires the following measures:

i) The communication of the contents of this HASP to project personnel

ii) The elimination of unsafe conditions. Efforts shall be initiated to identify conditions that can contribute to an accident and to remove exposure to these conditions

iii) The review all activities before beginning the task/job, after an incident, and/or any unusual circumstances. Stop activities to think about the task, analyze the task hazards, determine methods to reduce risk, and review the results with affected personnel

iv) The review of existing and the development of new Job Safety Analysis (JSA) forms for each project work activity. Supervisors and affected personnel are responsible for the development and any on-going revisions of project JSAs. JSAs for all known work activities are presented Attachment A

v) The reduction of unsafe acts. Project personnel shall make a conscious effort to work safely. A high degree of safety awareness must be maintained so those safety factors involved in a task become an integral part of the task. Supervisory personnel shall ensure that project personnel committing unsafe acts are held accountable via counseling, mentoring, and, if necessary, reprimand

vi) The frequent inspection of project activities. Regular safety inspections of the work site, materials, and equipment by qualified persons ensure early detection of unsafe conditions. Safety and health deficiencies shall be corrected as soon as possible, and project activities shall be temporarily suspended until the appropriate corrective actions are taken. Documentation of the daily inspections and corrective actions taken should be kept with the project files.

For the purpose of this HASP, activities performed at the Site involving contact with materials, which potentially have an elevated chemical presence will be considered contaminated operations requiring the use of Personal Protective Equipment (PPE). A detailed description of the required PPE is presented in Section 6.1 and is also identified on each JSA form.

The applicability of this HASP extends to all project personnel who will be on Site, including State and Federal Agency personnel, contractor personnel, subcontractor personnel, and visitors to the Site.

All project activities at the Site will be conducted in accordance with the provisions of an approved Site-specific HASP. A copy of the Site-specific HASP and employer-specific Standard Operating Procedures (SOPs) will be maintained on Site whenever activities are in progress. This HASP shall be used in conjunction with the selected contractor's Safety and Health Program.

1.1 Project Organization

All personnel conducting activities on Site must conduct their activities in compliance with all applicable Safety and Health standards as specified by OSHA including, but not limited to, the OSHA 29 CFR 1910, 29 CFR 1926. Project personnel must also be familiar with the procedures and requirements in their approved Site-specific HASP and the applicable procedures found within their company's SOP's and Safety and Health Policy Manual. In the event of any conflicting safety procedures/requirements, personnel shall implement those safety practices, which afford the highest level of safety and protection.

Project Management and Safety Organization

Project Manager Contractor – (to be determined)

The Project Manager (PM) shall be responsible for the overall implementation of the HASP, and for ensuring that all health and safety responsibilities are carried out in conjunction with this project. This shall include, but is not limited to, review and approval of the HASP; qualifying/directing subcontractors relative to safety and health performance; coordinating all safety and health submittals; providing the appropriate technical information to write submittals; and consultation with the selected contractor's Corporate Safety and Health Manager with regards to appropriate changes to the HASP.

Site Safety & Health Officer (SHO) Contractor – (to be determined)

The SHO is the person who, under the supervision of the PM and the contractor's Corporate Safety and Health Manager, shall be responsible for the communication of the Site requirements to project personnel and any subcontractor personnel. The SHO will have prior experience in working at hazardous waste sites and is responsible for carrying out the health and safety responsibilities by making sure that:

i) He/she is onsite at all times during the project work activities

ii) All necessary clean-up and maintenance of safety equipment is conducted by project personnel

iii) Emergency services are contacted when necessary

iv) A Site-specific Hazard Communication (HAZCOM) Program is maintained on Site

v) Project safety forms attached to the HASP are correctly completed and filed

vi) A pre-entry briefing is conducted, which will serve to familiarize project personnel with the procedures, requirements, and provisions of this HASP

vii) All necessary records are maintained in the project files (e.g., air monitoring results, calibration log sheets, incident reports, daily toolbox meeting sheets, daily safety logbook entries, training certificates and/or certifications, etc.). The selected contractor may use either their employer-specific safety forms or the forms that are provided in Attachment B

viii) Daily safety meetings are held and documented

ix) Safe work practices for project personnel are enforced

x) Safety of any visitors who enter the Site is ensured

xi) Communication is maintained with the PM

xii) Orders the immediate shutdown of project activities in the case of a medical emergency, unsafe condition, or unsafe practice

xiii) Designates work areas and define minimum PPE requirements

xiv) Provides the safety equipment, PPE, and other items necessary for project personnel

xv) Conducts the required worker and community air monitoring programs

xvi) Enforces the use of required safety equipment, PPE, and other items necessary for project personnel safety

xvii) Ensures that there is a competent person in place who will be supervising excavation work

xviii) Ensures that a licensed electrician qualified according to the National Fire Protection Agency (NFPA) 70E standards performs all electrical-required work

xix) Conducts job Site inspections with the Construction Superintendent (CS) or Site Supervisor (SS) as a part of quality assurance for safety and health

xx) Reports safety and health concerns to the selected contractor's management as necessary

Emergency Coordinator (EC)

The SHO or his/her designate will act as the EC. The EC shall be able to implement the emergency procedures and is responsible for implementing the following activities in the event of an emergency:

i) The EC shall immediately respond to all imminent or actual emergency situations. The EC shall notify all project personnel and emergency response agencies, identify the problem, assess the health or environmental hazards, and take all reasonable measures to stabilize the situation

ii) The EC shall take all reasonable measures necessary to ensure that fire, explosion, emission or discharge does not occur, re-occur, or spread. These measures may include stopping operations, collecting and containing released materials, and/or removing or isolating containers

iii) The EC shall develop Emergency Evacuation Routes on a daily bases and communicate them to all project personnel

iv) The EC shall also be responsible for follow-up activities after any incident such as the cleanup of the affected area, maintenance and decontamination of emergency equipment, and completion and submission of an incident report

Construction Superintendent (CS) /Site Supervisor (SS) - Contractor (to be determined)

Health and safety is a line management responsibility, and as such, the CS and/or SS will implement and support the overall onsite direction and enforcement of the health and safety for this project. The CS and/or SS must meet the requirements of the "competent person" as per the OSHA regulations. The CS and/or SS will report to the PM for this project.

The CS and/or SS is the person who, under the supervision of the PM, shall be responsible for the communication of the Site requirements to project personnel and subcontractors, and is responsible for carrying out the health and safety responsibilities by making sure that:

i) All underground utilities have been properly located prior to initiating work activities

ii) Each work area is secured with fencing at the end of each day

iii) All necessary cleanup and maintenance of safety equipment is conducted by project personnel

iv) JSA forms are developed, reviewed, and revised accordingly

v) Project personnel stop, think about, act accordingly and review the work activities that they are about to start before initiating activities

vi) Project safety forms attached to the HASP are properly completed and then filed

vii) A pre-entry briefing is conducted for all project personnel, which will serve to familiarize everyone with the procedures, requirements, and provisions of this HASP

viii) Orders the immediate shutdown of project activities in the case of a medical emergency, unsafe condition, or unsafe practice

ix) Provides the safety equipment, PPE, and other items necessary for project personnel

x) Enforces the use of required safety equipment, PPE, and other items necessary for personnel or community safety

xi) Conducts job site inspections as a part of quality assurance for safety and health

xii) Reports safety and health concerns to the selected contractor's PM as necessary

xiii) Is responsible for the overall implementation of the HASP, and ensuring that all health and safety responsibilities are carried out during the project work activities. This shall include, but is not limited to, review and approval of any subcontractor HASPs, communication of Site requirements to Subcontractor personnel, and consultation with the PM regarding appropriate changes to the HASP

xiv) The CS and/or SS also have the responsibility for enforcing safe work practices for all project personnel

xv) A competent person oversees all excavation and trenching work to ensure that work is completed in accordance with the OSHA Standards presented in 1926 Subpart P

xvi) The CS and/or SS watch all personnel for any ill effects, especially those symptoms caused by heat stress and/or chemical exposure

xvii) The CS and/or SS oversee the safety of any visitors who enter the Site

Corporate Safety & Health Manager (CSHM) Contractor – (to be determined)

The CSHM is an individual who is trained as a health and safety professional, works full-time for the selected contractor in a health and safety role, and who serves in a consulting role to the PM, SHO, and CS and/or SS regarding potential health and safety issues.

Equipment Operators

All equipment operators are responsible for the safe operation of heavy equipment. Operators are responsible for inspecting their equipment on a daily basis to ensure safe performance. Brakes, hydraulic lines, backup alarms, and fire extinguishers must be inspected routinely throughout the project. Documentation of daily inspections will be required via an equipment inspection checklist. Heavy equipment inspections will be submitted to the CS for review and subsequently placed in the project files. Unsafe conditions/acts are to be immediately reported to the CS. Equipment will be taken out of service if an unsafe condition occurs.

Project Personnel Safety Responsibilities

Project personnel are responsible for their own safety as well as the safety of those around them and shall use any equipment provided in a safe and responsible manner, as directed by their supervisor. Project personnel will follow the policies set forth in this HASP and those in their employer-specific SOPs and Safety and Health Program.

Project personnel are directed to take the following actions when appropriate:

i) Review all activity hazards and preventative measurers before initiating work

ii) Assist in the development/revision of JSA forms that are appropriate to their current work activities

iii) Suspend any operations that may cause an imminent health hazard to project personnel

iv) Inspect tools and other equipment before each use or as the manufacturer and/or OSHA mandates

v) Correct job site hazards when possible without endangering life or health

vi) Report safety and health concerns to the SHO CS and/or SS

Subcontractors

Selected subcontractor(s) will be responsible for providing a CS and/or SS ("competent person") and a SHO to direct their activities and to meet all applicable OSHA Regulations. This may be the same individual if so qualified. These individuals will be responsible for ensuring that all contract specifications are met, including those related to project health and safety. The names of these individuals will be presented in the subcontractor Site-specific HASP.

The selected contractor will review any subcontractor HASP prior to the subcontractor's mobilization to the Site. Subcontractors will be responsible for the health and safety of their personnel, which includes following all applicable OSHA Regulations and the subcontractors' Site-specific HASP. Subcontractors will be required to attend an initial Site briefing put on by the selected contractor and subsequent daily safety meetings.

Authorized Visitors

Authorized Visitors shall be provided with all known information with respect to the project operations and hazards, as applicable to the purpose of their visit.

2.0 Site Characterization and Potentially Hazardous Compounds

Section 2.0 of the SMP provides detailed information on the Site background and a characterization of the Site.

Table B2.1 presents a historical listing of all of the Chemical Compounds that have been detected in Site groundwater, subsurface soils and in drainage swale soils at the Site. This table also identifies the maximum detected concentrations of these chemicals in the groundwater (µg/L) and soils (µg/kg). The exposure routes and regulatory Time Weighted Average (TWA) exposure levels for these chemicals are presented in Table B2.2. These levels are set to protect the health of workers.

It has been determined that the following list of chemicals represent the Chemicals of Concern (COC) at the site. Trichloroethene (TCE), Arsenic, Benz(A)Anthracene, Benzo(A)Pyrene, Benzo(B)Fluoranthene, Benzo(K)Fluoranthene, Chrysene, Fluoranthene, Indeno(1,2,3-CD)Pyrene, Cadmium, Dichloroethylene, Vinyl Chloride, Toluene, Xylenes, and Dibenz(A,H)Anthracene.

3.0 Basis for Design

Regulations set forth by OSHA in Title 29, CFR, Parts 1910 and 1926 (29 CFR 1910 and 1926) form the basis of this HASP. Emphasis is placed on Section 1926.65 (Hazardous Waste Operations and Emergency Response), 1910 Subpart I (Personal Protective Equipment), 1910 Subpart Z (Toxic and Hazardous Substances), 1926 Subpart O (Motor Vehicles, Mechanized Equipment, and Marine

Operations), and 1926 Subpart F (Excavations). Some of the specifications within this section are in addition to the OSHA regulations, and reflect the positions of U.S. EPA, and the National Institute for Occupational Safety and Health (NIOSH), regarding safe operating procedures at hazardous waste sites.

The health and safety of the public and Site personnel and the protection of the environment will take precedence over cost and scheduling considerations for all project work.

4.0 Personnel Training

4.1 General

Project personnel shall complete hazardous waste operations and emergency response training (HAZWOPER), as required by the OSHA Standard 29 CFR 1926.65. Project personnel shall also initially receive a minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their training more than 12 months prior to the start of this project shall have also completed an 8-hour HAZWOPER refresher course within the past 12 months. The CS and or SS shall complete the additional 8 hours of training that is required for managers and/or supervisors along with any "competent persons" training that may be needed for required work.

Additional safety training for specific tasks/activities may include safety training for excavation safety. Further safety training may also be required based on the scheduled scope of work. This safety training is to be conducted and documented before any tasks that require additional training are initiated. It is the responsibility of the SHO and CS and/or SS to ensure that personnel have the necessary training and skills prior to activity assignment. Task safety training requirements are included on each JSA form.

4.2 Basic 40-Hour Course

The following is a list of the topics typically covered in a 40-hour training course:

i) General safety procedures

ii) Physical hazards (fall protection, noise, heat stress, cold stress)

iii) Names and job descriptions of key personnel responsible for Site health and safety

iv) Safety, health, and other hazards typically present at hazardous waste sites

v) Use, application, and limitations of PPE

vi) Work practices by which employees can minimize risks from hazards

vii) Safe use of engineering controls and equipment on site

viii) Medical surveillance requirements

ix) Recognition of symptoms and signs, which might indicate overexposure to hazards

x) Worker right-to-know (Hazard Communication OSHA 1926.59/1910.1200)

xi) Routes of exposure to contaminants

xii) Engineering controls and safe work practices that may be implemented

xiii) Components of a project HASP

xiv) Decontamination practices for personnel and equipment

xv) Confined space entry procedures

xvi) General emergency response procedures

4.3 Supervisor Course

Management and supervisors (i.e., the CS and SS), who work at the Site are required to receive an additional 8 hours of training in topics that are pertinent to the management of hazardous waste operations, which typically includes:

i) Instruction in detailed project safety and health procedures dealing with emergencies

ii) PPE programs

iii) The implementation of specialized emergency response procedures

iv) Air monitoring techniques

4.4 Site-Specific Training

All project personnel attending the initial safety meeting will accomplish the project-specific training on the contents of this HASP before work begins. The review will include a discussion of the chemical, physical, and biological hazards that may be present at the Site, the protective equipment and safety procedures to be used and followed, and emergency procedures that will be implemented at the Site. The Training Acknowledgment Form that project personnel will sign off on is presented in Attachment B (Project Safety Forms).

4.5 Daily Safety Meetings

Daily safety meetings (tailgate safety talks) will be held to cover the work that is anticipated to be accomplished each day, the associated hazards, the protective clothing and procedures required to minimize exposure to these hazards, and the required emergency response procedures. The CS, SS and/or SHO will present these meetings prior to beginning the day's fieldwork. No work will be performed in an Exclusion Zone (EZ) before the daily safety meeting has been held. Additional safety meetings shall also be held prior to initiating new tasks, and repeated if new hazards are encountered. The form for documenting the daily safety meetings is also found in Attachment B.

4.6 First Aid and CPR

At least one individual current in First Aid/CPR will be assigned to the work crew for every 10 individuals working at the Site and will be immediately available during all field activities to provide assistance as necessary. Refresher training in First Aid and CPR is required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens. Blood-borne pathogen training should be included as part of the First Aid/CPR training course delivered by the training provider.

5.0 Medical Surveillance

In accordance with the requirements detailed in 29 CFR 1926.65 and 29 CFR 1910.134, all project personnel who will come in contact with potentially contaminated materials will have received medical surveillance by a licensed physician or physician's group.

Medical records for all project personnel will be maintained by their respective employers. The medical records will detail the tests that were taken and will include a copy of the consulting physician's statement regarding the tests and the individual's suitability for work as per the employer's medical surveillance program which is to be in accordance with 29 CFR 1926.65.

The medical records will be available to the employee or his designated representative upon written request, as outlined in 29 CFR 1910.1020.

If it becomes necessary to use subcontractors, they will also provide certifications to the SHO showing that their personnel involved in Site activities have all necessary medical examinations prior to commencing work. The certifications will show proof of medical surveillance and respiratory fit testing. Personnel not obtaining medical certification will not perform work within contaminated areas.

Interim medical surveillance will be completed if an individual exhibits poor health or high stress responses due to any project activity or when accidental exposure to elevated concentrations of contaminants occur.

6.0 Personal Protective Equipment

PPE will be required to safeguard project personnel from various hazards. Varying levels of protection may be used depending on the level of contaminants and the degree of any physical hazard. This section presents the various levels of personal protection and defines the conditions of use for each level. Subcontractor Site-specific HASPs, if required, will adequately address PPE concerns for each specific task activity based on their proposed scope of work.

6.1 Levels of Protection

Protection levels are determined based upon chemical and physical hazards present in the work area. The specific protection levels to be employed at the Site for each work task are presented on each JSA form, which are presented in Attachment A.

6.1.1 Level D Protection

The minimum level of protection that will be required for all project personnel will be Level D. Level D will only be used in clean areas where there is no potential for exposure to the contaminants of concern. The following equipment is to be worn as Level D PPE:

i) Work clothing as prescribed by the weather

ii) Steel toed work boots meeting American National Standard Institute (ANSI) Z41

iii) Safety glasses or goggles, meeting ANSI Z87

iv) Leather work gloves

v) High visibility safety vest (Class II) when working near moving equipment

vi) Hard hat, meeting ANSI Z89

vii) Hearing protection when noise levels exceed 85 dBA. Hearing protection will have a minimum Noise Reduction Rating (NRR) of at least 20 dBA

6.1.2 Modified Level D Protection

Modified Level D will be worn when airborne contaminants are not present at levels where respiratory protection is required, but where project activities present an increased potential for skin contact with hazardous substances. The following equipment is to be worn as Modified Level D:

i) Tyvek® coveralls or polyethylene coated Tyvek® coveralls (if liquids/splash hazards are present)

ii) Steel toed work boots meeting ANSI Z41

iii) Neoprene, or polyvinyl chloride (PVC) overboots

iv) Safety glasses or goggles

v) Hard hat

vi) Face shield in addition to safety glasses or goggles when projectiles and/or splashing liquids pose a hazard

vii) Disposable nitrile inner gloves (NDEX 8005, as manufactured by Best, or equivalent)

viii) Nitrile over gloves

ix) Hearing protection (if necessary)

x) A high visibility safety vest (Class II) when working near moving equipment

6.1.3 Level C Protection

Level C protection will be required when the airborne concentration of suspected contaminants are present in the worker's breathing zone at sustained levels of greater than 1 part per million (ppm) of organic vapor as measured with a photoionization detector (PID) or 5mg/m3 of particulate as measured by a particulate monitor.

The following equipment will be used for Level C protection:

i) Full-face air purifying respirator (APR) with organic vapor/acid gas cartridges in combination with particulate filters (P-100) which are NIOSH approved (MSA GME P100 cartridges or equivalent)

ii) Polyethylene coated Tyvek® or Saranex® hooded suit (if liquids/splash hazards are present) or Tyvek® coveralls, ankles, and cuffs taped to boots and gloves

iii) nitrile over glove, as manufactured by Best or equivalent

iv) inner nitrile disposable gloves (NDEX 8005, as manufactured by Best, or equivalent)

v) safety toe work boots, ANSI approved

vi) chemical resistant neoprene or rubber boots with steel toes, or latex/PVC booties over safety toe shoes

vii) hard hat, ANSI approved

viii) hearing protection (if necessary)

ix) a high visibility safety vest (Class 2)

6.1.4 Level B Protection

Level B protection is not expected to be worn but would be required if sustained airborne concentrations of suspended organic vapors are greater than 1 ppm in the presence of vinyl chloride or 50 ppm in the absence of vinyl chloride. The action level necessitating Level B protection may be revised subject to determination of the compounds triggering the Level B protection requirement.

The following equipment will be used for Level B protection:

i) Supplied air respirator (NIOSH approved). Respirators may be positive pressure-demand self-contained breathing apparatus (SCBA), or positive pressure-demand airline respirator (with 5-minute escape bottle for immediately dangerous to life and health (IDLH) situations)

ii) Polyethylene coated Tyvek® or Saranex® hooded coverall with ankles and cuffs taped to boots and gloves (NOTE: Kimberly Clark Kleenguard A80 Hazard-Gard II Saranex® coveralls or equivalent)

iii) Nitrile over gloves, as manufactured by Best or equivalent

iv) Inner nitrile disposable gloves (NDEX 8005, as manufactured by Best, or equivalent)

v) Safety toe work boots, ANSI approved

vi) Chemical resistant neoprene or rubber boots with steel toes, or latex/PVC booties over safety toe shoes

vii) Hard hat, ANSI approved

viii) Hearing protection (if necessary)

ix) A high visibility safety vest (Class 2) if exposed to moving heavy equipment

6.1.5 Selection of PPE

Equipment for personal protection will be selected based on the potential for contact, Site conditions, ambient air quality, and the judgement of the PM, CS, SS, SHO and the CSHM. The PPE used will be chosen to be effective against the compound(s) present on the Site.

6.2 Respiratory Protection

Respiratory protection is an integral part of personnel health and safety at sites with potential airborne contamination.

6.2.1 Site Respiratory Protection Program

The Site respiratory protection program will consist of the following:

i) All project personnel who may use respiratory protection will have an assigned respirator

ii) All project personnel who may use respiratory protection will have been fit tested and trained in the use of a full-facepiece APR within the past 12 months

iii) All project personnel who may use respiratory protection must, within the past year, have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the SHO prior to commencement of Site work

iv) Only cleaned, maintained, NIOSH approved respirators are to be used on this Site

v) If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, prior to expected breakthrough or when breathing becomes labored (filter load-up occurs)

vi) Contact lenses may be worn with a full-face respirator

vii) All project personnel who may use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not interfere with the sealing surface of the respirator

viii) Respirators will be inspected and a negative pressure test performed prior to each use

ix) After each use, the respirator will be wiped with a disinfectant cleansing wipe or washed during a formal respirator cleaning procedure. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the facepiece.

Respiratory protection may be required during some of the project activities. This is to ensure worker protection from potentially contaminated particulates, SVOCs, and VOCs. It is expected that Modified Level D personal protection will be worn during the majority of the project activities involving the handling of impacted materials. However, the SHO will make the determination of the acceptable level of protection based upon the results of the air-monitoring program.

A photoionization detector (PID) with an 11.7 or greater eV lamp will be used to determine if organic vapors are present. A background reading will be established prior to commencing work activities at each active work area. When VOCs are detected in the worker breathing zones, colorimetric tubes will be used to determine if vinyl chloride is present. If vinyl chloride is present, then project personnel shall be monitored for their potential exposure to vinyl chloride in accordance to the OSHA Standard (see Section 9.1.4) and the work activities will only be continued with the increased level of personal protection (Level B). The results of the air sampling will be reviewed to ensure that the proper respiratory protection procedures are being implemented.

Action levels to determine the level of respiratory protection necessary for organic vapors are based on the sustained (15-minute) concentration of Site contaminants measured within the breathing zone. The action levels and appropriate respiratory protection are referenced in Table B8.1 of this document. The PID action levels have been set based on the presence of the known VOCs, which have been identified at the Site. However, if the ambient concentrations of organic vapors are due to identifiable substances, the level of respiratory protection may be altered by the SHO.

The appropriate air purifying respirator cartridges to be used at the Site are a combination organic vapor/acid gas and P-100 cartridge. The cartridge must be of the same manufacturer as the respirator face piece.

A personal aerosol monitor (e.g., MIE® Personal DataRam or equivalent) will also be utilized to determine airborne dust/particulate concentrations. Action levels to determine the level of respiratory protection necessary for dust levels are based on the concentration of Site contaminants that may potentially be attached to the dust that are measured within the breathing zone. The action levels and appropriate respiratory protection for particulates are included in Table B8.1 of this document.

6.3 Using PPE

Depending upon the level of protection selected for this project, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory if Level B or Level C PPE is used.

All personnel entering the EZ must put on the required PPE in accordance with the requirements of this plan. When leaving the EZ, PPE will be removed in accordance with the procedures listed, to minimize the spread of contamination.

6.3.1 Donning Procedures

These procedures are mandatory only if Level B or Level C PPE is used on the project:

i) Remove bulky outerwear. Remove street clothes and store in clean location

ii) Put on work clothes or coveralls

iii) Put on the required chemical protective coveralls

iv) Put on the required chemical protective boots or boot covers

v) Tape the legs of the coveralls to the boots with duct tape

viii) Put on the required chemical protective gloves

ix) Tape the wrists of the protective coveralls to the gloves

x) Don the required respirator and perform appropriate fit check

xi) Put hood or head covering over head and respirator straps and tape hood to facepiece

xii) Check and secure all seams

xiii) Don remaining PPE, such as hard hat.

When these procedures are instituted, one person (bottle watch/decon attendant) must remain outside the work area to ensure that each person entering has the proper protective equipment.

6.3.2 Doffing Procedures

The following procedures are only mandatory if Level B or C PPE is required for this project. Whenever a person leaves a Level B or C work site, the following decontamination sequence will be followed:

i) Upon entering the Contamination Reduction Zone (CRZ) rinse contaminated materials from the boots or remove contaminated boot covers

ii) Clean reusable protective equipment

iii) Remove protective garments, equipment, and respirator. All disposable clothing should be placed in a covered container, which is labeled

iv) Clean the respirator using the appropriate method as determined by the SHO

v) Wash hands, face, and neck and shower as soon as possible at the end of the day

vi) Proceed to clean area and dress in clean clothing

vii) Clean and disinfect respirator for next use

All disposable equipment garments, and PPE must be placed in covered containers and labeled for disposal. See Section 10.0 for detailed information on decontamination procedures.

6.4 Selection Matrix

The level of personal protection selected will be based upon real-time air monitoring of the work environment and an assessment by the SHO and CS and/or SS of the potential for skin contact with contaminated materials. The PPE selection matrix is given in each JSA form that is presented in Attachment A. This matrix is based upon information available at the time this plan was written.

6.5 Duration of Work Tasks

The duration of activities involving the usage of PPE will be established by the SHO based upon ambient temperature and weather conditions, the capacity of personnel to work in the designated level of PPE (heat stress, see Section 8.3) and the limitations of the protective equipment (i.e., ensemble permeation rates, life expectancy of air purifying respirator cartridges, etc.).

All rest breaks will be taken in the Support Zone (SZ) after full decontamination and PPE removal. Rest breaks will be observed based upon the heat stress monitoring guidelines presented in Section 8.3.

6.6 Limitations of Protective Clothing

PPE ensembles have been selected to provide protection against contaminants at anticipated concentrations. However, no protective garment, glove, or boot is chemical-proof, nor will it afford protection against all chemical types. Permeation of a given chemical through PPE is a complex process governed by contaminant concentrations, environmental conditions, physical condition of the protection garment, and the resistance of a garment to a specific contaminant. Chemical permeation may continue even after the source of contamination has been removed from the garment.

In order to obtain optimum usage from PPE, the following procedures are to be followed by all Site personnel using PPE:

i) When using disposable coveralls, don a clean, new garment after each rest break or at the beginning of each shift

ii) Inspect all clothing, gloves, and boots both prior to and during use for:

- a) imperfect seams
- b) non-uniform coatings
- c) tears
- d) poorly functioning closures

iii) Inspect reusable garments, boots, and gloves both prior to and during use for:

- a) visible signs of chemical permeation
- b) swelling
- c) discoloration
- d) stiffness
- e) brittleness
- f) cracks
- g) any sign of puncture
- h) any sign of abrasion

Reusable gloves, boots, or coveralls exhibiting any of the characteristics listed above will be discarded. PPE used in areas known or suspected to exhibit elevated concentrations of contaminants will not be reused.

Project personnel also carry certain responsibilities for their own health and safety, and are required to observe the following safe work practices:

i) Familiarize themselves with this HASP

ii) Use the "buddy system" when working in exclusion zones

iii) Use the safety equipment in accordance with training received, labeling instructions, and common sense

iv) Maintain safety equipment in good condition and proper working order

v) Refrain from activities that would create additional hazards (e.g., smoking, eating, etc., in restricted areas, leaning against dirty, contaminated surfaces)

vi) Smoking, eating, and drinking will be prohibited except in designated areas. These designated areas may change during the duration of the project to maintain adequate separation from the active work area(s). Designation of these areas will be the responsibility of the SHO

vii) Soiled disposable outerwear shall be removed and placed into a covered container prior to washing hands and face, eating, using lavatory facilities, or leaving the Site

7.0 Site Control

Site control is provided by the implementation of the following measures:

i) The PM, SHO, CS and/or SS are to be advised of the dates and purpose of all field activities

ii) All visitors must sign in and sign out each time they pass the Site access gate

iii) The selected contractor will ensure that a secure fence is in place around each active work area during the project activities

7.1 Authorization to Enter

All personnel working in exclusion zones (EZs) must have completed hazardous waste operations initial training as defined under OSHA Regulation 29 CFR 1926.65. They shall also have completed their training or refresher training within the past 12 months, and have been certified by a physician as fit for hazardous waste operations in order to enter a Site area designated as an EZ or contaminant reduction zone (CRZ). Personnel without such training or medical certification may enter the designated support zone (SZ) only. The SHO will maintain a list of authorized persons; only personnel on the authorized list will be allowed within the EZ or CRZ.

7.2 Site Orientation and Hazard Briefing

No person will be allowed in the general work area during project activities without first being given a Site orientation and hazard briefing. This orientation will be presented by the SHO, and will consist of attending an initial safety meeting. This training will cover the chemical, physical, and biological hazards, protective equipment, safe work procedures, and emergency procedures for the project. A Training Acknowledgment Form for documentation purposes is presented in Attachment B. In addition to this meeting, daily safety meetings will be held each day before work begins. All individuals on Site, including visitors, must document their attendance to this briefing as well as to each daily safety meeting on the form that is also included in Attachment B.

7.3 Certification Documents

A training and medical certification file will be established for the project and kept on Site during all project activities. The 40-hour training, update, and respirator fit test certificates, as well as current medical clearance for all project field personnel will be maintained within that file. Subcontractor personnel, if needed, will provide a copy of their training, respirator fit test, and medical certification to the selected contractor's SHO prior to the start of fieldwork.

7.4 Entry Requirements

In addition to the authorization, hazard briefing and certification requirements listed above, no person will be allowed to enter the Site unless he/she is wearing the minimum SZ PPE as described in Section 6.0. Personnel entering the EZ or CRZ must wear the required PPE for those locations as identified on each JSA form.

7.5 Emergency Entry and Exit

Individuals who must enter the Site on an emergency basis will be briefed of the hazards by the SHO. All hazardous activities will cease in the event of an emergency and any sources of emissions will be controlled, if possible.

Individuals exiting the Site because of an emergency will gather in a safe area, as determined by the SHO for a head count. The SHO is responsible for ensuring that all individuals who entered the work area have exited in the event of an emergency. See Section 11.0 of this HASP for additional information.

7.6 Contamination Control Zones

Contamination control zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas.

7.7.1 Exclusion Zone (EZ)

The EZ consists of the specific work area, or may be the entire area of suspected contamination. All employees entering the EZ must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. Barrier tape, fencing, or other appropriate means will identify the location of each EZ.

7.7.2 Contamination Reduction Zone (CRZ)

The CRZ or transition area will be established to perform decontamination of personnel and equipment and to provide a buffer zone around the EZ. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated

in the CRZ (or a separate CRZ decontamination area) that may be set up to better address equipment decontamination. The decontamination of all personnel will be performed on Site in the CRZ that is adjacent to each EZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the SZ.

7.7.3 Support Zone (SZ)

The SZ is a clean area outside of the CRZ located to prevent project personnel from exposure to hazardous substances. Eating and drinking will be permitted in the support area only after proper decontamination. Smoking will not be allowed in any portion of the SZ.

8.0 Activity Hazard/Risk Analysis and General Safety Practices

This section identifies and evaluates the potential chemical, physical, and biological hazards, which may be encountered while conducting project activities. Specific JSA forms (see Attachment A) have been developed to address the hazards associated with anticipated project activities, which are outlined in Section 1.0 of this HASP.

NOTE: If a non-routine task or previously unidentified task becomes necessary then a JSA that addresses the new task shall be developed and implemented before initiating the new activity.

In addition to the chemical hazards identified in Table B2.1 of this HASP, physical and biological hazards may exist at the Site including: potential heat/cold stress; hazards presented by the use of heavy equipment; underground/overhead utility hazards; hazards presented by excavations/trenches; fall hazards; biological hazards including, poison ivy, mosquitoes, ticks, bees, wasps, snakes; uneven terrain and slippery surfaces; electrical and other hazardous energy sources, hazards presented by undertaking hot work and the use of decontamination equipment. It will be the responsibility of the SHO and all project personnel to identify the physical and/or biological hazards posed by the various project activities that they are partaking in and implement all necessary preventative measurers.

8.1 General Practices

Additional general safety practices to be implemented are as follows:

i) A copy of the HASP must be at the project Site, in a location readily available to all personnel

ii) All project personnel must use the buddy system (working in pairs or teams)

iii) Food, beverages, or tobacco products must not be present or consumed in the EZ and CRZ. Cosmetics must not be applied within these zones

iv) Emergency equipment such as eyewash, fire extinguishers, etc., must be removed from storage areas and staged in readily accessible locations

v) Contaminated waste, debris, and clothing must be properly contained and legible and understandable precautionary labels must be affixed to the containers

vi) Removing contaminated soil or waste debris from protective clothing and/or equipment using compressed air, shaking, or any other means that disperses contaminants into the air is prohibited

vii) Containers must be moved only with the proper equipment, and must be secured to prevent dropping or loss of control during transport

viii) Visitors to the Site must be instructed to stay outside of the EZ and CRZ and remain within the SZ during the extent of their stay. Visitors must be cautioned to avoid skin contact with surfaces, which are contaminated or suspected to be contaminated

8.1.1 Buddy System

All project personnel shall use the buddy system. Visual contact must be maintained between project team members at all times, and personnel must observe each other for signs of chemical exposure and heat stress. Indications of adverse effects include, but are not limited to:

i) Changes in complexion and skin coloration

ii) Changes in coordination

iii) Excessive salivation and papillary response

iv) Changes in speech pattern

Team members must also be aware of potential exposure to possible safety hazards, unsafe acts, or noncompliance with safety procedures. Personnel shall inform their partners, fellow team members, SHO, CS and/or the SS of non-visible effects of exposure to toxic materials. The symptoms of such exposure may include:

i) Headaches

ii) Dizziness

iii) Nausea

iv) Blurred vision

v) Cramps

vi) Irritation of eyes, skin, or respiratory tract

If protective equipment or noise levels impair communications, pre-arranged hand signals must be used for communication. Personnel must stay within line of sight of another team member. Downrange field teams in conjunction with the "buddy" system will use the following hand signals. These signals are very important when working with heavy equipment. The entire field team shall know them before operations commence.

Signal	***Meaning***
Hand Gripping Throat	Out of Air; Can't Breathe
Grip Partner's Wrist	Leave Area Immediately
Hands on Top of Head	Need Assistance
Thumbs Up	Ok, I'm All Right, I Understand
Thumbs Down	No, Negative

8.1.2 Sanitation

Sanitation at the Site will be maintained according to OSHA and Department of Health requirements.

8.1.3 Break Area

Breaks must be taken in the SZ, away from the active work area after project personnel go through decontamination procedures. There will be no eating, drinking, or chewing gum in any area other than the SZ.

8.1.4 Potable Water

The following rules apply for all project field operations:

i) An adequate supply of potable water will be provided in each CRZ. Potable water must be kept away from hazardous materials, contaminated clothing, and contaminated equipment

ii) Portable containers used to dispense drinking water must be capable of being tightly closed, and must be equipped with a tap dispenser. Water must not be drunk directly from the container, nor dipped from the container

iii) Containers used for drinking water must be clearly marked and not used for any other purpose

iv) Disposable cups must be supplied, and both a sanitary container for unused cups and a receptacle for disposing of used cups must be provided

8.1.5 Washing Facilities

Access to facilities for washing ones hands, face and neck before eating, drinking, or smoking will be provided.

8.1.6 Lavatory

If permanent toilet facilities are not available, an adequate number of portable chemical toilets will be provided.

8.1.7 Trash Collection

Trash collected from the CRZ will be separated as potentially contaminated waste. Trash collected in the support and break areas will be disposed of as non-hazardous waste. Trash receptacles will be set up in the CRZ and in the SZ.

8.2 Chemical Exposure

Preventing exposure to toxic chemicals is a primary concern. Chemical substances can enter the unprotected body by inhalation, skin absorption, ingestion, or through a puncture wound (injection). A contaminant can cause damage at the point of contact or can act systematically, causing a toxic effect at a part of the body distant from the point of initial contact. The Site Chemical Contaminants of Concern and Their Properties are identified in Table B2.1

Chemical exposures are generally divided into two categories: acute and chronic. Symptoms resulting from acute exposures usually occur during or shortly after exposure to a sufficiently high concentration of a contaminant. The concentration required to produce such effects varies widely from chemical to chemical. The term "chronic exposure" generally refers to exposures to "low" concentrations of a contaminant over a long period of time. The "low" concentrations required to produce symptoms of chronic exposure depend upon the chemical, the duration of each exposure, and the number of exposures. For a given contaminant, the symptoms of an acute exposure may be completely different from those resulting from chronic exposure.

For either chronic or acute exposure, the toxic effect may be temporary and reversible, or may be permanent (disability or death). Some chemicals may cause obvious symptoms such as burning, coughing, nausea, tearing eyes, or rashes. Other chemicals may cause health damage without any such warning signs (this is a particular concern for chronic exposures to low concentrations). Health effects such as cancer or respiratory disease may not become evident for several years or decades after exposure. In addition, some toxic chemicals may be colorless and/or odorless, may dull the sense of smell, or may not produce any immediate or obvious physiological sensations. Thus, a worker's senses or feelings cannot be relied upon in all cases to warn of potential toxic exposure.

The effects of exposure not only depend on the chemical, its concentration, route of entry, and duration of exposure, but may also be influenced by personal factors such as the individual's smoking habits, alcohol consumption, medication use, nutrition, age, and sex.

An important exposure route of concern at the Site is inhalation. The lungs are extremely vulnerable to chemical agents. Even substances that do not directly affect the lungs may pass through lung tissue into the bloodstream, where they are transported to other vulnerable areas of the body. Some toxic chemicals present in the atmosphere may not be detected by human senses (e.g., they may be colorless, odorless, and their toxic effects may not produce any immediate symptoms). Respiratory protection is therefore extremely important if there is a possibility that the work site atmosphere may contain such hazardous substances. Chemicals can also enter the respiratory tract through punctured eardrums. Where this is a hazard, individuals with punctured eardrums should be medically evaluated specifically to determine if such a condition would place them at an unacceptable risk and preclude their working at the task in question.

Direct contact of the skin and eyes by hazardous substances is another important route of exposure. Some chemicals directly injure the skin. Some pass through the skin into the bloodstream where they are transported to vulnerable organs. Abrasions, cuts, heat, and moisture enhance skin absorption. The eye is particularly vulnerable because airborne chemicals can dissolve in its moist surface and be carried to the rest of the body through the bloodstream (capillaries are very close to the surface of the eye). Wearing protective equipment, not using contact lenses in contaminated atmospheres (since they may trap chemicals against the eye surface), keeping hands away from the face, and minimizing contact with liquid and solid chemicals can help protect against skin and eye contact.

Although ingestion should be the least significant route of exposure at the Site, it is important to be aware of how this type of exposure can occur. Deliberate ingestion of chemicals is unlikely; however, personal habits such as chewing gum or tobacco, drinking, eating, smoking cigarettes, and applying cosmetics at the Site may provide a route of entry for chemicals.

The last primary route of chemical exposure is injection, whereby chemicals are introduced into the body through puncture wounds (e.g., by stepping or tripping and falling onto contaminated sharp objects). Wearing safety shoes, avoiding physical hazards, and taking common sense precautions are important protective measures against injection.

Chemical Hazard Controls

Airborne exposure or contact with the contaminants of concern at the Site shall be controlled by:

i) Skin contact with chemicals may be controlled by use of the proper PPE and good housekeeping procedures. The proper PPE (e.g., polycoated Tyvek®, gloves) as described in Section 6.0 of this HASP shall be worn for all activities where contact with potentially harmful media or materials is anticipated

ii) Monitoring air concentrations for volatile organic chemicals and particulates shall be conducted in the breathing zone with a PID with an 11.7 eV lamp or greater and a particulate monitor, as discussed in Section 9.0

iii) Dust control measures, such as wetting the immediate area, shall be employed when visible dust is generated in active work areas

iv) Contact the CSHM for additional information regarding a particular product's or activity's exposure hazards

v) Using respiratory protection as appropriate, in areas known to have concentrations above the specified action level

Hazard Communication

Personnel required to handle or to use hazardous materials as part of their job duties will be trained and educated in accordance with the Hazard Communication Standard. The training shall include instruction on the safe usage, and handling procedures of hazardous materials, how to read and access Material Safety Data Sheets (MSDSs), and the proper labeling requirements.

The MSDSs for those chemicals in use at the Site will be available to project personnel. The SHO will be responsible for maintaining a copy of all MSDSs on Site.

8.3 Heat Stress

Heat stress is caused by a number of interacting factors including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load, and in particular, because wearing PPE can increase the risk of developing heat stress, workers must be capable of recognizing the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses and be able to recognize the signs and symptoms of these illnesses in both themselves and their co-workers.

Heat Rashes: Are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

Heat Cramps: Are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much and too little salt.

Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3 percent NaCl), excess salt can build up in the body if the water lost through sweating is

not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for six to eight hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

Heat Exhaustion: Occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include pale, cool, moist skin, heavy sweating, dizziness, nausea, headache, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, be given fluid replacement, and be encouraged to get adequate rest.

Heat Stroke: Is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion, irrational behavior, loss of consciousness, convulsions, a lack of sweating (usually), hot, dry skin, and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

Heat Stress Safety Precautions: Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A minimum work rest regimen and procedures for calculating ambient adjusted temperature are described below.

Adjusted Temperature(1)	***Work-Rest Regimen Normal Work Ensemble(2)***	***Work-Rest Regimen Impermeable Ensemble***
90°C (32.°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5° to 90°F (30.8°C to 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5° to 87.5°F (28.1° to 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° to 82.5°F (25.3° to 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° to 77.5°F (30.8° to 32.2°C)	After each 150 minutes of work	After each 120 minutes of work

Notes:

(1) Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F=ta °F + (13 x percent sunshine). Measure air temperature (ta) with a standard thermometer, with the bulk shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows).

(2) A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

In order to determine if the work rest cycles are adequate for the personnel and specific Site conditions, additional monitoring of individual heart rates will be conducted during the rest cycle. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one-third and maintain the same rest period.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any Site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

i) Project personnel will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day

ii) On-Site drinking water will be kept cool (50 to 60°F)

iii) A work regimen that will provide adequate rest periods for cooling down will be established, as required

iv) All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps

v) Cooling devices such as vortex tubes or cooling vests should be used when personnel must wear impermeable clothing in conditions of extreme heat

vi) Project personnel shall be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary

vii) A shaded rest area must be provided. All breaks should take place in the shaded rest area

viii) Project personnel must not be assigned to other tasks during breaks

ix) Project personnel must remove impermeable garments during rest periods. This includes Tyvek® garments

x) All project personnel must be informed of the importance of adequate rest, acclimation (usually takes about 2 hours/day for 1-2 weeks to become acclimated), and proper diet in the prevention of heat stress disorders

8.4 Sun Exposure

Overexposure to sunlight is a common concern when field activities occur during warm weather conditions. Overexposure can occur on clear, sunny days as well as on overcast and cloudy days. Ultraviolet (UV) rays from the sun can cause skin damage or sunburn, but can also result in vision problems, allergic reactions, and other skin concerns. Two types of UV rays are emitted from the sun: UVA and UVB rays.

UVB rays cause sunburn, skin cancer, and premature aging of the skin. UVB rays stimulate tanning but are also linked to other problems such as impaired vision, skin rashes, and some allergic and other reactions to certain drugs. Extra care should be taken if activities are to be conducted on or near water. Sunlight reflected off the surface of the water is intensified resulting in accelerated effects. The following steps should be taken to protect against overexposure to sunlight:

i) Always use sunscreen: Apply a broad-spectrum sunscreen with Sun Protection Factor (SPF) of at least 15 or higher liberally on exposed skin. Reapply every 2 hours or more. Even waterproof sunscreen can come off when you towel off or sweat

ii) Cover up: Wearing tightly woven, loose-fitting, and full-length clothing is a good way to protect your skin from UV rays

iii) Wear a hat: A hat with a wide brim offers good sun protection to your eyes, ears, face, and the back of your neck – areas particularly prone to overexposure to the sun

iv) Wear sunglasses that block 99 to 100 percent of UV radiation: Sunglasses that provide 99 to 100 percent UVA and UVB protection will greatly reduce sun exposure that can lead to cataracts and other eye damage. Check the label when buying sunglasses

v) Seek shade: Shade is a good source of protection, but keep in mind that shade structures (e.g., trees, umbrellas, canopies) do not offer complete sun protection

vi) Limit time in the midday sun: The sun's rays are strongest between 10 a.m. and 4 p.m. Whenever possible, limit exposure to the sun during these hours

8.5 Cold Stress

Cold stress is similar to heat stress in that it is caused by a number of interacting factors including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Fatal exposures to cold have been reported in individuals failing to escape from low environmental air temperatures or from immersion in low temperature water. Hypothermia, a condition in which the body's deep core temperature falls significantly below 98.6°F (37°C), can be life threatening. A drop in core temperature to 95°F (35°C) or lower must be prevented.

Air temperature is not sufficient to determine the cold hazard of the work environment. The wind chill must be considered as it contributes to the effective temperature and insulating capabilities of clothing. The equivalent chill temperature should be used when estimating the combined cooling effect of wind and low air temperatures on exposed skin or when determining clothing insulation requirements to maintain the body's core temperature.

The body's physiologic defense against cold includes constriction of the blood vessels, inhibition of the sweat glands to prevent loss of heat via evaporation, glucose production, and involuntary shivering to produce heat by rapid muscle contraction.

The frequency of accidents increases with cold temperature exposures as the body's nerve impulses slow down, individuals react sluggishly, and numb extremities make for increased clumsiness. Additional safety hazards include ice, snow blindness, reflections from snow, and possible skin burns from contact with cold metal.

Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 95°F (35°C). This must be taken as a sign of danger to the individuals on site, and cold exposures should be immediately terminated for any individual when severe shivering becomes evident. Useful physical or mental work is limited when severe shivering occurs.

Predisposing Factors for Cold Stress

There are certain predisposing factors that make an individual more susceptible to cold stress. It is the responsibility of the project team members to inform the SHO/SS to monitor an individual, if necessary, or use other means of preventing/reducing the individual's likelihood of experiencing a cold related illness or disorder.

Predisposing factors that will increase an individual's susceptibility to cold stress are listed below:

- **Dehydration:** The use of diuretics and/or alcohol, or diarrhea can cause dehydration. Dehydration reduces blood circulation to the extremities
- **Fatigue during Physical Activity:** Exhaustion reduces the body's ability to constrict blood vessels. This results in the blood circulation occurring closer to the surface of the skin and the rapid loss of body heat
- **Age:** Some older and very young individuals may have an impaired ability to sense cold
- **Poor Circulation:** Vasoconstriction of peripheral vessels reduces blood flow to the skin surface
- **Heavy Work Load:** Heavy workloads generate metabolic heat and make an individual perspire even in extremely cold environments. If perspiration is absorbed by the individual's clothing and is in contact with the skin, cooling of the body will occur
- **The Use of PPE:** PPE usage that traps sweat inside the PPE may increase an individual's susceptibility to cold stress
- **Lack of Acclimatization:** Acclimatization, the gradual introduction of workers into a cold environment, allows the body to physiologically adjust to cold working conditions
- **History of Cold Injury:** Previous injury from cold exposures may result in increased cold sensitivity

Prevention of Cold Stress

There are a variety of measures that can be implemented to prevent or reduce the likelihood of individuals developing cold related ailments and disorders. These include acclimatization, fluid and electrolyte replenishment, eating a well balanced diet, wearing warm clothing, the provision of shelter from the cold, thermal insulation of metal surfaces, adjusting work schedules, and personnel education.

- **Acclimatization:** Acclimatization is the gradual introduction of workers into the cold environment to allow their bodies to physiologically adjust to cold working conditions. However, the physiological changes are usually minor and require repeated uncomfortably cold exposures to induce them
- **Fluid and Electrolyte Replenishment:** Cold, dry air can cause individuals to lose significant amounts of water through the skin and lungs. Dehydration affects the flow of blood to the extremities and increases the risk of cold injury. Warm, sweet, caffeine-free, non-alcoholic drinks and soup are good sources to replenish body fluids
- **Eating a Well Balanced Diet:** Restricted diets including low salt diets can deprive the body of elements needed to withstand cold stress. Eat high-energy foods throughout the day
- **Warm Clothing:** It is beneficial to maintain air space between the body and outer layers of clothing in order to retain body heat. However, the insulating effect provided by such air spaces is lost when the skin or clothing is wet
- **Work/Rest Regimes:** Schedule work during the warmest part of the day, if possible. Rotate personnel and adjust the work/rest schedule to enable individuals to recover from the effects of cold stress

The parts of the body most important to keep warm are the feet, hands, head, and face. As much as 40 percent of body heat can be lost when the head is exposed.

8.6 Earthwork - Excavation and Trenching

Project activities will involve excavation work. Prior to initiating excavation activities, the CS is responsible for making sure that the following conditions are in place:

i) Ensure that all above and underground utilities have been properly located prior to initiating work activities

ii) Ensure that approved protective shoring devices are available for use at the Site if this means of protection is going to be used

iii) Ensure that the Safety Inspection Checklist for Excavations has been completed prior to allowing project personnel to enter any excavation

iv) Ensure that the proper fencing materials are available to secure each active work area

The selected contractor's competent person shall observe all excavation and trenching operations where project personnel will enter. The competent person shall be responsible for evaluating, classifying and inspecting excavation and trenching operations to prevent possible cave-in and entrapment, and to avoid other hazards presented by excavation activities.

It is the responsibility of the CS and SHO to implement the following components of the selected contractor's Excavation and Trenching Safety Program as they relate to project activities:

i) Ensure that all excavations are completed in accordance with the approved Excavation and Trenching Safety Program

ii) Ensure that the proper protective materials and equipment are available and being used to complete the excavation and/or trenching procedures

iii) Ensure that the necessary inspections of the excavation are completed as required.

Personnel who are required to enter or work in excavations greater than 5 feet in depth must be protected from the hazards of cave-ins. This requires the use of sloping and/or shoring systems that comply with State and Federal OSHA standards. Excavation and trenching operations require pre-planning to develop appropriate designs for such systems. The selected contractor will make the appropriate plans.

The estimated location of all underground installations shall be determined before digging begins. If there are any nearby buildings, walls, sidewalks, trees, or roads that may be threatened or undermined by the excavation, where the stability of any of these items may be endangered by the excavation, they must be removed or supported by adequate shoring, bracing, or underpinning.

Excavations may not go below the base of footings, foundations, or retaining walls, unless they are adequately supported or a person who is registered as a PE has determined that they will not be affected by the soil removal. OSHA recommends using civil engineers or those with licenses in a related discipline and experience in the design and use of sloping and shoring systems. PE qualifications shall be documented in writing and available at the Site.

The selected contractor's Excavation and Trenching Safety Program and the OSHA Excavation Standard (29 CFR 1926 Subpart P) will be followed during all excavation activities and provide detailed information regarding such activities.

Access and Egress

Personnel access and egress from trench and/or excavations are as follows:

i) A stairway, ladder, ramp, or other means of egress must be provided in excavations greater than four feet deep and for every 25 feet of lateral travel

ii) All ladders shall extend three feet above the top of the excavation

Atmosphere Monitoring and Testing

Air quality is measured by the following three parameters:

i) Oxygen concentration
ii) Flammability
iii) Organic vapors

There is a potential for hazardous atmospheres to exist in each proposed excavation. As such, project personnel will not be allowed to be exposed to any hazardous atmosphere. Whenever potentially hazardous atmospheres are suspected in excavations, the competent person shall test the atmosphere. A gas monitor capable of measuring the oxygen level, lower explosive limit (LEL) and toxicity will be used to take readings prior to and while workers are in any excavation. A hazardous atmosphere is defined as one that could contain less than 19.5 percent of oxygen, concentrations of hazardous substances greater than their permissible exposure level (PEL) including carbon monoxide and a LEL reading greater than ten percent. A forced air ventilator will first be used to pump fresh air into the excavation and to push out (purge) any potentially contaminated air.

In the event that an unusual odor or liquid is suspected in excavations, the competent person shall stop work and arrange for air quality assessment and mitigation, if necessary.

Daily Inspections

The competent person shall perform daily inspections of excavations, the adjacent areas, and all protective systems for situations that could potentially result in slope failure.

The competent person shall inspect, evaluate, and document (a form is provided in Attachment B) the inspection of the excavation on an Excavation Inspection Checklist at the following intervals:

i) Prior to the start of work, after each extended halt in work, and as needed throughout the shift as new sections of the excavation is opened
ii) After every rainstorm and other natural or man-made event that may increase the load on the walls of the excavation, or otherwise affect their stability

The competent person shall stop the work and instruct all project personnel to leave the excavation when any potential hazards are detected. The competent person has the ***authority*** to immediately suspend work if any unsafe condition is detected.

8.7 Heavy Equipment Safety

Personnel operating heavy equipment (such as backhoes) and personnel working in the vicinity of heavy equipment shall adhere to the following practices:

i) Heavy equipment is to be inspected when equipment is initially mobilized/delivered to a job site or after it is repaired and returned to service to ensure that it meets all manufacturer and OSHA specifications

iii) Heavy equipment is to be inspected on a daily basis. Documentation of this daily pre-operational inspection is to be filed with the project files

iv) Heavy equipment is only to be operated by authorized, competent operators

v) Seat belts are to be provided on heavy equipment that is not designed for stand up operation

vi) Equipment/vehicles whose payload is loaded by a crane, excavator, loader, etc. will have a cab shield and/or canopy to protect the operator

vii) Personnel will not be raised/lowered in buckets

viii) Personnel will not ride on fender steps or any place outside the cab

ix) Before leaving the equipment controls, ensure that the equipment is in its safe resting position. For a backhoe, apply the parking brake, put the front loader bucket down on ground level, and ensure that the rear excavator bucket is locked in the travel position. Bulldozers and scraper blades, loader buckets, dump bodies, and similar equipment will be fully lowered or blocked when not in use

x) Before raising any booms, buckets, etc., check for overhead obstructions

xi) Project personnel involved in the operation shall not wear any loose-fitting clothing, which has the potential to be caught in moving machinery

xii) Personnel shall wear high visibility safety vests, steel-toed shoes, safety glasses, hearing protection, and hard hats during heavy equipment operations

xiii) When moving heavy equipment or when working in tight quarters, a spotter will be used

Overhead Electrical Clearances: If excavation work is conducted in the vicinity of overhead power lines, the power to the lines must be shut off or the equipment must be positioned and blocked such that no part, including cables, can come within the minimum clearances as follows:

Nominal System Voltage	*Minimum Required Clearance*
0 to 50 kV	10 Feet
51 to 100 kV	12 Feet
101 to 200 kV	15 Feet
201 to 300 kV	20 Feet
301 to 500 kV	25 Feet
501 to 750 kV	35 Feet
751 to 1,000 kV	45 Feet

8.8 Noise

Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on Site. The selected contractor's Hearing Conservation Program will be implemented for affected project personnel.

Control: All personnel must wear hearing protection with a Noise Reduction Rating (NRR) of at least 20 when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All Site personnel who may be exposed to noise must also receive baseline and annual audiograms and training as to the causes and prevention of hearing loss.

Whenever possible, equipment that does not generate excessive noise levels will be selected for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

8.9 Electrical Hazards

Electricity may pose a particular hazard to project personnel due to the use of portable electrical equipment. When electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements include:

i) All electrical wiring and equipment must be a type listed by Underwriters Laboratory (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency

ii) All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or United States Coast Guard regulations

iii) A multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle must ground portable and semi-portable tools and equipment

iv) Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools must be distinctly marked and listed by UL or FM

v) Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them

vi) Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching

vii) All circuits must be protected from overload

viii) Temporary power lines, switch boxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage

ix) Plugs and receptacles must be kept out of water unless of an approved submersible construction

x) All extension outlets must be equipped with ground fault circuit interrupters (GFCIs)

xi) Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment

xii) Extension cords or cables must be inspected prior to each use, and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire

xiii) Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician

xiv) The OSHA requirements for electrical safety will be adhered to as minimum requirements to be followed by all Site personnel, including subcontractors. Electrical inspections are to occur during initial Site setup and monthly thereafter. These inspections are to be documented via either the CS's and/or the SS's logbook, the Site SHO's logbook, or on specific forms that the selected contractor may have as part of their Electrical Safety Program.

8.10 Material Handling

Material handling operations to be conducted at the project Site will include manual lifting of materials to and from trucks and the setup/maintenance of storage areas. It may also involve the handling of super sacks (very large bags) of chemical additives.

Hoisting and Rigging

Wire ropes, chains, ropes, and other rigging equipment will be inspected prior to each use and as necessary during use to assure their safety. Defective rigging equipment will be immediately removed from service.

Rigging will not be used unless the weight of the load falls within the rigging's safe work operating range. The authorized rigger prior to any "pick" or lifting operation must verify this.

Only personnel trained in safe rigging procedures will be authorized to engage in rigging procedures. Additionally, the rigger must understand and use recognized crane signals.

Job or shop hooks and links and other makeshift fasteners **will not** be used. When U-bolts are used for eye splices, the U-bolt will be applied so the "U" section is in contact with the dead end of the rope.

Wire ropes, chains, ropes, and other rigging equipment will be stored where they will remain clean, dry, and protected from the weather and corrosive fumes.

The proper length of rope or chain slings will be used to avoid wide-angle lifts and dangerous slack. Knotted ropes or lengths of ropes reduced by bolts, knots, or other keepers will not be used.

General Storage Practices

The basic safety requirement for storage areas is that the storage of materials and supplies shall not create a hazard. Additional general storage area practices include the following:

i) Bags, containers, bundles, etc. stored in tiers shall be stacked, blocked, interlocked, and limited in height so that they are stable and secure against sliding or collapse

ii) All stacked materials, cargo, etc. shall be examined for sharp edges, protrusions, signs of damage, or other factors likely to cause injury to persons handling these objects. Defects should be corrected as they are detected.

iii) Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion, or pest harborage

iv) Storage areas shall have provisions to minimize manual lifting and carrying. Aisles and passageways shall provide for the movement of mechanical lifting and conveyance devices

v) "NO SMOKING" signs shall be conspicuously posted as needed in areas where combustible or flammable materials are stored and handled

Special Precautions for Hazardous or Incompatible Materials Storage

Generally, materials are considered hazardous if they are ignitable, corrosive, reactive, or toxic. Manufacturers and suppliers of these materials must provide the recipient with MSDSs, which describe their hazardous characteristics, and give instructions for their safe handling and storage.

Many hazardous materials are incompatible, which means they form mixtures that may have hazardous characteristics not described on the individual MSDSs. The following special precautions shall be followed regarding the storage of hazardous materials:

i) Based on the information available on the MSDSs, incompatible materials shall be kept in separate storage areas

ii) Warning signs shall be conspicuously posted, as needed, in areas where hazardous materials are stored

Hand Protection

Hand protection is the most important form of PPE when handling materials manually. The SHO will select the appropriate hand protection for the task/activity. Gloves are often relied upon to prevent against abrasions, cuts and burns during material handling activities and many types of gloves actually improve your grip factor. Therefore, it is most important that the most appropriate glove (leather, cotton, kevlar, metal mesh, nitrile, etc.) is selected for the given situation. The following table presents protection factors for commonly used gloves.

Type of Glove	***Protection***
Rubber	Acids, bases, alcohol – moderate resistance to cuts.
Canvas or cloth	Dirt, wood slivers, sharp edges – some resistance to cuts.
Metal mesh or kevlar	Highly resistant to cuts and scratches and caught between hazards (crushing, etc.)
Insulated	Electrical charges
Cuffed	Protects against liquids trickling into glove and protects the wrist/forearm area from cuts and abrasions.
Leather	Moderate resistance to cuts and abrasions and caught between hazards.

It is important to wash hands frequently when wearing gloves to prevent the build-up of sweat and dirt on the hands. Check gloves regularly for cracks, holes and rips/tears. Keep gloves clean and dry as much as possible.

8.11 Manual Lifting

When lifting objects, use the following proper lifting techniques:

i) Feet must be parted, with one foot alongside the object being lifted and one foot behind. When the feet are comfortably spread, a more stable lift can occur and the rear foot is in a better position for the upward thrust of the lift

ii) Do not lift more than 50 pounds without the assistance of another individual

iii) Use the squat position and keep the back straight - but remember that straight does not mean vertical. A straight back keeps the spine, back muscles, and organs of the body in correct alignment. It minimizes the compression of the guts that can cause a hernia

iv) Grip is one of the most important elements of correct lifting. The fingers and the hand are extended around the object you're going to lift - using the full palm. Fingers have very little power - use the strength of your entire hand

v) The load must be drawn close, and the arms and elbows must be tucked into the side of the body. Holding the arms away from the body increases the strain on the arms and elbows. Keeping the arms tucked in helps keep the body weight centered

vi) The body must be positioned so that the weight of the body is centered over the feet. This provides a more powerful line of thrust and also ensures better balance. Start the lift with a thrust of the rear foot. Do not twist your back while lifting or moving heavy objects

8.12 Hand and Power Tools

Hand Tools Requirements:

i) Hand tools must meet the manufacturer's safety standards

ii) Hand tools must not be altered in any way

iii) At a minimum, eye protection must be used when working with hand tools

iv) Wrenches (including adjustable, pipe, end, and socket wrenches) must not be used when jaws are sprung to the point that slippage occurs

v) Impact tools (such as drift pins, wedges, and chisels) must be kept free of mushroom heads

vi) Wooden handles must be free of splinters or cracks and secured tightly to the tool

Power Tools Requirements:

i) All power tools must be inspected regularly and used in accordance with the manufacturer's instructions and the tool's capabilities

ii) Electric tools must not be used in areas subject to fire or explosion hazards, unless they are approved for that purpose

iii) Portable electric tools must be connected to a Ground Fault Circuit Interrupter (GFCI) when working in wet areas

iv) Proper eye protection must be used when working with power tools

v) Personnel must be trained in the proper use of each specific tool

vi) Any damaged or defective power tools must be immediately tagged and removed from service

8.13 Adverse Weather Conditions

The SHO, CS and/or SS shall decide on the continuation or discontinuation of work based on current and pending weather conditions. Electrical storms, tornado warnings, and strong winds (approximately

40 mph) are examples of conditions that would call for the discontinuation of work and evacuation of site. Strong winds can generate hazardous conditions during the handling of materials.

In addition, no work with elevated super structures (e.g., operation of excavators etc.) will be permitted during any type of electrical storm or during wind events that have wind speeds exceeding 25 mph.

8.14 Fall Hazards

Personnel that will use ladders and have the potential hazard of working on elevated surfaces or platforms of 6 feet or greater during project activities shall follow their employer-specific program for fall protection and procedures for using aerial lifts.

An aerial lift device is any vehicle-mounted device, telescoping or articulating, which is used to position personnel. Aerial lifts include the following: extendible boom platforms, aerial ladders, articulating boom platforms, vertical towers, and a combination of the above.

The following will be considered when using aerial lifts:

- Lift controls will be tested each day prior to use to verify they are in a safe working condition
- Only proficient operators will operate an aerial lift
- Personal fall protection (e.g., harness and lanyard) will be worn and attached to an appropriate anchorage while in the aerial lift basket
- Personnel must always stand firmly on the floor of the basket
- Boom and load limits specified by the manufacturer will **not** be exceeded
- Vehicle brakes, outriggers, and wheel chocks should be used when required and/or available
- The aerial lift truck will **not** be moved when the boom is elevated with personnel in the basket unless the aerial lift is designed to do so (i.e., controls to move truck are located in and may be operated while in the basket). In these cases, the movement of the lift truck will be for work positioning only and not for movement from one work location to another

A proficient operator is specifically required to operate a powered platform, manlift, and vehicle-mounted platform in accordance with the OSHA standard. This standard states, "working platforms will be operated only by persons who are proficient in the operation, safe use, and inspection of the particular working platform to be operated." This means that trained and knowledgeable individuals will be selected to operate work platforms.

To become a proficient operator for a powered platform, manlift, or vehicle-mounted platform, the individual must understand the following concepts:

- Operating parameters of the device
- Weight limitations

- Maximum boom length in the fully extended position
- Maximum slope allowed for safe operation
- Safe operating distances from overhead obstructions, including electrical lines
- Operation of the outriggers and their load limits

Powered platforms, manlifts, or vehicle mounted platforms and their components will be inspected for visible defects before every use and after any occurrence that could affect the platform's structural integrity. A maintenance inspection or test will be conducted following the procedures established by the manufacturer of the equipment. Inspections will be conducted and documented by the use of a Manlift Daily Equipment Checklist.

Rental equipment (platforms and manlifts) will undergo a visual inspection at time of delivery, before each use, and after any occurrence which will affect structural integrity. An example of a manlift checklist inspection form is provided in Attachment B. Maintenance inspections will be conducted on rental equipment or requested of the equipment owner if the equipment is kept on site for extended use.

An emergency rescue plan shall be developed and written out prior to project personnel wearing personal fall arrest equipment (e.g., harness, lanyard etc.) The plan shall be communicated to all personnel working at the site so that they will be able to take the appropriate action in an emergency.

8.15 Biological Hazards

Biological hazards may include poison ivy, snakes, thorny bushes, ticks, mosquitoes, and other pests.

8.15.1 Vegetation Overgrowth

Overgrown weeds, bushes, trees, grass and other vegetation are fire and safety hazards. There are a number of hidden hazards not immediately recognized due to the overgrowth of vegetation in areas where field activities may occur, including discarded junk, litter, and debris. Construction materials such as boards, nails, concrete, and other debris may be hidden beneath blades of tall grass, weeds, and bushes. Other hazards may include steep slopes, potholes, trenches, soft spots, dips, etc.; all dangerously concealed from the view of the individual walking or operating motorized equipment in the area. Additionally, there are biological hazards such as snakes, ticks, chiggers, and mosquitoes that breed in overgrowth conditions.

Here are some simple actions you can take:

i) Assess the work area and determine if the area requires vegetation clearance. Consider that overgrowth that extends above the lowest level of motorized equipment (i.e., bumper or fender) or 6 inches above your ankle has hidden hazards that you will not be able to readily identify

ii) Determine if the area is safe to walk or whether you need motorized equipment. Consider the limitations of the equipment

iii) Identify slip, trip, and fall hazards and remove from the general work area. Remember to give adequate clearance so that the items being removed do not pose future hazards

iv) Adequately protect yourself against the hazards by wearing boots that protect the ankles, long pants, and using insecticides

v) Consider the limitations of manual or mechanical equipment for the clearance of overgrowth, particularly the safety hazards when using sling blades, machetes, weed eaters, bush hogs, or other brush removing equipment

Before taking any action, determine whether there any ecological issues that would affect or prevent the removal of overgrowth in protected areas such as wetlands, wildlife habitats, or sanctuaries for endangered and/or protected species.

8.15.2 Tick-Borne Diseases

Lyme Disease, Erlichiosis, and Rocky Mountain Spotted Fever (RMSF) are diseases transmitted by ticks and occur throughout the United States during spring, summer, and fall.

Lyme Disease: The disease commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, Rhode Island Minnesota, and Wisconsin. Few cases have been identified in other states.

Erlichiosis: The disease also commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, Massachusetts, Connecticut, Rhode Island Minnesota, and Wisconsin. Few cases have been identified in other states.

Primarily the Deer Tick transmits these diseases, which is smaller and redder than the common Wood Tick. The disease may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, swelling and pain in the joints, and eventually, arthritis. Symptoms of Erlichiosis include muscle and joint aches, flu-like symptoms, but there is typically no skin rash.

Control: Tick repellent containing diethyltoluamide (DEET) should be used in tick- infested areas, and pants legs should be tucked into boots. In addition, workers should search the entire body every three or four hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since

crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

8.15.3 Poisonous Plants

Common Poison Ivy (Rhus radicans) grows as a small plant, a vine, and a shrub. Poison Ivy occurs in every state. The leaves always consist of three glossy leaflets. Poison Sumac (Rhus vernix) grows as a woody shrub or small tree 5 to 25 feet tall. It usually contains nine leaves, with eight paired leaves and one on top, and is common in swampy areas. The plants are potent sensitizers and can cause a mild to severe allergic reaction. This reaction is called contact dermatitis.

Dermatitis, in Rhus-sensitive persons, can result from contact with the milky sap found in the roots, stems, leaves, and fruit. The sap may retain its potency for months or years in a dry atmosphere, and can occur during any time of the year. The sap may also be carried by animals, equipment or apparel.

The best form of prevention is to avoid contact. This can occur by wearing long sleeves and gloves if necessary. Disposable clothing, such as Tyvek, is recommended in high-risk areas to avoid exposure from contaminated apparel. Barrier creams and cleaners are also recommended.

8.15.4 Insects

Construction work presents many opportunities to be exposed to a variety of insects. Many these insects may present health and safety hazards. Wasps, bees, spiders, and mosquitoes present the bulk of these hazards.

Bees and wasps present problems to people working outdoors due to being stung and having adverse reactions to the venom injected during the sting. Mosquitoes on the other hand cause hazards by transmitting disease(s) from other infected animals and humans.

It is important to recognize the venomous spiders (spiders dangerous to humans) that are present in your work environment. Inspect boots, clothing and other areas before using/entering, as spiders tend to hide in dark places. Many spiders are nocturnal.

Preventing Exposure

Preventing exposure to insects can be accomplished by the following:

i) Wearing proper clothing and PPE

ii) Inspecting work areas for wasp or bee nests prior to conducting work activities

iii) Awareness of regional insects and their behavioral habits

iv) Shaking out clothing and shoes and inspecting areas for spiders

v) Using repellants

Proper Clothing

While working outdoors it is important to wear proper clothing and PPE. Insects tend to be attracted to bright colors, floral, prints, black, white, green, tan and khaki colors. Also it is important to wear long pants and if possible a long-sleeved shirt. Personnel should tuck the pant bottoms into the tops of boots and use insect proof work gloves (leather, thick cloth, etc).

Repellants

It is important to ensure that there is an adequate supply of insect repellent. Use insect repellent, which contains DEET. Apply it to any exposed skin as per the manufacturer's directions.

Reaction to insect bites can range from mild reactions to severe allergic reactions. In addition, mosquitoes may carry life-threatening diseases such as West Nile virus.

Bee (and Wasp) Stings

Reaction to bee stings may range from painful swelling, redness, itching all the way to shock. Swelling, redness, and itching should stop hurting within a day or two. Treatment for these items can be done at home. The treatment will involve initially removing any stinger left in the skin by scraping away from the skin and towards the venom sac (thus preventing one from squeezing more venom into the wound). Afterwards apply ice and anti-histamine cream. If irritation, swelling and/or pain persist seek medical attention.

If the victim of a bee sting is aware that they are allergic to bees, or if they begin to exhibit signs such as difficulty swallowing, difficulty breathing, abdominal cramps, nausea then they may be going into anaphylactic shock and will require medical treatment.

If personnel know that they are allergic to insects then they will be required to carry their own insect sting kit as directed by their personal physician. The victim must be taken to the hospital immediately.

Mosquito Bites

Mosquito bites can range from mild skin irritation to severe viral infections. One of the most common viruses that mosquitoes carry is the West Nile virus. West Nile virus can cause encephalitis (swelling of the brain) and meningitis (swelling of the spinal cord).

First symptoms are as follows: rapid onset of headaches, dizziness, difficulty swallowing, deep muscle aches, nausea, stiff neck, high-fever, high fever, confusion, muscle weakness. Once any of these symptoms are exhibited seek medical attention.

8.15.4.1 Poisonous Spiders

Black Widow

Black Widow spiders are not usually deadly (especially to adults) and only the female is venomous. The female spider is shiny black, usually with a reddish hourglass shape on the underside of her spherical abdomen. Her body is about 1.5 inches long while the adult male's is approximately half that. The spider's span ranges between 1 to 3 inches. The adult males are harmless, have longer legs, and usually have yellow and red bands and spots over their back, and the young black widows are colored orange and white. The bite of a black widow is often not painful and may go unnoticed. However, the poison injected by the spider's bite can cause severe reactions in certain individuals.

Symptoms

Spider bites can range from mild skin irritation to severe infections and tissue damage depending on the type of spider. New York State has only one spider that is considered dangerous to humans (the black widow). Symptoms that may be experienced include abdominal pain, profuse sweating, swelling of the eyelids, pains to muscles or the soles of the feet, salivation and dry-mouth (alternating), and paralysis of the diaphragm. If a person is bitten, they should seek immediate medical attention. Clean the area of the bite with soap and water. Apply a cool compress to the bite location. Keep effected limb elevated to about heart level. Ask doctor if Tylenol or aspirin can be taken to relieve minor symptoms. Additional information can be obtained from the Poison Center (1-800-222-1222). ***Black widows are found throughout the tropics, U.S. and Canada.***

8.15.5 Threatening Dogs

If you are approached by a frightened or menacing dog:

i) Do not attempt to run and don't turn your back

ii) Stay quiet, and remember to breathe

iii) Be still, with arms at sides or folded over chest with hands in fists

iv) Slowly walk away sideways

v) Don't stare a dog in the eyes, as this will be interpreted as a threat

vi) Avoid eye contact

vii) If you have a jacket, you could wrap it around your arm and should he snap, take the bite harmlessly

viii) Try calling its bluff. Yell, "sit!" "stay!" or "go home!" You might convince the dog that you are the stronger in the situation

8.15.6 Rodents

Rodentia: (rats, mice, beavers, squirrels, guinea pigs, capybaras, coypu)

Rodents, or Rodentia, are the most abundant order of mammals. There are hundreds of species of rats; the most common being the black and brown rat.

The **Brown Rat** has small ears, blunt nose, and short hair. It is approximately 14 to 18 inches long (with tail). They frequently infest garbage/rubbish, slaughterhouses, domestic dwellings, warehouses, shops, super-markets; in fact, anywhere there is an easy meal and potential nesting sites.

The **Black Rat** can be identified by its' tail, which is always longer than the combined length of the head and body. It is also slimmer and more agile than the Norwegian or Brown rat. Its size varies according to its environment and food supply.

The **House Mouse** has the amazing ability to adapt and it now occurs more or less in human dwellings. In buildings, mice will live anywhere and they are very difficult to keep out. Mice are also totally omnivorous; in other words, they will eat anything.

Rats and mice often become a serious problem in cold winter months when they seek food and warmth inside buildings. They may suddenly appear in large numbers when excavation work disturbs their in-ground nesting locations or their food source is changed.

There are six major problems caused by rats and mice:

i) They eat food and contaminate it with urine and excrement

ii) They gnaw into materials such as paper, books, wood, or upholstery, which they use as nest material. They also gnaw plastic, cinder blocks, soft metals such as lead and aluminum, and wiring, which may cause a fire hazard

iii) Rats occasionally bite people and may kill small animals

iv) They, or the parasites they carry (such as fleas, mites, and worms), spread many diseases such as salmonella, trichinosis, rat bite fever, Hantavirus, Weils disease, and the bubonic plague

v) Rats can damage ornamental plants by burrowing among the roots or feeding on new growth or twigs. They also eat some garden vegetables, such as corn and squash

vi) Rats and mice are socially unacceptable. These rodents have been a problem for centuries, chiefly because they have an incredible ability to survive and are so difficult to eliminate. In addition, they are extremely compatible with human behavior and needs

9.0 Air Monitoring Program

This section of the HASP presents the requirements for conducting air monitoring at the Site. The air-monitoring program is designed to ensure protection for personnel working on Site as well as the surrounding community. The on-Site monitoring program will be conducted by the SHO or designee (i.e., Environmental Monitoring Technician) and will consist of monitoring project personnel exposures to VOCs and dust/particulate matter. A Community Air Monitoring Plan will also be conducted at the Site and is presented in Attachment C. The air monitoring program will be completed with the use of real-time direct reading instruments.

Inhalation hazards are caused from the intake of vapors and contaminated dust. Air monitoring shall be performed during ground intrusive activities and during the handling and movement of all soils (both potentially impacted and clean). The purpose of air monitoring is to identify and quantify airborne contaminants in order to determine the level of worker protection needed. Initial screening for identification is often qualitative, but the determination of its concentration (quantification) must wait subsequent testing. Two principle approaches are available for identifying and/or quantifying airborne contaminants:

i) The use of real-time (on-Site) reading instruments (i.e., photoionization detector [PID])

ii) Laboratory analysis of air samples obtained by the use of various sampling equipment and methods

Direct reading instruments may be used to rapidly detect VOCs, and dusts. They are the primary tools of initial site characterization. The information provided by direct reading instruments could be used to institute appropriate measures (i.e., PPE, evacuation), and determine the most appropriate equipment for future monitoring. All direct reading instruments have inherent constraints in their ability to detect hazards. It is imperative that direct reading instruments are operated, and the data interpreted by qualified individuals who are thoroughly familiar with the particular devices, operating principles and limitations. At hazardous waste sites, where unknown and multiple contaminants are the rule rather than the exception, instrument readings should be interpreted conservatively. The following guidelines may facilitate accurate recording and interpretation:

i) Calibrate instruments according to the manufacturer's instruction before and after each use

ii) Develop chemical response curves if the instrument manufacturer does not provide these. Response curves/response factors are necessary to adapt PID action levels to actual PID readings when a specific contaminant of concern is detected via air sampling and/or colorimetric evaluation

iii) Remember that the instrument readings have limited value where contaminants are unknown. When reading unknown contaminants, report them as "needle deflection", or "positive instruments

response", or "units", rather than a specific concentration (i.e., PPM). Conduct additional monitoring at any location where a positive response occurs

iv) A reading of zero should be reported as "no instrument response" rather than "clean" because quantities of the chemicals may be present that are not detectable by the instrument

v) The survey should be repeated with several detection systems to maximize the number of chemicals detected

The data collected throughout the monitoring effort shall be used to determine the appropriate levels of protection.

9.1 Site Air Monitoring

The SHO or designee (i.e., Environmental Monitoring Technician) will perform air monitoring to evaluate the exposure of project personnel to chemical and physical hazards, verify the effectiveness of engineering controls, evaluate the effectiveness of Site control measures, and to determine the proper level of PPE. During the progress of remedial activities, the SHO will monitor the levels of VOCs and particulate levels on an hourly basis or more frequently as necessary based on Site conditions. The following monitoring equipment will be used for this purpose:

i) A PID equipped with an 11.7 or greater eV lamp

ii) A combination oxygen, combustible gas and carbon monoxide instrument (for entering excavations)

iii) A particulate monitor

An EZ perimeter air monitoring program will be implemented. PID and particulate monitoring will be conducted on an hourly basis or more frequently as necessary at the perimeter of the EZ in order to evaluate the effectiveness of Site control measures and verifies the integrity of the Site's clean areas. If necessary, the SHO in conjunction with the SS will adjust the EZ and CRZ boundaries.

In the event that an EZ perimeter air sample identifies readings that are above background conditions then air monitoring readings will also be taken at the Site perimeter. The SHO will evaluate all air sampling results and modify operating conditions on the Site as necessary to ensure all potentially exposed receptors are within safe limits.

All instruments will be calibrated on a daily basis in accordance with the manufacturer's guidelines. Records of all calibrations and real-time measurements will be kept in a bound field logbook or documented via air monitoring and calibration log sheets. All air monitoring data collected by SHO will be filed and made available upon request.

9.1.1 Real-Time VOC Monitoring

The SHO or designee will continuously monitor for the presence of VOCs during the handling of impacted materials and intrusive activities. PID readings will be taken in and around all EZs. In addition, a combination oxygen, combustible gas and carbon monoxide instrument will be used to monitor the air in any excavation prior to and during personnel entry into the excavation. Action levels for upgrading or downgrading of PPE have been established and Table B8.1 presents the action levels for the on-Site Air Monitoring Program.

An action level is a point at which increased protection or cessation of activities is required due to the concentration of contaminants in the work area. Most activities shall be initiated in Modified Level D. The appropriate actions will be taken at designated action levels.

In addition to the action levels, an upgrade to Level C or evacuation of the immediate area is required if:

i) Any symptoms occur

ii) Sustained readings (15 minutes or greater) occur in the worker's breathing zone that are above the applicable action levels

iii) Requested by an individual performing the task

iv) Any irritation to eye, nose, throat, or skin occurs

9.1.2 Particulate Monitoring

The particulate action levels are located in Table B8.1. Dust control measures (water spray, etc.) should be implemented at the Site to control visible dust emissions. All readings should be taken in the worker's breathing zone.

9.1.3 Oxygen, Combustible Gas, and Carbon Monoxide Monitoring

Air monitoring for oxygen, combustible gas, and carbon monoxide will also be conducted during excavation and during other activities where oxygen deficient, elevated carbon monoxide readings, and/or flammable atmospheres may be encountered. The point of excavation and the immediate work area around these activities must be monitored to ensure that an adequate level of oxygen is present, and to determine if a flammable atmosphere exists, especially prior to and during any entry into an excavation. All work activity must stop where monitoring indicates the flammable vapor concentration is 10 percent of the lower explosive limit (LEL) at a location with a potential ignition source. Such an area must be ventilated to reduce the concentration to an acceptable level.

Action levels for combustible gases, oxygen, and carbon monoxide are provided in Table B8.1.

9.1.4 Personal Air Sampling Program

The selected contractor shall implement a personnel air sampling program for those project personnel who have the highest risk of potential for exposure to chemicals present on Site. This monitoring will be done in compliance with 1926.65(h). OSHA has also developed specific standards that deal with employee exposure levels for arsenic (1926.1118), cadmium (1926.1127), and vinyl chloride (1910.1017) that the selected contractor will need to comply with. These chemical compounds may be present in Site soils and groundwater. Samples will be collected during the startup of those project activities where personnel face potential exposure. The SHO and PM will determine if any additional chemicals will be sampled for and the number and frequency of sampling events. Appropriate National Institute of Occupational Safety and Health (NIOSH) methodology will be followed and all samples would be sent to an American Industrial Hygiene Association (AIHA) accredited laboratory. Results for any personnel air sampling event will be provided to all project personnel for review.

10.0 Decontamination Procedures

In general, everything that enters the EZ at this Site must either be decontaminated or properly discarded upon exit from the EZ. All personnel, including any State and local officials must enter and exit the EZ through the CRZ. Prior to demobilization, potentially contaminated equipment will be decontaminated on a wash pad (decontamination pad) which has a built in sump and the equipment will be inspected by the SHO before it is moved into the clean zone. A decontamination facility complete with water supply and sump for collection of wash water will be constructed at the Site. Any material that is generated by decontamination procedures will be collected and stored in a designated area in the EZ until disposal arrangements are made.

The type of decontamination solution to be used is dependent on the type of chemical hazards. The decontamination solution for heavy equipment and for any reusable PPE is Alconox/Liqui-nox soap. The MSDSs for Liqui-nox and any other chemical containing products brought to the Site will be maintained on Site by the SHO.

10.1 Equipment Decontamination Procedures

All equipment that comes in contact with waste material must be decontaminated within the CRZ by high-pressure water cleaner upon exit from the EZ. Decontamination procedures will include knocking soil/mud from machines; water brush scrubbing using a solution of water and Liqui-nox; and a final water rinse. Personnel shall wear Level C or Modified Level D protection, as determined by the SHO, when decontaminating equipment. All decontamination wash water and residues will be carefully collected and disposed of in accordance with the appropriate environmental regulations. Following decontamination and prior to exiting from the EZ, the SHO shall be responsible for ensuring that the item has been sufficiently decontaminated. This inspection shall be included in the Site log.

10.2 Personnel Decontamination Procedures

Procedures for decontamination must be followed to prevent the spread of contamination and to eliminate the potential for chemical exposure. Personnel decontamination will be completed in accordance with the procedures that are presented below. Potentially contaminated PPE and trash will be stored in covered and labeled containers until disposal arrangements are made. It will be kept separate from trash generated in clean areas of the Site.

All disposable equipment shall be doffed before meal breaks and at the conclusion of the workday and replaced with new equipment prior to commencing work. Spent PPE will be kept in covered containers.

Personnel - Decontamination will take place upon exiting the contaminated work area in the CRZ.

Modified Level D decontamination procedures are as follows:

Step 1 - Remove all visible contamination and loose debris by washing with clean water.
Step 2 - Remove all outer clothing that came in contact with the contamination (i.e., boot covers and outer gloves) and either dispose of in disposable container or wash in detergent solution and rinse.
Step 3 - Remove protective clothing; dispose of in disposable container.
Step 4 -Remove inner gloves, dispose of in disposable container.
Step 5 - Wash and rinse hands.

Level C decontamination procedures to be utilized as follows:

Step 1 - Remove all visible contamination and loose debris by washing with clean water.
Step 2 - Remove all outer clothing that came in contact with the contamination (i.e., boot covers and outer gloves) and either dispose of in disposable container or wash in detergent solution and rinse.
Step 3 - Remove protective clothing; dispose of in disposable container.
Step 4 - Remove respirator, sanitize prior to reuse.
Step 5 - Remove inner gloves; dispose of in disposable container.
Step 6 - Wash and rinse hands with soap and water.

11.0 Emergency Response and Contingency Procedures

It is essential that project personnel be prepared in the event of an emergency. Emergencies can take many forms; illnesses or injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in the weather. The following sections outline the general procedures for emergencies.

Emergency information should be posted as appropriate. Radios will be provided for contact purposes. All emergencies will be reported to the appropriate emergency responders. They may give the selected contractor further direction as to the responsibilities during any emergency situation. In general, project

personnel will shut down equipment and evacuate to a safe pre-determined meeting area (rally point) during Site emergencies.

The SHO will contact and meet on-Site with local emergency response agencies (e.g., fire department, police department, etc.) prior to initiating construction activities. The purpose of this meeting is to inform these local authorities of the nature of the work and potential risks, to ensure that these responders are equipped to respond to a Site emergency, and to identify and resolve any potential problems, concerns, or conflicts.

The SHO will be informed of Site hazards and activities prior to project initiation so those emergency situations can be handled most efficiently. A general orientation meeting to discuss emergency response procedures is to be held prior to initiating project activities.

In case of an emergency, an evacuation alarm would sound, which means that all the personnel should evacuate the area and proceed to a rally point for further instruction.

The SHO will notify all project personnel of the emergency through radio/cell phone communications. Radios and cell phones will be taken to the rally point to enable further receipt of instruction(s) from the SHO.

11.1 Accident, Injury and Illness Reporting

Any work-related incident, accident, injury, illness, exposure, or property loss shall be immediately reported to your supervisor, the SHO and the SS. The SS and/or SHO will report the accident details to the CSHM and will submit a completed accident report form to the project engineering firm. A sample Incident Reporting Form is provided in Attachment B. The selected contractor may use their own company-specific form if they so choose. The report must be filed for the following circumstances:

i) Accident, injury, illness, or exposure to project personnel
ii) Injury to any subcontractor personnel
iii) Damage, loss, or theft of property; and/or
iv) Any motor vehicle accident regardless of fault, which involves a company vehicle, rental vehicle, or personal vehicle while the individual is acting in the course of employment

The SHO and PM will investigate occupational accidents resulting in employee injury or illness. This investigation will focus on determining the cause of the accident and modifying future work activities to eliminate the hazard.

All project personnel have the obligation and right to report unsafe work conditions, previously unrecognized safety hazards, or safety violations of others. If you wish to make such a report, it may be

made orally to your supervisor or other member or management, or you may submit your concern in writing, either signed or anonymously.

11.2 Emergency Contacts

Fire Department	911
Police Department	911
Ambulance	911
Hospital: Newark Wayne Community Hospital	315-332-2022

See Figure B11.1 – Hospital Route Map Directions to the Hospital.

Communication between work areas and the command post, located within the CZ, will be via verbal communication, auto horn, or two-way radio. The SHO will use a mobile telephone to communicate with outside emergency and medical facilities.

The following signals shall be established for use with auto or compressed air-type horns:

i) 3 Blasts: evacuate exclusion zones and meet at the designated evacuation area

ii) An "All Clear" will be conveyed by radio communication

11.3 Additional Emergency Numbers

National Response Center (NRC)	800-424-8802
Poison Information	800-764-7661
Utility Locating Commission (One Call Nationwide)	811
Agency for Toxic Substances & Disease Registry (24 Hours)	404-488-4100
U.S. EPA Emergency Response	800-424-8802
State of New York Emergency Response Commission	513-457-9996
Engineering Project Manager (Katherine Galanti)	716-856-2142
NYSDEC Site Representative (Matt Gillette)	585-226-5308
Contractor Corporate Safety and Health Manager	TO BE DETERMINED
Contractor Site Superintendent	TO BE DETERMINED
Contractor Safety and Health Officer	TO BE DETERMINED

11.4 Emergency and First Aid Equipment

Emergency safety equipment will be available for use by project personnel and will be located and maintained on Site. The safety equipment will include, but is not limited to, the following:

i) Portable emergency eye wash and drench shower (pressurized)

ii) Two 20-pound ABC type dry chemical fire extinguishers

iii) Field eye wash/flush bottles

iv) Approved first-aid kit for a minimum of twenty personnel

v) Fire blanket

vi) Spill response kit containing absorbent materials (booms/socks, pads, and earth/clay), overpack drum, shop vacuum, and hand tools (shovel, rake/hoe, etc.)

vii) Two Self Contained Breathing Apparatus (SCBA) units

viii) Portable air horn

11.5 Project Personnel Responsibilities during Emergencies

SAFETY AND HEALTH OFFICER (SHO)

As the administrator of the HASP, the SHO has primary responsibility for responding to and correcting emergency situations. The SHO will:

i) Take appropriate measures to protect personnel including: posting of acceptable Site evacuation routes, withdrawal from the EZ, total evacuation and securing of the Site or upgrading or downgrading the level of protective clothing and respiratory protection

ii) Take appropriate measures to protect the public and the environment including isolating and securing the Site, preventing runoff to surface waters, and ending or controlling the emergency to the extent possible

iii) Ensure that appropriate Federal, State, and local agencies are informed, and emergency response plans are coordinated. In the event of fire or explosion, the local fire department should be summoned immediately. In the event of an air release of toxic materials, the local authorities should be informed in order to assess the need for evacuation. In the event of a spill, sanitary districts and drinking water systems may need to be alerted

iv) Ensure that appropriate decontamination treatment or testing for exposed or injured personnel is obtained

v) Determine the cause of the incident and make recommendations to prevent the reoccurrence

vi) Ensure that all required reports have been prepared

11.6 Medical Emergencies

Any person who becomes ill or injured in the EZ must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed as much as possible without causing further harm to the patient. First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must immediately be reported to the SHO, SS and PM.

Any person transporting an injured/exposed person to a clinic or hospital for treatment should take with them directions to the hospital and a copy of the identified chemicals on Site to which they may have been exposed.

Any vehicle used to transport contaminated personnel, will be cleaned or decontaminated as necessary.

11.7 Fire or Explosion

In the event of a fire or explosion, the local fire department should be summoned immediately. Upon their arrival, the SHO or designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on Site.

If it is safe to do so, Site personnel should:

i) Report to the PM

ii) Use fire fighting equipment available on Site

iii) Remove or isolate flammable or other hazardous materials, which may contribute to the fire

11.8 Spill Control and Countermeasures

If a spill has occurred, the first step is personal safety, then controlling the spread of contamination if possible. Project personnel will immediately contact Site management to inform them of the spill and activate emergency spill procedures.

General Spill Response Procedures

If a spill occurs, the following general procedures will be followed:

i) Notify the SHO, SS and PM

ii) Evacuate immediate area of spill

iii) Determine the needed level of PPE

iv) Don required levels of PPE and prepare to make entry to apply spill containment and control procedures

v) After obtaining the proper spill response tools (shovels, booms and pads, absorbent socks, etc.) and PPE, personnel will attempt to contain the spill so that it does not enter any conveyance (sewer, drainage ditch, etc.) that eventually discharges to surface water

vi) Locate and abate source of spill

vii) Absorb or otherwise clean up the spill and containerize the material, sorbent, and affected soils

viii) Clean and decontaminate the affected area(s)

ix) Replace used/spent spill kit contents

All spill material and debris will be managed in a manner that complies with applicable federal, state, and local environmental rules regarding recycling or disposal of wastes.

The SHO and SS have the authority to commit resources as needed to contain and control released material and to prevent its spread to off-Site areas.

12.0 Recordkeeping

The SHO shall establish and maintain records of all necessary and prudent monitoring activities as described below:

i) Name and job classification of the employees involved on specific tasks

ii) Records of fit testing and medical surveillance results for project personnel

iii) Records of all OSHA and other applicable safety training certifications for project personnel

iv) Records of daily Site safety inspections

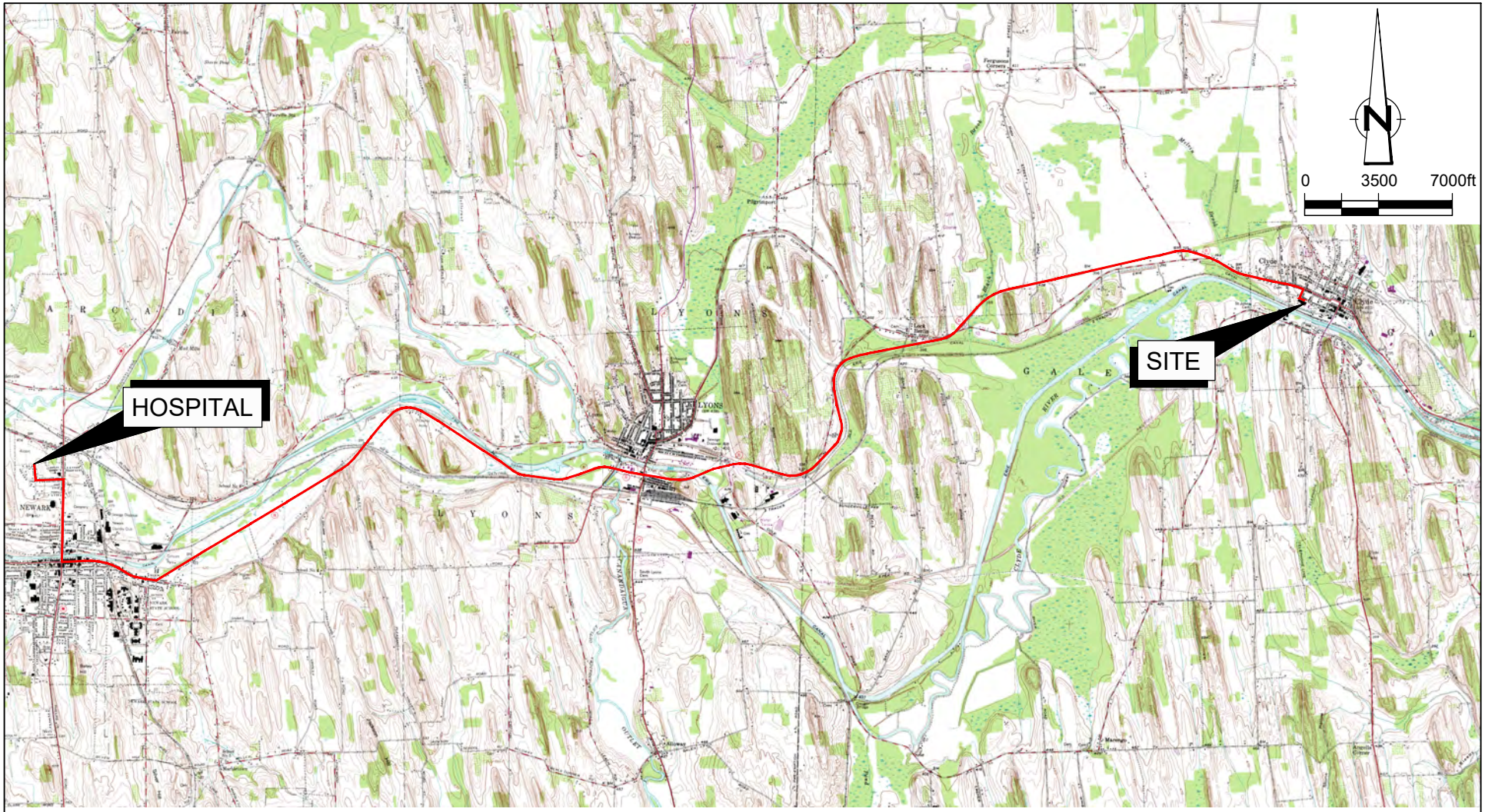
v) Records of training acknowledgment forms and daily safety meetings

vi) Emergency report sheets describing any incidents or accidents

vii) Air monitoring equipment calibrations

viii) Air monitoring data

FIGURES



1. HEAD NORTHWEST ON COLUMBIA ST. TOWARD REESE ST.
2. TAKE THE 1ST RIGHT ONTO REESE ST.
3. TAKE THE 1ST LEFT ONTO NY-31 W/STATE HWY 31 W/ W GENESEE ST. CONTINUE TO FOLLOW NY-31 W/ STATE HWY 31 W
4. TURN RIGHT ONTO N MAIN ST.
5. TURN LEFT ONTO STUERWALD AVE.
6. TAKE THE 1ST RIGHT ONTO DRIVING PARK AVE.
   1200 DRIVING PARK AVE. WILL BE ON THE LEFT

SOURCE:
USGS, USC&GS,TVA, NEW YORK
QUADRANGLE, DATED 1953

figure B11.1

ROUTE TO THE HOSPITAL
OLD ERIE CANAL SITE
Clyde, New York

TABLES

TABLE B2.1

**MAXIMUM DETECTED CONCENTRATION
OF THE CHEMICAL COMPOUNDS OF CONCERN
IN GROUNDWATER, SOILS AND DRAINAGE SWALE SOILS
OLD ERIE CANAL SITE
CLYDE, NEW YORK**

	Compounds	***Maximum Detected Concentrations in Groundwater (ug/L)***	***Maximum Detected Concentrations in Subsurface Soil and Soil in the Drainage Swale (mg/kg)***
VOC's			
	1,1-Dichloroethylene	210	ND
	cis 1,2-Dichloroethylene	240,000	10J
	trans 1,2-Dichloroethylene	478J	ND
	1,1,2-Trichloroethane	6.5J	ND
	2-Butanone	ND	0.15J
	Acetone	ND	.63J
	Benzene	23J	ND
	Chloroform	14	ND
	Ethylbezene	360.0	ND
	Methylene Chloride	1200	0
	Napthlene	30J	ND
	Tetrachloroethene	17.3J	ND
	Toluene	24,900	4.3
	Trichloroethene	580,000J	130J
	Vinyl Chloride	73,200	.56J
	Xylenes (total)	1,600	ND
Semi-Volatiles			
	2-Methylphenol	13	ND
	4-Methylphenol	66	ND
	Benzo(a)anthracene	ND	88J
	Benzo(a)pyrene	ND	97J
	Benzo(b) Fluoranthene	ND	130J
	Benzo(k) Fluoranthene	ND	78J
	Bis(2-ethylhexyl)Phthalate	9J	ND
	Chrysene	ND	100J
	Dibenzo(a, h)anthracene	ND	16J
	Fluoranthene	ND	230J
	indeno (1,2,3 cd) Pyrene	ND	38J
	Phenol	5J	ND
	Phenanthrene	ND	120J
	Pyrene	ND	140J
Metals			
	Antimony	3.6	ND
	Arsenic	ND	113J
	Barium	ND	464J

TABLE B2.1

**MAXIMUM DETECTED CONCENTRATION
OF THE CHEMICAL COMPOUNDS OF CONCERN
IN GROUNDWATER, SOILS AND DRAINAGE SWALE SOILS
OLD ERIE CANAL SITE
CLYDE, NEW YORK**

Compounds	***Maximum Detected Concentrations in Groundwater (ug/L)***	***Maximum Detected Concentrations in Subsurface Soil and Soil in the Drainage Swale (mg/kg)***
Cadmium	ND	85.7J
Chromium	ND	209J
Copper	ND	609J
Iron	59500J	ND
Lead	ND	1,480
Magnesium	110000J	ND
Manganese	3970J	3230J
Mercury	ND	0.889J
Nickel	ND	78.7J
Sodium	568000	ND
Pesticides		
4,4'DDD	ND	0.058
4,4'DDE	ND	0.079
4,4'DDT	ND	0.580

Key
ND - Non Detect
E - Estimated / Above the Calibration Range
J - Estimated Concentration

TABLE B2.2

EXPOSURE ROUTES AND EXPOSURE LEVELS FOR THE CHEMICAL COMPOUNDS OF CONCERN OLD ERIE CANAL SITE CLYDE, NEW YORK

	Chemical Compound	***Ionization Potential***	***Exposure Routes***	***Acceptable Exposure Levels in Air***
Metals				
	Antimony	NA	Inhalation, Ingestion	0.5 mg/m3 (1) (2) 50 mg/m3 (3)
	Arsenic	NA	Inhalation, Ingestion, Human Carcinogen	0.01 mg/m^3 (1) (2) 10 mg/m^3 (3)
	Baruim	NA	Inhalation, Ingestion	0.05 mg/m^3 (1) (2) 50 mg/m^3 (3)
	Cadmium	NA	Inhalation, Ingestion, Suspected Human Carcinogen	0.01 mg/m3 (1) 0.005 mg/m3 (2) 9 mg/m3 (3)
	Chromium	NA	Inhalation, Ingestion	0.5 mg/m^3 (1) (2) 25 mg/m^3 (3)
	Copper	NA	Inhalation, Ingestion	1 mg/m3 (1) (2) 100 mg/m3 (3)
	Iron	NA	Inhalation, Ingestion	5 mg/m3 (1) 10 mg/m3 (2) 2500 mg/m3 (3)
	Lead	NA	Inhalation, Ingestion, Animal Carcinogen	0.05 mg/m^3 (1) (2) 100 mg/m^3 (3)
	Magnesium	NA	Inhalation, Ingestion	NE
	Manganese	NA	Inhalation, Ingestion	0.2 mg/m3 (1) 500 mg/m3 (3)
	Mercury	NA	Inhalation, Ingestion, Skin Absorption	0.025 mg/m3 (1) 10 mg/m3 (3)
	Nickel	NA	Inhalation, Ingestion	1.5 mg/m3 (1) 1 mg/m3 (2) 10 mg/m3 (3)
	Sodium	NA	Inhalation, Ingestion	NE

TABLE B2.2

EXPOSURE ROUTES AND EXPOSURE LEVELS FOR THE CHEMICAL COMPOUNDS OF CONCERN OLD ERIE CANAL SITE CLYDE, NEW YORK

Chemical Compound	*Ionization Potential*	*Exposure Routes*	*Acceptable Exposure Levels in Air*
Semi-Volatiles			
2-Methylphenol	NI	Inhalation, Ingestion Skin Absorption	22 mg/m3 (1) (2)
4-Methylphenol	NI	Inhalation, Ingestion Skin Absorption	22 mg/m3 (1) (2)
Benzo(a)anthracene	NA	Inhalation, Ingestion	NE
Benzo(a)pyrene	NA	Inhalation, Ingestion, Suspected Human Carcinogen	0.2 mg/m^3 (2)
Benzo(b) Fluoranthene	NA	Inhalation, Ingestion	0.2 mg/m3 (2)
Benzo(k) Fluoranthene	NA	Inhalation, Ingestion	NE
Bis(2-ethylhexyl) phthalate	NA	Inhalation, Ingestion	NE
Chrysene	NA	Inhalation, Ingestion, Human Carcinogen	0.2 mg/m3 (1) (2) 80 mg/m3 (3)
Dibenzo(a, h) Anthracene	NA	Inhalation, Ingestion	NE
Fluoranthene	NA	Inhalation, Ingestion	NE
indeno (1,2,3 cd) Pyrene	NA	Inhalation, Ingestion	NE
Phenol	8.69	Inhalation, Ingestion Skin Absorption	19 mg/m3 (1) (2) 250 mg/m3 (3)
Phenanthrene	NA	Inhalation, Ingestion, Suspected Human Carcinogen	NE
Pyrene	NA	Inhalation, Ingestion	NE
VOCs			
1,1-Dichloroethylene	10.8	Inhalation, Ingestion	5 ppm(1)
cis 1,2-Dichloroethylene and trans	9.8	Inhalation, Ingestion,	200 ppm (1) 200 ppm (2) 1000 ppm (3)
1,1,2-Trichloroethane	11	Inhalation, Ingestion	10 ppm(1)

TABLE B2.2

EXPOSURE ROUTES AND EXPOSURE LEVELS FOR THE CHEMICAL COMPOUNDS OF CONCERN OLD ERIE CANAL SITE CLYDE, NEW YORK

Chemical Compound	*Ionization Potential*	*Exposure Routes*	*Acceptable Exposure Levels in Air*
		Skin Absorption	10 ppm(2) 100 ppm(3)
2-Butanone (Methyl Ethyl Ketone)	9.54	Inhalation, Ingestion	200 ppm (1) (2) 3000 ppm (3)
Acetone	9.69	Inhalation, Ingestion	500 ppm (1) 1000 ppm (2) 2500 ppm (3)
Benzene	9.2	Inhalation, Ingestion, Skin Absorption, Human Carcinogen	0.5 ppm (1) 1 ppm (2) 500 ppm (3)
Chloroform	11.37	Inhalation, Ingestion, Skin Absorption, Animal Carcinogen	10 ppm (1) 50 ppm (ceiling) 500 ppm (3)
Ethylbenzene	8.8	Inhalation, Ingestion	100 ppm (1) (2) 800 ppm (3)
Methylene Chloride	11.3	Inhalation, Ingestion, Animal Carcinogen	50 ppm (1) 25 ppm (2) 2300 ppm (3)
Naphthalene	8.12	Inhalation, Ingestion	10 ppm (1) (2) 250 ppm (3)
Tetrachloroethene	9.32	Inhalation, Ingestion,	25 ppm (1) 50 ppm (2) 150 ppm (3)
Toluene	8.8	Inhalation, Ingestion, Skin Absorption	50 ppm (1) 200 ppm (2) 500 ppm (3)
Trichloroethene	9.5	Inhalation, Ingestion	50 ppm (1) 100 ppm (2) 1000 ppm (3)
Vinyl Chloride	9.99	Inhalation, Ingestion,	1 ppm (1) (2)

TABLE B2.2

EXPOSURE ROUTES AND EXPOSURE LEVELS FOR THE CHEMICAL COMPOUNDS OF CONCERN OLD ERIE CANAL SITE CLYDE, NEW YORK

Chemical Compound	*Ionization Potential*	*Exposure Routes*	*Acceptable Exposure Levels in Air*
		Suspected Human Carcinogen	
Xylenes	8.5	Inhalation, Ingestion	100 ppm (1) (2) 900 ppm (3)

Notes:

(1) 2014 Values, American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs).
(2) Federal Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL).
(3) Immediately Dangerous to Life and Health (IDLH).
ppm Parts Per Million.
mg/m^3 Milligrams per Cubic Meter.
NA Not Applicable.
NE Not Established.

TABLE B.8.1

ON-SITE AIR MONITORING PROGRAM ACTION LEVELS
OLD ERIE CANAL SITE
CLYDE, NEW YORK

Monitoring Device	***Action Level***	***Action***
Combustible Gas Indicator	>10 Percent LEL	Cease operations and move to a safe place. Notify CSHO. Do not continue working until conditions are constantly below 10 percent LEL.
Oxygen Meter	<19.5 Percent or >23.5 Percent	Cease operations and move to a safe place. Notify CSHO. Do not continue working until oxygen levels are between 19.5 and 23.5 percent. Note: When oxygen levels are outside this range, percent LEL readings are not reliable.
Photoionization Detector (PID)	**Note: Due to the presence of certain chemical compounds at the Site that have poor warning properties, the action levels are subject to change based on results of air sampling that will be conducted and the potential use of colorimetric tubes.**	
11.7 or greater eV lamp	< 1.0 ppm or Background	Full-Face Respirator Available
	≥ 1.0 ppm and ≤ 50 ppm	Full-face air purifying respirator Level C PPE
	>50 ppm and < 500 ppm	Supplied air respirator Level B PPE. Implement additional engineering controls
	≥ 500 ppm	Shut down activities. Notify CSHO. Implement additional engineering controls
Dust / Particulate - (Impacted Soils) (for worker protection)	< 5.0 mg/m³ (respirable fraction)	Full-Face Respirator Available
	≥ 5.0 mg/m³	Wear Full-Face Respirator - Level C PPE
Carbon Monoxide	>35 ppm	Shut down activities. Notify CSHO. Implement additional engineering controls

Notes:

CSHO	Contractor Safety and Health Officer
LEL	Lower Explosive Limit.
PPE	Personal Protection Equipment.
ppm	Parts Per Million.

ATTACHMENT A

JOB SAFETY ANALYSIS (JSA) FORMS

JOB SAFETY ANALYSIS (JSA)

OVERSIGHT OF CONSTRUCTION ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority (SWA).**

Date Issued/Revised	October 2014	**JSA Type**	Oversight of Construction Activities
Work Type	Construction	**Client**	
Work Activity	Oversight of Construction Activities		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	NA		
Task-specific Training	Safety Introduction/Briefing, 40-HR (initial) and 8-HR Refresher HAZWOPER training, Hazard Communication Training, Personal Protective Equipment, Confined Space Entry, Mobil Equipment Safety Awareness training and Fall Protection training		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☒ Reflective Vest	☐ Goggles	☒ Gloves*	**Supplied Air**	**APR**	
☒ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☒ Lifeline/Harness*	☐ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☒ Other* Personal Fall Arrest Equipment as may be required			☒ Other* Air Monitoring Equipment (LEL/O2 and a PID)	☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Reflective Vest -Class II Air Monitoring Equipment to be provided by the contractor					
Gloves – Leather Lifeline/Harness (Personal Fall Arrest Equipment) – As required by OSHA's Fall Protection Standard					

Development Team	**Position/Title**	**Reviewed By**	**Position/Title**	**Date**

JOB SAFETY ANALYSIS (JSA)

OVERSIGHT OF CONSTRUCTION ACTIVITIES

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
1	• Discuss STAR (Stop Think Act & Review) and Stop Work Authority (SWA)	• Near Loss, Injury, and even Death	• Identify any hazards. Modify the JSA accordingly. Discuss the task and expectations of the task to all personnel. Have all applicable personnel sign off on this JSA prior to starting work. • Project team to discuss the importance of and documentation procedures for SWA during pre-job safety meeting. Use SWA to stop any work that is unsafe.	Site Representative
2	• General inspection of contractor's work activities	• Slip/Trip/Falls • Injury from Heat/Cold Stress or Inclement Weather • Working From Elevated Heights Greater Than 6 Feet • Noise • Biological Hazards • Lifting Heavy Objects • Exposure to Vehicular traffic and Heavy Equipment • Potential Hazards in Excavations including potential falls, being trapped, changing conditions (i.e., water accumulation, changing atmospheric hazards, communication issues etc.) • Failure to identify and remove all hazards including atmospheric hazards, water, electrical, biological and items falling into the confined space from above • Electrical hazards and potential physical injury from exposure to hazardous energy (i.e., hydraulic, pneumatic etc.)	• Walk work area first, especially when view of ground surface is covered. • Keep area free of excess materials and debris. • Remove all travel path hazards by keeping materials/objects organized and out of walkways. • Note and communicate areas of slick or uneven ground. • Take breaks as needed by monitoring the Daily Heat Index, as outlined in the HASP • Consume adequate food/beverages. Personnel should consume at least 8 ounces of cool water or electrolyte replacement drinks every 20-30 minutes. • Observe work-rest schedule to manage heat/cold stresses • When warranted, stay alert for rain, lightning, and high wind hazards, perform work in such weather as outlined in the HASP. • Fall protection is required when working adjacent to work areas are 6 ft. or greater • Do not stand directly next to open excavations > 6-ft. without fall protection • Access ladders must be available to enter into and out of any excavation • Perform pre-entry air monitoring to verify acceptable conditions • Complete and Sign off on the Confined Space Entry Permit when required • Perform continuous air monitoring while the inspector is in any confined space • Remain vigilant and maintain communications between the Attendant and the Entrant • Use a powerful flashlight to provide adequate light • Attendant is not to leave the opening at the Confined Space. • The Attendant will maintain a cell phone and keep it available during the inspection activities. • Keep supplies away from the edge of the opening for any confined space. • Hearing protection required when working within 20' of operating equipment or units, if levels are suspected to be >85 dBA, or for personal comfort. • Determine that object is within weight limit. • Check for contact hazards such as other boxes/objects in the vicinity as well as other people/equipment in the area. Check there is ample room to squat, lift, turn, or maneuver without twisting the back or other muscles or joints. • Check travel path for, and remove, slip hazards such as tools puddles, and debris. • Wear Reflective Safety Vest in areas near moving traffic and operating equipment • Maintain eye contact with equipment operators and do not walk into their path unless the operator motions for you to move. • Review any applicable energy control procedures as necessary. • Perform Lock Out/Tag Out (LOTO) as necessary. • Close/turn off appropriate valves and switches.	Site Representative

(1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.

JOB SAFETY ANALYSIS (JSA)

OVERSIGHT OF CONSTRUCTION ACTIVITIES

(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

JOB SAFETY ANALYSIS (JSA)

Boating Safety

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority (SWA).**

Date Issued/Revised:	October 2014	**JSA Type:**	Boating Safety
Work Type:	Environmental	**Client:**	
Work Activity:	Surface Water Sampling		
Work Site:	The Old Erie Canal Site Clyde, New York		
Key Equipment:	Boat		
Task-specific Training:	Towing and Trailering, Boating Safety and PPE		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☒ Reflective Vest	☐ Goggles	☐ Gloves*	**Supplied Air**	**APR**	
☐ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☐ Safety Glasses	☐ Safety-toed Boots				☐ Acid Gas
☒ Other* CSA approved Life Jacket or PFD			☐ Other*	☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Sunglasses; sunscreen					
Personal Flotation Device					

Project Development Team Name	Position/Title	Modified By	Reviewed By	Position/Title	Date

JOB SAFETY ANALYSIS (JSA)

Boating Safety

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
1	Perform the STAR Process (Stop Think Act Review) and discuss Stop Work Authority (SWA)	• Slips, trips, falls; • Situational risks; • Use STAR;	• Ensure that the project team understands and discusses the STAR process and SWA and the importance of using them • Verify that project personnel have all of the required training. • Provide any additional hands on training as may be necessary • Maintain neutral posture; refer to the HASP for additional lifting information • Take breaks; stay hydrated; be able to recognize the signs of heat stress in yourself and others; wear sunscreen as may be necessary	Technicians
2	Mob equipment to boat launch	• Overloading boat capacity • Inclement weather • Potential to encounter a bull that may be running loose in a farmer's field • Lifting hazards • Manual material handling • Back injury • Pinch points • Moving or flying projectiles inside vehicle while transporting equipment • Slip/trip/fall hazards • Fuel spill • Biological Hazards	• Review boat capacity and complete weight survey including personnel and gear • Monitor weather forecasts • Distribute the load evenly on the boat • Make sure grip is adequate; wear leather/cotton gloves • Heightened awareness of wasps, ants, bees, spiders, and poison plants • Stretch affected muscles (triceps, back, neck, and shoulder) prior to/during/after activity • Avoid repetitive motions and overhead lifts; use proper lifting techniques • Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds then assistance (mechanical or a buddy lift) will be required • Use a two-person lift or mechanical assistance for handling objects in excess of 50 pounds • Ensure all equipment is properly secured during transport • Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position • Avoid one-handed carrying if possible; maintain awareness of footing • Refuel in appropriate location, no sparks or static buildup • Practice STAR • Maintain neutral posture; refer to the HASP for additional lifting information • Take breaks; stay hydrated; be able to recognize the signs of heat stress in yourself and others; wear sunscreen as may be necessary	Technicians
3	Launch boat	• Lifting hazards • Manual material handling • Back injury • Pinch points • Moving or flying projectiles inside vehicle while transporting equipment • Slip/trip/fall hazards • Fuel spill • Drowning	• Practice STAR • Make sure grip is adequate; wear leather/cotton gloves • Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds then assistance (mechanical or a buddy lift) will be required • Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position • Avoid one-handed carrying if possible; maintain awareness of footing • Review JSA for proper fuelling • Wear the PPE that is identified in this JSA along with a PFD • Bring boating safety kit	Technicians
4	Navigate boat to the sampling site	• Causing unnecessary wake • Running aground • Disturbing others • Drowning	• Practice STAR • Wear the PPE that is identified in this JSA along with a PFD • Bring boating safety kit • Remain seated • Keep an eye out for changing weather	Technicians

JOB SAFETY ANALYSIS (JSA)

Boating Safety

5	Perform sampling activities	• Tipping boat • Wet equipment • Drowning	• Remain seated when operating; If the boat tips over, remain with the boat • Keep equipment dry by storing in waterproof storage containers during transport • Be aware of surroundings, verify water depth in shallow waters • Wear the PPE that is identified in this JSA along with a PFD	Technicians

(1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.

(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
CLEARING ACTIVITIES - BULLDOZER

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority (SWA).**

Date Issued/Revised	October 2014	**JSA Type**	Clearing Activities – Bulldozer
Work Type	Construction	**Client**	
Work Activity	Clearing Activities – Bulldozer		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Bulldozer		
Task-specific Training	40 HR and 8 HR HAZWOPER, PPE and Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☒ Reflective Vest	☐ Goggles	☒ Gloves*	**Supplied Air**	**APR**	
☒ Hard Hat	☒ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☒ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☐ Other*			☐ Other*	☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Gloves - Leather					

Reviewed By	Position/Title	Date	Reviewed By	Position/Title	Date

Job Safety Analysis (JSA)
CLEARING ACTIVITIES - BULLDOZER

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
1	Perform the STAR Process (Stop Think Act Review) and discuss Stop Work Authority (SWA) -	• Slips, trips, falls; • Situational risks - use STAR;	• Verify that personnel training is sufficient for scheduled task(s). Is Job Instruction (hands-on) Training necessary?	All Project Personnel
2	Inspect heavy equipment and PPE	• Equipment failure; • PPE failure; • Slip/trip/fall hazards; • Pinch points; • Hot surfaces; • Fuel (fire hazard)	• Don all necessary PPE: o Hearing protection o Hard hat o Safety boots • Training on inspection procedures • Inspect travel path for weather related hazards (i.e., wet, puddles, mud, obstacles); • Use three points of contact; **do not** jump off of equipment; • Equipment must pass inspection prior to operation. If not, remove from service until repaired and report problem(s) to supervisor;	Bulldozer Operator and Laborer
3	Completion of daily inspection report while inspecting machine	• Equipment problems • PPE failure	• Don all necessary PPE • Trained on inspection procedures	Bulldozer Operator
4	Transporting equipment to the work area	• Backing into or running over objects	• Walk around the equipment or use a spotter when necessary	Bulldozer Operator
5	Clearing Activities -Operating equipment after making sure area is cleared of all unnecessary personnel; pulling out stuck equipment	• Cable or shackle breaks (becomes a flying projectile) • Bulldozer becomes stuck • Cuts • Pinched fingers/limbs • Struck by flying objects or falling trees	• Don all necessary PPE • After hooking up cables, let all personnel retreat to a safe area • Inspect cables and shackles before hooking up each time • Use a qualified operator	Bulldozer Operator and Laborer
6	Shutdown and exiting of equipment	• Slip/trip/fall hazards • Situational risks	• Keep the blade on the ground when the machine is not running • Maintain three points of contact when entering or exiting	Bulldozer Operator

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(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

Job Safety Analysis (JSA)

ENHANCED BIODEGRADATION PRODUCT MIXING, STORAGE AND INJECTION ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority (SWA).**

Date Issued/Revised	October 2014	**JSA Type**	Enhanced Biodegradation Product Mixing, Storage and injection Activities
Work Type	Remediation	**Client**	
Work Activity	Enhanced Biodegradation Product Mixing, Storage and injection Activities		
Work Site	The Old Erie Canal Site		
Key Equipment	Hand and Power Tools		
Task-specific Training	40 HR and 8 HR HAZWOPER, PPE, Mobile Equipment Operations, Hearing Conservation and Hazard Communication		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☐ REFLECTIVE VEST*	☒ GOGGLES	☒ APR: Full Face/Particulate Crtdgs*	☒ GLOVES*
☒ HARD HAT	☒ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☒ HEARING PROTECTION*	☒ PPE CLOTHING*	☐ OTHER*
☐ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER*	☐ OTHER* _____

ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below

Reflective Vest - Class II Face Shield – Full Face Shield

Gloves - Leather for moving equipment, Nitrile when handling chemical solution

Development Team	Position/Title	Reviewed By	Position/Title	Date

Job Safety Analysis (JSA)

ENHANCED BIODEGRADATION PRODUCT MIXING, STORAGE AND INJECTION ACTIVITIES

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
1	Discuss STAR (Stop Think Act & Review) and Stop Work Authority (SWA)	• Site personnel not aware of STAR & SWA	• Project team to discuss the importance of and documentation procedures for SWA during pre-job safety meeting. Use SWA to stop any work that is unsafe.	Technicians
2	Storage of dry biodegradation product	• Slip/trip/fall hazard when placing 5-gallon pails of product in temporary storage boxes or other lined storage pads • Lifting hazards • Manual material handling • Back injury • Incompatibility with other chemicals • Release to environment and human exposure	• Inspect work areas before access for obstructions, moisture, and clear pathways • Pick up pails of product and position them for storage • Line storage area with durable plastic sheeting with upturned sides to contain potential releases • Carefully step into plastic lined area, and do not carry pails across threshold without both feet on the plastic and stable • Keep containers of product closed when not in use • Initiate in Level D with leather gloves • Make sure grip is adequate; Use gloves to enhance grip when necessary • Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds then assistance (mechanical or a buddy lift) will be required • Lift no more than one pail of product at a time and keep it close to your body • Carry with two hands in front of you to avoid back stress, or get assistance • Lift pail to carrying position using heavy lifting techniques, keeping back vertical and straight, lifting with leg muscles as opposed to back muscles • Refer to the HASP for additional lifting information • Store in cool, dry, ventilated location away from greases, oils, heat, or ignition sources • Do not store in close proximity to water, acids, organics • Do not store on or near wood, metal salts, peroxides, or reducing agents	Technicians
3	Preparation of solution from dry product and decontamination of equipment, personnel, and soil	• Slip/trip/fall hazard when placing 5-gallon pails of product in temporary storage area • Lifting hazards • Manual material handling • Back injury • Incompatibility with other chemicals • Release to environment and human exposure	• Inspect work areas before access for obstructions, moisture, and clear pathways • Area used for liquid solution preparation must be lined with plastic sheeting to prevent spillage onto soil • Carefully step into plastic lined area, and do not carry pails across threshold without both feet on the plastic and stable • Initiate in Level D with leather gloves • Refer to step 1 and the HASP for additional lifting information • Keep 5-gallon pails of the product tightly closed when not opened for mixing • Do not open containers of product or preparing liquid solution in windy conditions • When opening containers, ensure all personnel within 25 feet of mixing activity are wearing a full face shield or Level C PPE if determined necessary and are ready to work • Open no more than one 5-gallon pail at a time • Wear a full face shield or Level C protection when mixing or adding more product. When handling dry product, wear nitrile gloves,Tyvek® coveralls, and full-face respirator • After being mixed into solution, close container and revert to Modified Level D. • Allow no more than one person in product mixing area if possible.	Technicians

Job Safety Analysis (JSA)

ENHANCED BIODEGRADATION PRODUCT MIXING, STORAGE AND INJECTION ACTIVITIES

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
4	Injection of solution into subsurface	• Pressurized line rupture, spillage • Disconnection drips and associated releases	• All personnel within proximity (50 feet) of pumps, lines, rig, drill-string and probe should wear Modified Level D PPE including a full-face splash shields, polycoated Tyvek® coveralls over boots and nitrile gloves • Depressurize and bleed lines to buckets before depressurizing injection system • Stop injection if excessive pressure (>25 psi) is experienced or releases are evident, or if any other unusual condition is observed • Inspect all fittings and lines from solution batch tank to drill-string probe prior to use	Technicians

(1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.

(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
EQUIPMENT FUELING ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	**JSA Type:**	Equipment Fueling Activities
Work Type	Construction	**Client:**	
Work Activity	Pumping fuel into equipment		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Pickup Truck w/ Fuel Tank and Temporary fuel storage tank w/ secondary containment		
Task-specific Training	HAZCOM, PPE, Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: _____ *	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER*	☐ OTHER*
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest - Class II			

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
EQUIPMENT FUELING ACTIVITIES

JOB STEPS (1)	TASK ACTIVITY	POTENTIAL HAZARD(S) (2)	CORRECTIVE MEASURE(S)(3)	Person Responsible
1	Perform the STAR Process (Stop Think Act Review) and discuss Stop Work Authority (SWA) -	• Slips, trips, falls; • Situational risks - use STAR;	• Verify that personnel training is sufficient for scheduled task(s). Is Job Instruction (hands-on) Training necessary?	Fueling Technician
2	Refer to the equipment manufacturer's operating manual before using any machinery. Place Nozzle in tank	• Property damage and personal injury from fire; • Fire potential from static/ contact spark	• No cell phones allowed on site. No cell phones in fueling areas. No smoking. No fueling during storm events. Determine appropriate area for fueling. Have two 20lb fire extinguishers within 25 feet of the fueling area. Use a bonding wire to establish a connection between the two tanks.	Fueling Technician
3	Turn on pump and dispense fuel into equipment	• Property damage and personal injury from fire; • Fire potential from static/ contact spark; • Personal injury due to skin /eye contact with fuel due to splash/ spills of fuel	• No cell phones allowed on site. No cell phones in fueling areas. No smoking. No fueling during storm events. Determine appropriate area for fueling. Have two 20lb fire extinguishers within 25 feet of the fueling area. Ensure the end of the nozzle is secured in the tank before turning on the pump and dispensing fuel. Wear the proper PPE. Stay upwind when fueling equipment. Remain in attendance of the nozzle at all times during fueling. Avoid overfilling of the equipment. Use a bonding wire to establish a connection between the two tanks.	Fueling Technician
4	Turn off pump and return nozzle to the fuel tank	• Property damage and personal injury from fire; • Fire potential from static/ contact spark; • Slips/ trips/ falls; pinch points	• No cell phones allowed on site. No cell phones in fueling areas. No smoking. No fueling during storm events. Determine appropriate area for fueling. Have two 20lb fire extinguishers within 25 feet of the fueling area. Ensure the end of the nozzle is secured in the tank before turning on the pump and dispensing fuel. Wear the proper PPE. Stay upwind when fueling equipment. Remain in attendance of the nozzle at all times during fueling. Avoid overfilling of the equipment. Pay Attention to surroundings. Pick up tools, equipment, and trash in the fueling area. Pay attention to the surroundings. Wear gloves. Do not rush.	Fueling Technician

(1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.

(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
EXCAVATION ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	**JSA Type:**	Excavation Activities
Work Type	Construction	**Client:**	
Work Activity	Excavation Activities		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Excavator; air monitoring equipment (PID and 4-gas); Excavation Safety Checklist		
Task-specific Training	40 HR and 8 HR HAZWOPER, PPE, Mobile Equipment Operations, Excavation Safety Training; Excavation Competent Person (for supervisors); Heavy Equipment Safety		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: Full-Facepiece*	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* _____	☐ OTHER* _____
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest- Class II Gloves - Leather			
APR –Full-Facepiece equipped with organic vapor and particulate cartridges			

Reviewed By	Position/Title	Date	Reviewed By	Position/Title	Date

Job Safety Analysis (JSA)
EXCAVATION ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process (Stop Think Act Review) and discuss Stop Work Authority (SWA) -	• Slips, trips, falls; • situational risks - use STAR;	• Verify personnel training is sufficient for scheduled task(s). Is Job Instruction (hands-on) Training necessary?	All Affected Personnel
2	Verify Utility Clearance procedures completed (overhead and underground); verify excavation trench layout	• Underground utility strike • Overhead utilities	• Clear all underground utilities • Utility Locate Ticket number on file within 10 days of excavation startup? • Mark work area and safe distances for overhead lines • use spotter as necessary	Site Supervisor Project Manager
3	Setup necessary work area and traffic controls	• Fall-in • Caught-between and struck-by hazards	• Demarcate site and work areas to ensure that personnel and truck/equipment traffic is maintained safely and smoothly • Stockpile and laydown area are setup properly	Site Supervisor Laborers
4	Hand digging and pot holing activities conducted (where/if necessary based on utility locates)	• Underground utility strike	• Use preventive techniques • Maintain proper utility clearances with heavy equipment and use hand digging/pot holing when necessary	Site Supervisor Laborers Operator
5	Heavy equipment operations to excavate and handle soils and spoils	• Caught-between and struck-by hazards • Underground/overhead utilities	• Stay out of swing radius • Use spotters to verify clear route of travel and work area; maintain eye contact with operator and/or signal operator; keep soil 2 feet from edges • Inspect heavy equipment – document inspection • Ensure above utility clearances and safe work protocols are followed	All Affected Personnel
6	Excavation Activities	• Soil cave-in; noise • Struck-by/against • Encountering impacted soils	• Keep proper distances from edge of excavation • Limit equipment operations in trench area • Keep work area free of trip hazards • Perform necessary soil classification • Use hearing protection as necessary • Follow air monitoring protocols • Contact site supervisor if odors and/or discolored soils are encountered	Operator Laborers Site Supervisor
7	Entry into an Excavation	• Soil cave-in • Struck-by/against • Encountering slag • Hazardous atmospheres • Slip/trip/fall hazards • Emergency egress	• Keep proper distances from edge of excavation • Limit equipment operations in trench area • Keep work area free of trip hazards • Perform necessary soil classification • Use daily inspection form to document/meet competent person inspection requirements • Inspect trench after any change in conditions (rain, equipment vibrations, etc.) • Utilize trench box properly; ensure that tabulated data sheet is on site (as required) • Use 4-gas monitor and PID to screen excavation air prior to and during entry • Ladder safety and proper slope of ladder • If necessary based on air monitoring and/or other site conditions use harness and lifeline when entering trenches over 5 feet deep	Site Supervisor Operators Laborers

(1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.

Job Safety Analysis (JSA)
EXCAVATION ACTIVITIES

(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
EXCAVATOR OPERATION ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	**JSA Type**	Loading Soil and/or Waste Material
Work Type	Construction	**Client**	
Work Activity	Excavator Operation Activities		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Excavator		
Task-specific Training	40 HR and 8 HR HAZWOPER, PPE, Mobile Equipment Operations, Excavation Safety Training; Heavy Equipment Safety		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: Full Facepiece*	☒ GLOVES*
☒ HARD HAT	☒ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☒ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER*	☐ OTHER* _____
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest - Class II Gloves - Leather			

Reviewed By	Position/Title	Date	Reviewed By	Position/Title	Date

Job Safety Analysis (JSA)
EXCAVATOR OPERATION ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process (Stop Think Act Review) and discuss Stop Work Authority (SWA) -	• Slips, trips, falls; • Situational risks - use STAR;	• Verify personnel training is sufficient for scheduled task(s). Is Job Instruction (hands-on) Training necessary?	Site Supervisor on all
2	Inspect equipment	• Equipment malfunction or damage • Hydraulic fluid, fuel, oil leaks/spills • Loss of steering, loss of brakes, etc.; accidents, decreased visibility • Fire • Slip/trip/fall hazards • Unexpected operation of equipment • Swing radius signage missing	• Follow Equipment Inspection Form/Tag Out if malfunction found • Grease moving parts • Check all fluids • Ensure that fluids are not too low or too full • Walk around equipment and look for leaking fluids • Ensure that tracks are acceptable (no unacceptable wear and no objects present) • Ensure that windows and mirrors are clean. Adjust mirrors! • Remove trash or other debris from cab • Ensure that back up alarm and horn are operational • Correct any problems immediately and inform supervisor • If equipment appears as though it has been tampered with or vandalized, do not start it • Ensure that fire extinguisher is in place and functioning • Inspect the fire extinguisher monthly • Use three point mount/dismount at all times • Be cautious of where you step and be aware of your surroundings • Ensure that ignition key is in your pocket, equipment is in neutral and parking brake is engaged • Use interlock safety mechanism any time equipment is not conducting a productive and/or controlled activity	Site Supervisor and Operator
3	Entering equipment	• Reduced visibility • Uncomfortable seating - back strain • Debris on floor getting stuck under pedals • Unexpected movement of excavator	• Adjust seat and mirrors so that you are able to see where traveling • Adjust controls and seat to your comfort and safety • Ensure that all materials inside cab are secured • Be cautious of where you step and be aware of your surroundings • Ensure steps are clear of water, mud, and other debris • Ensure parking brake is engaged and gear is in neutral • Use interlock safety mechanism any time equipment is not conducting a productive and/or controlled activity	Site Supervisor and Operator
4	Configure controls and seating	• Ergonomics/unnecessary physical stress/ back injury • Incapable of reaching controls • Visual blocks	• Upon sitting, adjust seat fully to accommodate reach and comfort zone • Fasten seat belt • Make certain all controls are set in neutral positions • Adjust mirrors	Site Supervisor and Operator
5	Starting and warming up	• Unanticipated rolling or movement, engine fire, or mechanical/electrical faults	• Review operator's manual if new to this particular machine • Start engine and check controls to ensure all are in working conditions • Allow a minimum of 2 minutes to warm up	Site Supervisor and Operator

Job Safety Analysis (JSA)
EXCAVATOR OPERATION ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
6	Moving equipment work area	• Other equipment, personnel, or objects in work area • Uneven terrain	• Perform STAR – be aware of surroundings • Know the daily task and other people and equipment in the area • Make eye contact with other operators and site personnel in the immediate vicinity • Inspect pathway prior to moving equipment to ensure clear pathway	Site Supervisor and Operator
7	Performing tasks	• Other equipment (collision) • Slopes, ground conditions possible injuries to personnel and equipment, buried obstacles, underground and overhead utilities • Dust	• Perform STAR • Know where utilities are located – know where your bucket is in relation to any underground utilities at all times • Be aware of the scope of work to be performed • Use a spotter • Know the paths of other equipment or persons entering and leaving your work area • Communicate with supervisors and other operators throughout the day with any questions • Stop work immediately and contact a supervisor if you are uncertain of your task, experience equipment failure, or personal injury or near loss • Wear dust mask if conditions warrant	Site Supervisor and Operator
8	Stopping at end of day	• Slip/trip/fall hazards • Overnight parking of equipment	• Be cautious of where you step and be aware of your surroundings • Park in designated area • Set brake/control locks • Idle for 2 minutes if engine is hot • Lower bucket to ground – zero energy state • Turn equipment off; remove keys • Use three-point dismount • Secure inside equipment (i.e., fire extinguisher)	Site Supervisor and Operator

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(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
HEAVY EQUIPMENT DECONTAMINATION – PRESSURE STEAM HEAT

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. Project personnel have the authority and responsibility to use **Stop Work Authority (SWA).**

Date Issued/Revised	October 2014	**JSA Type**	Heavy Equipment Decontamination – Pressure Steam Heat
Work Type	Construction	**Client**	
Work Activity	Heavy Equipment Decontamination – Pressure Steam Heat		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Steam Cleaner, brushes Liquinox		
Task-specific Training	40 HR and 8 HR HAZWOPER, PPE, Mobile Equipment Operations and Hazard Communication		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☐ Reflective Vest	☐ Goggles	☒ Gloves*	**Supplied Air**	**APR**	
☒ Hard Hat	☒ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☒ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☒ Other*			☐ Other*	☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Splash shield, poly coated Tyvek®, rubber neoprene gloves					
Gloves – Outer Nitrile Gloves					

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
HEAVY EQUIPMENT DECONTAMINATION – PRESSURE STEAM HEAT

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
1	Discuss STAR and SWA	• Site personnel not aware of STAR and SWA • Property damage • Personal injury • Cross contamination	• Project team to discusses importance of and documentation procedures for SWA during pre-job safety meeting • Use SWA if unsafe conditions exist • Discuss all potential hazards based on location, utilities, terrain, and waste water disposal	Site Supervisor All personnel involved with the Task.
2	Review manufacturer's Operation and Maintenance Manual (prior to initial operations of pressure washer)	• Improper inspection procedures • Lack of recognition/ knowledge of specific manufactured model • High pressure (>2,000 psi)	• Review manufacturer's Operation and Maintenance Manual • Utilize the STAR process and discuss with site supervisor on the operations of the equipment • Make sure rental company provides a copy of the manual or have them illustrate proper operating procedures including daily checks • Important: Read manufacturer's warning labels on the pressure unit itself for step by step operations (DOs and DON'Ts)	Site Supervisor Operator
3	Inspect equipment	• Equipment malfunction • Leaks • Missing/broken components • Personal injury • Property damage • Spills	• Complete a daily equipment checklist – Report all NR (Needs Repair) or items in question to your site supervisor – Do not use until repairs/parts have been completed • Thoroughly check hose, hose fitting, pressure wand, o-rings, leaks, pressure tips, engine oil, fuel type, etc. • Reference Manufacturer's Operation and Maintenance Manual for **specific** daily checks • Wear hand protection • Review site JSA on Fueling Operations • Avoid overfilling and immediately clean up spills using absorbent pads, towels and shovel or combination of all three and dispose of properly • Review Haz. Com. (MSDS) on type of fuel used in unit (i.e., Flammable, Combustible and Health risks). • Use an approved OSHA safety can (red or yellow) for dispensing needs; remove can from service if severely dented, missing, or broken components; tag out of service immediately • Keep gasoline can away from any heat sources; place in OSHA- approved storage cabinet or in a fenced-off secondary spill containment area with signage and labeled	Operator

Job Safety Analysis (JSA)
HEAVY EQUIPMENT DECONTAMINATION – PRESSURE STEAM HEAT

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
4	Mobilize washer into position	• Slip/trip/fall hazards • Back strain • Property damage • Unsecured • Uneven terrain • Heavy lifting	• Get assistance (buddy system) when moving washer either physically or means of powered equipment • Use proper lifting techniques; keep back straight and knees slightly bent when placing unit into the decon area • Keep hose(s) and wand securely on unit • Place washer on solid, level ground • Determine your route of travel to work area; avoid uneven ground, slopes, and inclines • Secure washer if transporting by truck, trailer, or loader using nylon ratchet straps; DO NOT use chains or bungee cords • Determine best place to position washer to account for length of hose to reach all points of washing	Operator & Spotter
4	Connect water source to pressure washer	• Splashing • Slip hazard • Pinch points • Improper fittings • Water pressure • Property damage • Personal injury • Electrical - electrocution	• Don appropriate PPE (polycoated Tyveks®, rubber gloves, rubber overboots, splash shield, hard hat, hearing protection, etc.) • Check water hose condition and connections • Install one end of hose to unit first and then to water source • Slowly release water into pressure washer unit; avoid excessive splashing and don't leave unit unattended • Keep hands and fingers clear of pinch points • Minimize water pooling; tighten connections as necessary to avoid slip hazards • Keep water away from electrical panels, outlets, and power cords	Operator
5	Operate pressure washer In this Order: 1. Select proper wash tip 2. Start the washer unit 3. Move into position 4. Hold pressure wand and handle firmly with both hands 5. Point wand in area to begin wash *6.* Pull trigger and begin washing	• High pressure (>2,000 psi) • Infections - bacteria • Eye, hand, foot Injury • Flying debris • Slip/trip hazards • Hose whipping • Kink in hose • Equipment malfunction • Property damage • Hand and wrist fatigue/numb • Noise • Poor visibility • Windy conditions • Clogged pressure tips • Poor communications • Steam burns	• Wear splash shield and hearing protection! • Determine wind direction and place back to the wind to avoid over spray of water back into the operator's face • Install proper washing tip on the end of wand; turn unit off, relieve pressure from unit, and let it cool down before changing tips • Keep both hands on the wand at all times to avoid excessive fatigue and numbness in hand and wrists • Keep hands off metal section of wand to avoid a burn to the hand • Do not point the spray towards others, ground, or hose • Position your body off to one side during washing to prevent deflection of material debris back in your direction; keep a safe distance between surface to be washed and the spray • Keep hoses free and clear to avoid trips; be aware of your surroundings • Keep face shield clear as best as you can; stop washing and wipe off as needed • Never unclog a tip while the unit is running; shut off unit, depressurize hose and wand, then remove tip for cleaning • Keep hands, feet, and eyes out of the "line of fire" of the spray – High pressure can cut through gloves, boots, and severely and cause bodily injury; infections can occur if cut into the skin • DO NOT use steam washer to remove debris from clothing (PPE) or any parts of the body!	Operator

Job Safety Analysis (JSA)
HEAVY EQUIPMENT DECONTAMINATION – PRESSURE STEAM HEAT

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
6	End of task 1. Relieve pressure 2. Turn off water supply to unit and disconnect 3. Shut off pressure washer 4. Allow to cool down 5. Storage	• Burns (muffler) • Hose damage • Equipment damage • Theft • Slips • Back strain	• Doff PPE and dispose of properly • Relieve pressure on hose and drain the water from hose and unit • Avoid placing hands on muffler section of washer unit; allow unit to cool down before handling and or filling with gasoline • Drain hose and wrap up to unit; inspect hose for excessive wear or blistering • During cold temperatures, winterize unit using environmentally safe anti-freeze • Secure unit inside connex trailer or use chain and padlock to prevent theft • Check unit over and make sure all components (tips, wand, hose) are in good condition • Turn gasoline valve to off/close when not in use or in storage • Use proper lifting techniques when moving unit and get assistance (buddy system)	Operator and Spotter
7	Collect a wipe sample (if necessary)	• Cross contamination • Liability	• Confirm with site supervisor if a wipe sample is needed prior to demobilization of equipment from the site	Project Manager and Site Supervisor

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(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
HEAVY EQUIPMENT OPERATION DOZER/LOADER

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	**JSA Type**	Construction
Work Type	Construction	**Client**	
Work Activity	Heavy Equipment Operation: Dozer / Loader		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Dozer and or Loader		
Task-specific Training	40 HR and 8 HR HAZWOPER, Heavy equipment operation; Mobile Equipment Operations, HAZCOM, PPE		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: Full-Facepiece*	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☒ HEARING PROTECTION*	☐ PPE CLOTHING*	☒ OTHER* Fire Extinguisher
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER*	☐ OTHER* _____
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Gloves - Leather Hearing Protection - NNR 20 Reflective Vest - Class 2			

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
HEAVY EQUIPMENT OPERATION DOZER/LOADER

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA) Perform Review "General Site Activities" JSA.	• Failing to identify hazardous conditions resulting in losses or near losses.	• Perform the STAR Process STAR. • Assess the risks and verify personnel training is sufficient for scheduled task(s). • Determine the hazards of performing the task and survey the work area. • Consider weather conditions such as fog that could reduce visibility. • Always consider the worst case scenario. • Analyze the hazards determined. • Decide a plan of action to eliminate or reduce the hazards and act on it.	Construction Superintendent and Operator
2	Inspect Equipment	• Equipment malfunction or damage. • Hydraulic fluid, fuel, oil leaks/spills • Loss of steering, loss of brakes, etc. – accidents decreased visibility. • Fire. • Slips, trips, falls. • Unexpected operation of equipment.	• Follow equipment inspection form/tag out if malfunction found. • Grease moving parts. • Check all fluids. • Ensure that fluids are not too low or too full. • Walk around equipment and look for leaking fluids. • Ensure that dozer tracks are acceptable (no unacceptable wear and no objects present). Check loader tires • Ensure that windows and mirrors are clean. • Remove trash or other debris from cab. • Ensure that back up alarm and horn are operational. • Correct any problems immediately and inform supervisor. • If equipment appears as though it has been tampered with or vandalized, do not start it • Ensure that fire extinguisher is in place and functioning. • Inspect the fire extinguisher monthly. • Use three point mount/dismount at all times. • Be cautious of where you step and be aware of your surroundings. • Ensure that ignition key is in your pocket, equipment is in neutral and parking brake is engaged.	Construction Superintendent and Operator
3	Entering Equipment	• Reduced visibility, uncomfortable seating-back strain. • Debris on floor getting stuck under pedals. • Unexpected movement of truck. • Unexpected movement of truck.	• Adjust seat and mirrors so that you are able to see where traveling. • Adjust controls and seat to your comfort and safety. • Ensure that all materials inside cab are secured. • Be cautious of where you step and be aware of your surroundings. • Ensure steps are clear of water, mud and other debris • Ensure parking brake is engaged and gear is in neutral.	Construction Superintendent and Operator
4	Configure controls and seating.	• Ergonomics / unnecessary physical stress. • Incapable of reaching controls. • Visual blocks.	• Upon sitting, adjust seat fully to accommodate reach and comfort zone. • Fasten seat belt • Make certain all controls are set in neutral positions. • Adjust mirrors.	Construction Superintendent and Operator

Job Safety Analysis (JSA)
HEAVY EQUIPMENT OPERATION DOZER/LOADER

JOB STEPS (1)	TASK ACTIVITY	POTENTIAL HAZARD(S) (2)	CORRECTIVE MEASURE(S)(3)	Person Responsible
5	Starting and warming up.	• Unanticipated rolling or movement, • engine fire, or mechanical/electrical faults	• Review operator's manual if new to this particular machine. • Start engine and check controls to ensure all are in working conditions. • Allow a minimum of two minutes to warm up.	Construction Superintendent and Operator
6	Moving equipment work area.	• Other equipment, personnel, or objects in work area. • Uneven terrain.	• Perform the STAR Process. • Know the daily task and other people and equipment in the area. • Make eye contact with other operators and site personnel in the immediate vicinity. • Inspect pathway prior to moving equipment to ensure clear pathway.	Construction Superintendent and Operator
7	Performing tasks.	• Other equipment (collision), • slopes, ground conditions • possible injuries to personnel and equipment, • buried obstacles, underground and overhead utilities. • Organic Vapors/Dust.	• Perform the STAR Process • Know where utilities are located. Be aware of the scope of work to be performed. • Know the paths of other equipment or persons entering and leaving your work area. • Communicate with supervisors and other operators throughout the day with any questions. • Stop work immediately and contact a supervisor if you are uncertain of your task, experience equipment failure, or personal injury or near loss. • Wear respirator if conditions warrant.	Construction Superintendent and Operator
8	Stopping at end of day.	• Slips, trips and falls. • Overnight parking of equipment.	• Be cautious of where you step and be aware of your surroundings. • Park in designated area. • Set brake/control locks. • Idle for two minutes if engine is hot. • Lower blade or bucket to ground. • Turn equipment off. • Use 3-point dismount. • Secure inside instruments (i.e., fire extinguisher).	Construction Superintendent and Operator

(1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.

(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
MATERIAL HANDLING ACTIVITIES – RIGGING AND PLACEMENT OF MATERIALS

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	**JSA Type**	Material Handling Activities
Work Type	Construction	**Client**	
Work Activity	Rigging and Placement of Materials		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Excavator, Backhoe, or Crane		
Task-specific Training	Rigging; lifting signals; heavy equipment safety; use of taglines; proper use of load charts; 40 HR and 8 HR HAZWOPER, HAZCOM, PPE, Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: _____ *	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER* _____
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* _____	☐ OTHER* _____

ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below

Reflective Vest - Class II

Gloves - Leather

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
MATERIAL HANDLING ACTIVITIES – RIGGING AND PLACEMENT OF MATERIALS

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA) Equipment Inspection	• Hydraulic failure	• Inspect equipment lines and fluid reservoirs	Operator
2	Rigging components – Inspection of load and rigging	• Attachment point failure	• Inspect attachment hook/ring for fractures, dents or abuse. • Certify load capability of attachment point.	Operator, Qualified Rigger and all field personnel involved in the operation
3	Rigging components – Continue inspection of load, rigging, and material to be lifted	• Rigging assembly failure	• Inspect rigging chains, wire rope, cables, hooks, slings, d-rings, splitters, spreaders and all other components for unusual shape, fractures, fraying, dents, abuse or abnormalities. • Insure components used have annual certification, proper load rating and are implemented as recommended by training and the manufacturer.	Operator, Labor and all field personnel involved in operation.
4	Rigging components	• Improper component attachment, lifting point usage, incorrect balance or component orientation	• Use the manufacturer's recommended lifting attachment points, slots or cable points to secure load to be rigged. • Use proper rigging components to assure load is evenly distributed, proper balance is achieved and place hoisting equipment and rigged components in proper orientation to assure placement logistics are correct.	Operator, Labor and all field personnel involved in operation.
5	Tag lines – Proper placement of taglines to ensure control of load. No one is to work under a suspended load	• Lift control failure	• Use of tag lines, as a lifting control measure is mandatory as appropriate for correct placement of rigged component. • Personnel assisting rigging or lift should never physically be in contact with rigged or lifted components as a measure of component control.	Operator, Labor and all field personnel involved in operation.
6	Pre-plan the lift and prepare the landing zone	• Objects/personnel in swing radius path; • Lifting outside of equipment's load safe load radius	• Pre-plan the lift to ensure swing radius does not impact other operations. • Ensure that load and load path stays within load radius of lifting equipment.	Rigger, And Operator
7	Component placement – Pick the load and place the item in the correct position.	• Improper preparation of location receiving rigged or lifted component resulting in need for multiple lifts.	• Preparation of the area receiving the rigged or lifted component to avoid and necessary re-lift or multiple lifts.	Operator, Labor and all field personnel involved in operation.
8	Maintain Control of Area	• Unauthorized personnel or equipment in rigging or lifting exclusion zone	• Area marking and clearance of all personnel and equipment to prevent interference during rigging or lifting activities. • Spotter action to terminate rigging or lifting if situational changes occur putting personnel or equipment at risk.	Operator, Labor and all field personnel involved in operation.
9	Control of communication between task personnel	• Multiple signals interfering with operator	• During lifting or rigging activities, a communication order must be established previous to any attempt to hoist load. • Spotters communicate to one load controller; load controller communicates to operator. • Operator must maintain visual contact with load controller at all times. • All operations are controlled by ground controller.	Operator, Labor and all field personnel involved in operation.
10	Trench entry in order to place materials and piping – see JSA for Excavation Activities	• Excavation Hazards (review of that JSA)	• Follow JSA for Excavation.	All Affected Personnel

Job Safety Analysis (JSA)
MATERIAL HANDLING ACTIVITIES – RIGGING AND PLACEMENT OF MATERIALS

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(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
MOBILE EQUIPMENT OPERATION ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	**JSA Type:**	Mobile Equipment Operation Activities
Work Type	Construction	**Client:**	
Work Activity	Mobile Equipment Operation Activities		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Excavator; Dozer, Loader, Skidsteer, Compactor, Grader, Off-road Dump Truck, Pickup Trucks		
Task-specific Training	40 HR and 8 HR HAZWOPER, PPE and Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: _with organic vapor and P-100 cartridges for stabilization activities_*	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER*	☐ OTHER* _____
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest- Class II Gloves – Outer Leather			

Reviewed By	Position/Title	Date	Reviewed By	Position/Title	Date

Job Safety Analysis (JSA)
MOBILE EQUIPMENT OPERATION ACTIVITIES

JOB STEPS (1)	TASK ACTIVITY	POTENTIAL HAZARD(S) (2)	CORRECTIVE MEASURE(S)(3)	Person Responsible
1	Perform the STAR Process (Stop Think Act Review) and discuss Stop Work Authority (SWA) -	• Slips, trips, falls; • Situational risks	• Verify that personnel training is sufficient for scheduled task(s). Is Job Instruction (hands-on) Training necessary?	Operator
2	Perform daily (pre-shift) equipment inspection include area around the equipment and PPE and perform a complete walk around inspection	• Equipment failure • PPE failure	• Don all necessary PPE • Provide training to personnel on inspection procedures • Document daily inspection • Defects must be corrected before operating unit	Operator
3	Mount/dismount the equipment	• Slip/trip/fall hazards • Sprains/Strains • Potential injury	• Use three points of contact • Never jump from the machine • Clear tracks and personnel access points of debris and mud as necessary • Only a trained operator will be allowed on equipment • Never carry riders unless unit is so designed	Operator
4	Starting heavy/mobile equipment	• Struck-by • Caught between • Equipment failure	• Perform inspection (see Task 2) • Check to be certain all workers and equipment are a safe distance from unit • All operators manuals should be available for each piece of equipment and used in employee training • Allow proper warm-up and wait for gauges to register properly • Raise the blade, cable and chokers, boom, grapple, or other attachments before moving the unit	Operator
5	Operation of heavy/mobile equipment	• Struck-by/Caught In • Overhead/underground utilities • Flying debris • Rollover • Fire • Broken and/or frayed cables	• Appropriate guarding (according to machine type and use) shall be in place at all times unit is in operation • Backup alarms shall be functional • Seat belts shall be provided and their use enforced • Fire extinguishers and first aid kits shall be provided on each unit • Fire extinguishers shall be inspected for functionality on a daily basis • Do not operate equipment unless you have been trained to safely operate the equipment	Operator
6	Perform equipment maintenance	• Equipment failure/loss • Sharp objects • Pinch points	• Use STAR process • Follow equipment manufacturer's preventive maintenance procedures and instructions • Only qualified individuals should perform maintenance activities on equipment	Operator
7	Cleaning and housekeeping of equipment	• Fire • Slip/trip/fall hazards • Equipment failure	• Remove loose items and all trash from the operator's compartment • Clean equipment as necessary to prevent buildup of debris that may cause fire	Operator

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(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
MOBILIZATION AND DEMOBILIZATION ACTIVITIES

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Date Issued/Revised	October 2014	**JSA Type**	Mobilization and Demobilization Activities
Work Type	Construction	**Client**	
Work Activity	Mobilization of Equipment and Supplies to and from the job site		
Work Site	The Old Erie Canal Site, New York		
Key Equipment	Pickup trucks and trailers		
Task-specific Training	PPE, HAZCOM, Motor Vehicle Safety, Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: _____ *	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER* _____
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* _____	☐ OTHER* _____
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective Vest - Class II			
Gloves - Leather			

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
MOBILIZATION AND DEMOBILIZATION ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Discuss STAR (Stop Think Assess & Review) and Stop Work Authority (SWA)	• Site personnel not aware of STAR & SWA	• Project team to discuss the importance of and documentation procedures for SWA during pre-job safety meeting. Use SWA to stop any work that is unsafe.	Personnel Taking Part in this Activity
2	Check weather	• Unexpected storm; Fog; Rain; Snow; Lightening/Thunder; • Heat/Cold stress	• Check local weather forecast. • Discuss weather issues and precautions to take while driving and on-site during the pre-job safety meeting. If weather conditions (e.g., fog, rain, snow, etc.) impair the ability/vision of the driver, exit at nearest safe location and assess the situation. • While on-site, at first sign of lightening/thunder utilize SWA and assess weather conditions. In extreme temperatures, ensure all personnel have proper clothing, hydration, and heat/cold protection (e.g., canopy, fan, and glove warmers).	Personnel Taking Part in this Activity
3	Load equipment into vehicle	• Back strain; • Cuts; • Pinch points; • Hand/Foot injury; • Forgotten equipment; • Damaged equipment	• Use proper lifting techniques and buddy system if needed. • Wear leather/cotton gloves and avoid placing hands/fingers in pinch point locations. Wear steel toe boots. • Verify requested equipment against warehouse form. • Load equipment in an organized manner to prevent shifting during transport or use cargo netting.	Personnel Taking Part in this Activity
4	Complete Daily Operator Vehicle Checklist	• Damaged vehicle lights, tires, windows, mirrors, horn; Inadequate vehicle documents and/or safety items	• Check for fluid leaks under vehicle. • Test operation of headlights, front/rear turn signals, backup lights, brake lights, and emergency flashers. Visually check the pressure/wear of tires. Ensure the vehicle has a spare tire. Assure windshield and window glass is clean and free from obstructions. Test the windshield wipers and horn. Verify vehicle registration, insurance card, and inspection sticker is present and valid. • Ensure the vehicle contains a first aid kit, fire extinguisher, and road hazard kit.	Personnel Taking Part in this Activity
5	Check and adjust seat, steering wheel, headrest, and mirrors	• Back/body strain; • Blind spots; impaired vision.	• Adjust seat, headrest, and steering wheel height so body is fully supported/comfortable and pedals are within easy reach. Ensure mirrors are properly adjusted.	Personnel Taking Part in this Activity
6	Fasten seat belt(s) and ensure passenger(s) seat belts are fastened	• Serious injury, ejection, or death from collision and/or traffic citation	• Verify driver and passenger(s) seat belts are in good condition and properly latched.	Personnel Taking Part in this Activity
7	Ensure vehicle doors are locked	• Serious injury, ejection, or death from collision; • Unwanted intrusion; Lost equipment	• Manually lock all doors to vehicle.	Personnel Taking Part in this Activity
8	Start engine and check gauges and warning lights	• Vehicle breakdown	• Verify sufficient fuel and other hazard lamps (e.g., battery, oil, and temperature) are not lit.	Personnel Taking Part in this Activity

Job Safety Analysis (JSA)
MOBILIZATION AND DEMOBILIZATION ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
9	Mobilize to site	• Arriving late; • Collision; • Injury or Death to occupants or other parties	• Do not use cell phones or perform other distracting activities while vehicle is in motion. • Constantly scan intersections, move eyes, check mirrors, and assess traffic lights (fresh vs. stale). • Maintain safety cushion around vehicle (front, sides, and rear) and 4 second following distance. • Utilize all driving defensive techniques.	Personnel Taking Part in this Activity
10	Arrive at site	• Pedestrian injury; • Collision	• Maintain awareness of pedestrian/vehicular traffic when entering site and traveling to work zone.	Personnel Taking Part in this Activity
11	Park vehicle	• Pedestrian injury; • Collision; • Property damage	• Maintain awareness of pedestrian/vehicular traffic. • Park vehicle in pull-through parking space or facing the exit. • Use caution and mirrors/spotter when backing vehicle.	Personnel Taking Part in this Activity
12	Demobilization	• Collision; • Injury or Death to occupants or other parties	• Perform perimeter vehicle check. • Maintain awareness of pedestrian/vehicular traffic when exiting site. • Utilize defensive driving techniques. • Complete post-departure checklist and report vehicle problems to company vehicle maintenance manager or rental car agency.	Personnel Taking Part in this Activity

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(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

JOB SAFETY ANALYSIS

OVERSIGHT OF DRILLING ACTIVITIES AND WELL INSTALLATIONS

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	**JSA Type**	Oversight of Drilling Activities and Well Installation
Work Type	Field Construction	**Client**	
Work Activity	Oversight of Drilling Activities and Well Installation		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Safety cones/fencing/barricades;		
Task-specific Training	PPE, Drilling Safety and Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: _____ *	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☒ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER* _____
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* _____	☐ OTHER* _____
ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below			
Reflective vest/class II, hearing protection/NRR 20, glove/leather glove			

Development Team	Position/Title	Reviewed By	Position/Title	Date

JOB SAFETY ANALYSIS

OVERSIGHT OF DRILLING ACTIVITIES AND WELL INSTALLATIONS

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Mark out of underground utilities.	Property damage; Explosion; Electrocution; Injury; Death	• Call public underground utility agency (One-Call) at least 5 or more days prior to work activities; Review State Law pertaining to underground pipe line safety and have private utility mark-out performed., • Expose lines if warranted (i.e., hand dig, test pit or daylight)	Site Representative
2	Conduct site walk, identify unsafe conditions, and determine sample point locations	Traffic; Slips/trips/falls; Biological hazard; Overhead/underground hazards	• Maintain awareness of on-site traffic and walking surfaces. • When selecting soil boring locations, be aware of biological hazards (e.g. ants, poison ivy, wasps) and overhead/underground hazards (e.g. overhead utilities, concrete scarring, station canopy).	Site Representative and the Subcontractor's Supervisor
3	Inspection of equipment	Pinch points; Injury; Property damage; Lost time due to damaged equipment/parts	• Discuss pinch points on equipment (e.g. drill rig, air knife, pressure washer, etc.). • Familiarize all personnel with location/operation of fire extinguisher(s) and kill switch on drill rig. • Visually inspect equipment/parts for damage; document inspections.	Subcontractor Personnel
4	Set up work zone for drilling	Traffic; Slips/trips/falls; Property damage; Overhead hazards; Environmental impact	• Maintain awareness of on-site traffic, work zones, walking surfaces, overhead hazards (e.g. canopy and low hanging overhead lines). Utilize barricades/cones/caution tape to define work zone and direct traffic. • Wear leather gloves when setting up barricades. • Be aware of any potential sensitive receptors and verify all personnel are aware of the location of spill kit.	Subcontractor Personnel
5	Set up staging area	Traffic; Slips/trips/falls; Back strain; Injury; Pinch points; Heat/Cold stress	• Maintain awareness of on-site traffic and walking surfaces. Utilize barricades/cones/caution tape to define work zone and direct traffic. • Wear leather gloves when setting up barricades. • Utilize proper lifting techniques and use buddy system if needed. • Avoid placing hands/fingers in pinch point locations. • In extreme temperatures, ensure all personnel have proper clothing, hydration, and heat/cold protection (e.g. canopy, fan, glove warmers).	Subcontractor Personnel
6	Contractor oversight/ management of hole clearance/drilling activities	Traffic; Slips/trips/falls; Back strain; Injury; Underground utilities; Contaminant exposure; Heat/Cold stress; Pinch Points; Entanglement	• Maintain awareness of on-site traffic and practice good house keeping. • Ensure personnel don proper PPE (e.g. face shield, leather gloves, hearing protection) and utilize proper lifting techniques. • If non-native material (e.g. pea gravel, sand, fill material) or underground utilities are observed, utilize SWA and assess situation. • Monitor safe drill movement / Positional set-up • Lower the mast before moving the drill rig. • Monitor all personnel for signs and symptoms of heat/cold stress and refer to HASP for recommendations. • Ensure that safe hoisting and material handling practices are followed. • Ensure that personnel use proper augering and auger handling techniques.	Site Representative and Subcontractor Personnel

JOB SAFETY ANALYSIS

OVERSIGHT OF DRILLING ACTIVITIES AND WELL INSTALLATIONS

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
7	Site / Drilling and Well Installation Security	Traffic; Injury; Slips/trips/falls; Back strain	• Wear leather gloves when moving barricades. • Maintain awareness of on-site traffic and walking surfaces. • Use proper lifting techniques and buddy system if needed. Ensure area is clean of debris. • Secure boring location if open overnight.	Subcontractor Personnel

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[3] Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
ASPHALT/CONCRETE SAW CUTTING ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	JSA Type	Construction
Work Type	Construction	Client	
Work Activity	Asphalt/Concrete Saw Cutting		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Walk behind cut saw/ hand held cut saw		
Task-specific Training	40 HR and 8 HR HAZWOPER, Hand and Power Tool Safety, PPE, HAZCOM		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)

☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: _____*	☒ GLOVES*
☒ HARD HAT	☒ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☒ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER* _____
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* _____	☐ OTHER* _____

ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below

Gloves - Leather Face Shield - Full

Reflective Vest - Class II Hearing Protection - NRR 20

Development Team	Position/Title	Reviewed By	Position/Title	Date

Job Safety Analysis (JSA)
ASPHALT/CONCRETE SAW CUTTING ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA). Refer to the specific saw's operation manual before using equipment.	Slips, Trips, Falls: Situational risks	• Verify personnel's training is sufficient for the scheduled task(s). • Is job instruction training (hands-on) training necessary? • Employees should remove finger rings, necklaces, or jewelry which may be hazardous in equipment operation	Assigned Laborer
2	Equipment Safety Checklist	Faulty hose connections; Damaged hoses and fittings	• Replace worn or damaged hoses and fittings • Replace hose connections with operation connections. • Perform an overall inspection of the equipment for any defects or signs of damage.	Assigned Laborer
3	Verify Utility Clearance procedures completed. Verify excavation layout	Property damage and personal injury from hitting buried utilities. Fire potential from static/contact spark	• Utility Locate Ticket number on file • Mark work area and safe distances	Assigned Laborer
4	Saw and Water hose set up	Slip, Trip, Fall: Uneven terrain; Wet, Icy and muddy conditions; Material Handling – Back sprains and strains; Struck-by and line of fire; Pinch points.	• Be aware of your surroundings (footing, weather conditions, etc.) • Use proper lifting techniques; "straight back-bent knee" lifting approach. Have a "buddy" assist with the lift. • Use gloves to ensure a secure grip. • Grab the Equipment only on the designated handles or if none are available, at location where the hands and fingers will not get caught in the equipment or smashed. • Test the weight of the equipment before lifting • Straighten out the hoses before connection and keep them out of high traffic areas. • Be aware of "stored energy" hazards presented by hoses	Assigned Laborer
5	Equipment Fueling/Refueling	Fires; Explosion; Chemical Hazard	• Turn off equipment before fueling. • No smoking while fueling • Do not use cell phones while fueling • Store fuel in proper safety containers only. • If transferring fuel from large vessels into portable cans, use proper grounding or bonding techniques. • Do fuel the equipment when it is hot. • Wear gloves and wash hands after fueling	Assigned Laborer
6	Starting the Saw	Back Strains; Slippery Conditions	• Make sure starting cord is free pulling. Test the cord before pulling • Be aware of your surrounding conditions. Make sure Slip/Trip/Fall hazards were properly identified and corrected.	Assigned Laborer
7	Saw Operation	Hot surfaces; Noise; Exposure to particles	• Inspect saw blade. Remove worn, dull or damaged blades & replace • Keep hands away from the exhaust or hot components of the equipment • Be aware of any unguarded moving parts on the equipment • Use dust masks, respirators to prevent breathing of particles. • Use wet methods as much as possible	Assigned Laborer

[1] Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.

Job Safety Analysis (JSA)
ASPHALT/CONCRETE SAW CUTTING ACTIVITIES

[2] A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

[3] Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
SILT FENCE INSTALLATION

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	JSA Type	Construction
Work Type	Construction	Client	
Work Activity	Silt Fence Installation Activities		
Work Site	The Old Erie Canal Site, New York		
Key Equipment	Skidsteer, Sledge Hammer, Shovel		
Task-specific Training	Mobile Equipment Operations, PPE, Hand and Power Tool Safety		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)

☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR*	☒ GLOVES*
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER* _____
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* _____	☐ OTHER* _____

ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below

Reflective Vest - Class II Gloves - Leather

Reviewed By	Position/Title	Date	Reviewed By	Position/Title	Date

Job Safety Analysis (JSA)
SILT FENCE INSTALLATION

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA) Equipment Inspection	• Hydraulic failure • Instrument/monitor failure	• Inspect equipment lines and fluid reservoirs – document inspection. • Calibrate instrument prior to use – document calibration.	Personnel involved in this activity
2	Underground Utilities	• Impact, breach or rupture of underground utilities	• Inspect area. • Call underground utility locator and monitor locator during locating activities. • Verify all markings, locations and procedures prior to installation work.	Personnel involved in this activity
3	Installation zone inspection	• Underground Insects, nests and hives; • Poisonous plants; • Stinging/biting insects • Chemical hazards	• Visually inspect area of fence installation for any activity regarding hornets, yellow jackets, bees, fire ants or termites. A slow walk or drive along the fence path prior to excavation to inspect for insects flying in and out or ground, ant humps or mounds and trails.	Personnel involved in this activity
4	Silt fence trough (pathway) excavation	• Struck-by/against; • Utilities; • Chemical hazards; • Cross-contamination	• Setup safe work area. Use a spotter when moving equipment. • Use a spotter when digging to assist with observing for underground installations. Spotter will be used when working near overhead lines to assist equipment operator and keep machine away/out of lines. • Control areas where excavator will travel. Attempt to keep excavator tires out of impacted spoils and areas. Employees are to setup work area access to minimize spread of contamination.	Personnel involved in this activity
5	Hand tool use	• Improper hammer/tool selection; • Improper stapler use • Potential cuts/abrasions • Chemical hazards	• Use only a hammer of a weight and handle length appropriate to individual laborers' capability. Inspect every post and hammer for signs of metal fatigue/fractures. Inspect stapler for correct staple installation. Inspect stapler and test operation for gauging correct drive pressure. Use staples of a length needed for the job. Safety glasses and awareness of installer hand location during use of a hammer or staple gun. • Ensure that all hand tools (fence post driver, shovel, etc.) are in good working condition. • Wear proper PPE such as stout leather gloves to prevent trauma to hands. • Use work practices that do not generate visible dust levels.	Personnel involved in this activity
6	Fence layout activities	• Back or muscle strain	• Use the 'buddy system' during fence installation. 100' fence rolls require a coordinated two-man effort to place fence correctly and according to Mfg. requirements.	Personnel involved in this activity

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(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
SOIL AND GROUNDWATER SAMPLING ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	**JSA Type:**	Soil and Groundwater Sampling Activities
Work Type	Construction	**Client:**	Commander Oil – Great Neck, New York Site
Work Activity	Soil and Groundwater Sampling Activities		
Work Site	The Old Erie Canal site, New York		
Key Equipment			
Task-specific Training	40 HR and 8 HR HAZWOPER, PPE, Hand and Power tool Safety and Hazard Communication		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☒ Reflective Vest	☐ Goggles	☒ Gloves*	**Supplied Air**	**APR**	
☒ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots				☐ Acid Gas
☐ Other*			☐ Other*	☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Gloves – nitrile for sampling. Light duty mechanic style gloves for moving equipment and supplies around the site					

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
SOIL AND GROUNDWATER SAMPLING ACTIVITIES

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Mitigating Measure(s)[3]	Person Responsible
1	Perform the STAR Process (Stop Think Act Review) and discuss Stop Work Authority (SWA) -	• Site personnel not aware of STAR and SWA	• Project team to discusses importance of and documentation procedures for SWA during pre-job safety meeting • Use SWA to stop any work that is unsafe	Site Personnel
2	Inspect and calibrate sampling and monitoring equipment	• Lost time from improperly functioning equipment • Incorrect sampling procedures/ collection due to malfunctioning equipment	• Ensure all equipment is functioning properly • Wear light duty mechanic style gloves	Sampling Technician
3	Prepare to collect soil and/or groundwater samples	• Lifting hazards • Back injury • Manual material handling • Pinch points • Cuts • Punctures • Sample misidentification • Electrical Shock Hazards	• Wear Ndex nitrile gloves over light duty mechanic style gloves • Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds then assistance (mechanical or a buddy lift) will be required • Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position • Avoid one-handed carrying if possible; maintain awareness of footing • No bending or twisting while under load • Refer to the HASP for additional lifting information • Avoid placing hands/fingers in pinch point locations • Use proper tools when opening container packaging • Do not use fixed open blade knives when opening boxes or containers • Ensure the sample id label matches sample location with site plan site supervisor/subcontractor	Sampling Technician
4	Sample collection	• Contaminant exposure • Cuts from container breakage • Sample misidentification	• Wear Ndex nitrile gloves over light duty mechanic style • Inspect glass bottles for breaks/cracks • Do not attempt to use any suspect containers • Close glass sample containers carefully to avoid breakage • Check sample labels for accuracy prior to placing in cooler	Sampling Technician
5	Headspace screening of soil samples	• Contaminant exposure • Incorrect headspace readings	• Wear Ndex nitrile gloves over light duty mechanic style • Ensure proper calibration of equipment	Sampling Technician
6	Sample selection	• Bottle breakage • Contaminant exposure • Pinch points • Lost time due to incorrect sample selection	• Wear Ndex nitrile gloves over light duty mechanic style • Confirm selected samples are correct based on work plan selection criteria, PID readings, and soil boring logs • Avoid placing hands/fingers in pinch point locations (e.g., between cooler and lid)	Sampling Technician

Job Safety Analysis (JSA)
SOIL AND GROUNDWATER SAMPLING ACTIVITIES

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Mitigating Measure(s)[3]	Person Responsible
7	Packing samples in cooler(s)	• Bottle breakage • Contaminant exposure • Cuts • Pinch points • Lifting hazards • Back injury • Manual material handling • Lost time due to incorrect sample packaging or hold time exceedances	• Wear Ndex nitrile gloves over light duty mechanic style • Pack glass containers in bubble wrap • Check COC against sample labels for accuracy before shipping • Avoid placing hands/fingers in pinch point locations (e.g., between cooler and lid) • Use proper lifting techniques as discussed in step 3 • If possible use a dolly or cart if cooler is heavy or has to be moved over a long distance • Ensure equipment and supplies are loaded correctly and do not shift during transport	Sampling Technician
8	Investigation derived waste (IDW) management	• Contaminant exposure • Lifting hazards • Back injury • Manual material handling • Pinch points • Slips/trips/fall hazards • Mislabeled waste	• Wear Ndex nitrile gloves over light duty mechanic style • Use proper lifting techniques as discussed in step 3 • Avoid placing hands/fingers in pinch point locations • Maintain awareness of walking surfaces • Label IDW with generator, a contact number, identification of contents, and site location • Specify IDW as either hazardous or non-hazardous material	Sampling Technician

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(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

Job Safety Analysis (JSA)

SURFACE WATER SAMPLING

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	**JSA Type**	Surface Water Sampling
Work Type	Construction	**Client**	
Work Activity	Surface Water Sampling		
Work Site	The Old Erie Canal Site Clyde, New York		
Key Equipment	Sampling Equipment and supplies and potentially a boat		
Task-specific Training	40 HR and 8 HR HAZWOPER, PPE and Hazard Communication		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (see job steps for task-specific requirements)					
☐ Reflective Vest	☐ Goggles	☒ Gloves*	**Supplied Air**	**APR**	
☒ Hard Hat	☐ Face Shield*	☐ Coveralls*	☐ SCBA	☐ Full Face APR	☐ Particulate ☐ Organic Vapor
☐ Lifeline/Harness*	☐ Hearing Protection*	☐ PPE Clothing*	☐ Airline Respirator (attach description)	☐ Half Mask APR	☐ Particulate/Organic Vapor Combined
☒ Safety Glasses	☒ Safety-toed Boots and/or hip waders				☐ Acid Gas
☒ Other*	Sunscreen and a Personal Flotation Device if a boat is used		☐ Other*	☐ Other*	
ADDITIONAL PPE (*provide specific type(s) or descriptions of this item below)					
Gloves – Nitrile					

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)

SURFACE WATER SAMPLING

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
1	Perform the STAR Process (Stop Think Act Review) and discuss Stop Work Authority (SWA)	• Slips, trips, falls; • Situational risks - use STAR;	• Verify that personnel training is sufficient for scheduled task(s). Is Job Instruction (hands-on) Training necessary?	Sampling Technician
2	Inspection and setup of sampling equipment including on boat	• Lost time from improperly functioning equipment • Incorrect sampling procedures/ collection due to malfunctioning equipment • Potential Drowning • Potential back injuries	• Ensure all PPE is worn including PFD for each person • Ensure all equipment is functioning properly; complete Quality Control documents • Ensure boat sufficiently stable for retrieval of samples • Obtain training in boating safety • Do not lift more than 50 pounds without getting assistance. • Practice good lifting procedures that are presented in the HASP	Sampling Technician
3	Prepare to lower sampler into water	• Lifting hazards • Back injury • Manual material handling • Pinch points • Cuts • Punctures • Sample misidentification	• Reduce travel distance when there is a need to carry/lift materials • Make sure grip is adequate; wear leather gloves • Size up the load; if the object is too large or odd shaped OR is in excess of 50 pounds then assistance (mechanical or a buddy lift) will be required • Lift with the legs (bend at the knees and use the leg muscles) to protect the lower back and keep lower back in a neutral position • Avoid one-handed carrying if possible; maintain awareness of footing • Sampler will be heavier when raised; take breaks to rest arms/shoulders • Avoid placing hands/fingers in pinch point locations • Use proper tools when opening container packaging • Do not use fixed open blade knives when opening boxes or containers • Ensure the sample id label matches sample location with site plan Site Supervisor/subcontractor	Sampling Technician
4	Retrieve sampler when sample collected	• Cuts due to sharp edges of sample sleeve; Contaminant exposure • Lifting hazards • Back injury • Manual material handling • Cuts from sharp objects retrieved by sampler • Contamination hazards	• Refer to step 3 and the HASP for additional lifting information • Wear nitrile gloves • Maintain awareness of sharp edges from objects that may be in sampler	Sampling Technician
5	Sieving sample collection using mesh sieve (if applicable)	• Contaminant exposure • Cuts from container breakage • Sample misidentification • Chemical exposure to reagent if used	• Wear nitrile gloves and replace between samples • Inspect glass bottles for breaks/cracks; do not attempt to use any suspect containers • Close glass sample containers carefully to avoid breakage • Check sample labels for accuracy prior to placing in cooler	Sampling Technician
6	Headspace screening of samples (if applicable)	• Contaminant exposure • Incorrect headspace readings	• Wear nitrile gloves • Ensure proper calibration of equipment	Sampling Technician

Job Safety Analysis (JSA)

SURFACE WATER SAMPLING

Job Steps[1]	Task Activity	Potential Hazard(s)[2]	Corrective Measure(s)[3]	Person Responsible
7	Sample selection	• Bottle breakage • Contaminant exposure • Pinch points • Lost time due to incorrect sample selection	• Wear nitrile gloves when handling sample containers • Confirm selected samples are correct based on work plan selection criteria, PID readings, and soil boring logs • Avoid placing hands/fingers in pinch point locations (e.g., between cooler and lid)	Sampling Technician
8	Packing samples in cooler(s)	• Bottle breakage • Contaminant exposure • Cuts • Pinch points • Lifting hazards • Back injury • Manual material handling • Lost time due to incorrect sample packaging or hold time exceedances	• Wear nitrile gloves when handling sample containers • Pack glass containers in bubble wrap • Check COC against sample labels and SSOW for accuracy before shipping • Avoid placing hands/fingers in pinch point locations (e.g., between cooler and lid) • Refer to step 3 and the HASP for additional lifting information • Ensure equipment and supplies are loaded correctly and do not shift during transport	Sampling Technician
9	Investigation derived waste (IDW) management	• Contaminant exposure • Heavy lifting • Pinch points • Slips/trips/fall hazards • Mislabeled waste	• Wear nitrile gloves when handling IDW • Use proper lifting techniques to transport/dispose of IDW into drums and use buddy system if needed • Avoid placing hands/fingers in pinch point locations • Maintain awareness of walking surfaces • Label IDW with generator, a contact number, identification of contents, and site location • Specify IDW as either hazardous or non-hazardous material	Sampling Technician

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(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress/ergonomics/lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught".

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable, and quantified terms. Avoid subjective general statements such as "be careful" or "use as appropriate".

Job Safety Analysis (JSA)
SURVEYING AND COMMUNITY AIR MONITORING ACTIVITIES

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each workday. **Stop, Think, Act, Review (STAR)** must be used prior to any activity. All personnel must possess the appropriate training prior to initiating scheduled tasks. Also consider weather conditions. All project personnel have the authority and responsibility to use **Stop Work Authority.**

Date Issued/Revised	October 2014	**JSA Type**	Surveying and Community Air Monitoring Activities
Work Type	Construction	**Client**	
Work Activity	Surveying and Community Air Monitoring Activities		
Work Site	The Old Erie Canal Site, New York		
Key Equipment	GPS Unit, Grade Rod, Stakes, Hammer, Wood Lathe, Ribbon, Tripods, Air Monitoring Equipment		
Task-specific Training	Flagger safety; Traffic control devices; PPE, Mobile Equipment Operations		

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE JOB STEPS FOR TASK-SPECIFIC REQUIREMENTS)			
☒ REFLECTIVE VEST*	☐ GOGGLES	☐ APR: _____ *	☒ GLOVES* Leather
☒ HARD HAT	☐ FACE SHIELD*	☐ SUPPLIED AIR RESPIRATOR*	☐ COVERALLS*
☐ LIFELINE / HARNESS*	☐ HEARING PROTECTION*	☐ PPE CLOTHING*	☐ OTHER*
☒ SAFETY GLASSES	☒ STEEL TOED BOOTS	☐ OTHER* _____	☐ OTHER* _____

ADDITIONAL PPE: * Provide specific type(s) or descriptions of this item below

Reflective Vest – Class II

Gloves - Leather gloves for mobilization and demobilization equipment

Reviewed By	**Position/Title**	**Date**	**Reviewed By**	**Position/Title**	**Date**

Job Safety Analysis (JSA)
SURVEYING AND COMMUNITY AIR MONITORING ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
1	Perform the STAR Process and discuss Stop Work Authority (SWA) Perform Review "General Site Activities" JSA.	• Failing to identify hazardous conditions resulting in losses or near losses.	• Perform the STAR Process STAR. • Assess the risks. • Determine the hazards of performing the task and survey the work area. • Consider weather conditions such as fog that could reduce visibility. • Always consider the worst case scenario. • Analyze the hazards determined. • Decide a plan of action to eliminate or reduce the hazards and act on it.	Survey or Air Monitoring Technician
2	Mob equipment to surveying area	• Potential back Injuries loading equipment; • Pinch points; • Moving or flying projectiles inside vehicle while transporting equipment; • Slip/trip/fall; • Biological hazards. • Struck by moving vehicles	• Follow proper lifting procedure identified in the HASP; • Wear leather gloves when moving equipment around; • Review JSA and HASP; • Practice STAR; • Properly secure all equipment inside the vehicle. • Contact the owner of any public roadway (State or City) to determine requirements for surveying on or along their roadway. • Develop a Temporary Traffic Control Plan (TTCP) if surveying activities will be taking place on or along the shoulder of a public highway. • Set up a Temporary Traffic Control Zone (TTCZ) if surveying activities will be taking place on or along the shoulder of a public highway. The TTCP will describe the set up of the TTCZ.	Survey or Air Monitoring Technician
3	Setup in work zone	• Struck by oncoming traffic/heavy equipment; • Slip/trip/fall; • Biological hazards; • Potential back injuries from moving equipment; • Heat/Cold Stress; • Struck by moving vehicles	• Communication with other personnel/heavy equipment operators to notify them of survey team presence; • Position a company truck with flashers on for added protection and to aid in the protection of the survey crew as they set up the TTCZ; • Follow hot/cold stress procedures presented in the HASP. Ensure fluid intake and clothing/PPE is appropriate for conditions.	Survey or Air Monitoring Technician

Job Safety Analysis (JSA)
SURVEYING AND COMMUNITY AIR MONITORING ACTIVITIES

JOB STEPS [1]	TASK ACTIVITY	POTENTIAL HAZARD(S) [2]	CORRECTIVE MEASURE(S)[3]	Person Responsible
4	Conduct survey activities	• Struck by oncoming traffic; • Slip/trip/fall; • Potential injuries from misuse of tools or use of tools in disrepair; • Splinters, eye injuries from broken stakes; • Utility strikes; • Biological hazards; • Weather • Struck by moving vehicles	• Wear hi-visibility safety vest, steel-toed boots, safety glasses, and hard hat; • Do not use old or faded PPE; • Make sure that proper PPE is being worn; • Notify nearby equipment of changes in you activities/movement through work area; • Inspect tools; • Repair/replace tools as necessary; • Visually inspect stakes prior to driving into ground. Do not use stakes that are cracked, split, have large knots, etc; • Perform utility clearance to with clients representative to verify presence of underground utilities to avoid driving grade stakes through any underground obstructions; • Watch for snakes, insects, animals, etc; avoid walking though tall grass and shrubs as much as possible; • Check weather prior to entering work area; • Should conditions be windy, wear spoggles (safety glass goggles) to prevent dirt and debris from getting into the eyes; • Wear sunscreen, as required; • If thunder is heard o lightning seen, leave work area immediately and take shelter; do not re-enter work area until 30 minutes after last lightning strike is seen	Survey or Air Monitoring Technician
5	Exit work zone	• Struck by oncoming traffic; • Slip/trip/fall; • Biological hazards; • Weather • Struck by moving vehicles	• Walk through clear paths, especially when carrying equipment; watch for and avoid rough terrain as much as possible; • Note traffic patterns, make sure path to vehicle is clear and notify nearby equipment you are moving through their path; • Watch for snakes, insects, animals, etc; avoid walking though tall grass and shrubs as much as possible; • Check weather prior to entering work area; • Should conditions be windy, wear spoggles (safety glass goggles) to prevent dirt and debris from getting into the eyes; • Wear sunscreen, as required; • If thunder is heard o lightning seen, leave work area immediately and take shelter; do not re-enter work area until 30 minutes after last lightning strike is seen.	Survey or Air Monitoring Technician

(1) Each Job or Task consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the potential (associated) hazards.

(2) A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

(3) Aligning with the Job Steps, Task Activity Description, and Potential Hazard columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

ATTACHMENT B

PROJECT SAFETY FORMS

- **HASP TRAINING ACKNOWLEDGEMENT FORM**
- **DAILY SAFETY MEETING FORM**
- **INCIDENT REPORTING FORM**
- **SAFETY INSPECTION CHECKLIST FOR EXCAVATIONS**
- **SAFETY INSPECTION CHECKLIST FOR MOBILE EQUIPMENT**
- **HOT WORK PERMIT AND CHECKLIST**
- **MANLIFT DAILY EQUIPMENT CHECKLIST**

HASP ACKNOWLEDGMENT FORM

This is to certify that I have received a pre-entry briefing regarding this HASP for the Old Erie Canal Site - Clyde, New York and I understand its contents. My failure to follow and comply with the requirements contained in this plan may result in disciplinary action and/or removal from the Site.

Print Name	Signature	Company	Date

DAILY SAFETY MEETING FORM

PROJECT: **Old Erie Canal Site**

LOCATION: **Clyde, New York**

DATE/TIME: _____

1. Safety Issues or Topics Discussed:
2. Work Summary and Physical/Chemical Hazards of Concern:
Planned Activities:
Physical hazards:
Biological hazards:
Chemicals onsite:
3. Protective Equipment/Procedures:
4. Emergency Procedure:
MUSTERING POINT:
5. Signatures of Attendees (Handwriting must be legible):

INCIDENT REPORTING FORM

Report all accidents immediately to the Safety and Health Officer

Instructions: For Personal Injuries, Property Damage, and Near Miss Reports, Complete Sections 1 and 2.
For Vehicle Accidents, Complete Sections 1, 2, and 4. Form must be completed within 24 hours.

SECTION 1

A. Employee Identification ( ) Employee ( ) Temporary Employee ( ) Subcontractor

Employee No.	Last Name	First Name	Middle Name/Initial	M or F

Area Code ( )	Telephone Number	Address (Street, City, State, Province, Zip Code)

Date of Hire / /	Position/Title	Supervisor	Employee's Company/Office Location

B. General Information

Where did the accident occur?	Type of Occurrence
( ) Office ( ) Project Site	( ) Near Miss Only ( ) Employee Injury ( ) Vehicle Accident ( ) Property Damage

Date and Hour of Accident		Date and Hour Reported to Employer		Date and Hour Last Worked		Time Employee Began Work
Month Day Year	a.m. p.m.	Month Day Year	a.m. p.m.	Month Day Year	a.m. p.m.	a.m. p.m.

Normal Work Hours on Last Day Worked		Witnesses?	Witness Name and Telephone Number
From: To:	a.m. p.m.	( ) Yes ( ) No	

C. Project Information (Project Related Accidents/Near Misses Only)

Project #	Project Name	Project Manager	Site Telephone Number ( )	Employee Cell Number ( )

Was the Client Advised of the Accident?	Project Address (Street, City, State, Province, Zip Code)
( ) Yes ( ) No Name:	Specific Location of Accident

SECTION 2

A. Details of the Accident/Near Miss

1. What job/task was being performed when the accident occurred?

2. Describe the employee's specific activities at the time of the accident. Include details of equipment/materials being used, including the size and weights of objects being handled.

3. For injuries, identify the part of body injured, and specify left or right side.

4. Identify the object or substance that directly injured employee and how.

5. Identify Property Damaged (include owner of property, nature and source of damage, model and serial number, if appropriate).

B. Health Care/Medical Treatment

Employee received health care?	Identify the type of health care provided and where it was performed. (Check all that apply).
( ) Yes ( ) No	( ) First Aid ( ) Medical treatment other than first aid (sutures, etc.) ( ) Hospitalized ( ) Clinic ( ) Hospital emergency room ( ) On location by self or co-worker) ( ) On site by EMT

Name of Health Care Provider, Physician's Name, Address (Street, City, Province/State, and Postal/Zip Code)

Section 2 (Continued)

C. Accident Investigation		
H&S plan prepared and on site? ( ) Yes ( ) Not applicable	Did the safety plan identify and provide safety procedures for the specific tasks the employee was conducting when injured? ( ) Yes ( ) No If no, why not? (Explain).	
Did the employee have the proper safety training to conduct these tasks or use the equipment? ( ) Yes ( ) No If not, why not?		
Identify all of the potential contributing factors and how they led to the occurrence of the accident. (Lack of attention, wrong use of equipment, lack of training, etc.)		
What contributing factor above was the underlying root cause of the accident.		
Is any training or retraining recommended? If yes, describe.		
What actions have been or will be taken to correct this accident from reoccurring?		
Additional information: Attach photos, accident diagrams, as applicable.		
Report Date Month Day Year	Report Prepared by: (please print)	Report Prepared by: (signature)

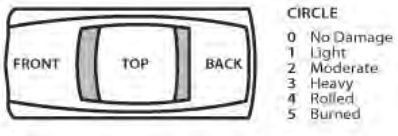
VEHICLE ACCIDENT SECTION

(Complete this Section for all Vehicle Accidents)

SECTION 4

A. Vehicle

License Plate No.	State	Police Department	City	State
Vehicle Year/Make/Model	Odometer Reading at Time of Accident	Police Report Number	Weather Conditions	

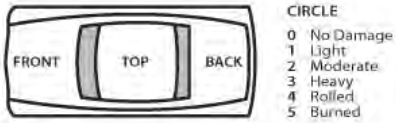
Name of Person Operating Vehicle	"X" IN AREA OF VEHICLE DAMAGE
Address	
City State/Province Zip Code	
Telephone: Area Code ( )	

Vehicle Type: ( ) Personal ( ) Rental ( ) Company-Owned

Description of Vehicle Damage:

B. Other Vehicles Involved

Name of Owner	Address	City/State/Zip	Area Code and Telephone Number ( )
Operator's Name (if different from above)	Address	City/State/Zip	Area Code and Telephone Number ( )

Year/Make/Model	Description of Property Damage:	"x" IN AREA OF VEHICLE DAMAGE
Insurance Co. Name & Telephone		
License Plate No./State/Province		

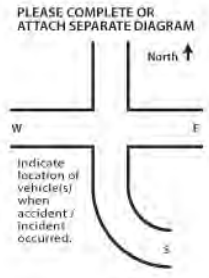
C. Injured Persons

Name	Address Street, City, State/Zip Code	Phone Number	Nature of Injury	Indicate if Injured was a Vehicle Driver/ Passenger, Employee, Other, or Pedestrian
1.				
2.				
3.				

D. Witnesses

Name	Address Street, City, State/Prov./Zip Code	Area Code and Telephone Number
1.		( )
2.		( )

E. Description of Accident



Was Ticket Issued: Reason:

Other Operator ☐

Company Operator ☐

Report Date Month Day Year	Report Prepared by: (please print)	Report Prepared by: (signature)

Note: If Additional Space is Required to Complete this Report, Use Separate Sheet of Paper and Attach.

SAFETY INSPECTION CHECKLIST FOR EXCAVATIONS
REFERENCED BY OSHA STANDARDS

This checklist is to be completed by the competent person at the start of work and as needed throughout the shift (i.e., after rain events, etc.). ***(A competent person has been trained in the current OSHA excavation standard, is knowledgeable about soil analysis and protective systems, and has the authority to shut down the job.)***

Site Location: _____		Project #: _____	
Date: _____ Time: _____		Competent Person: _____	
Were visual soil tests made? If Yes, what type?		YES NO ☐	Type: _____
Were manual soil tests made? If yes, what type?		YES NO ☐	Type: _____
Soil Type: _____		Signature: _____	
Soil Classification: _____			
Excavation Depth: _____		Excavation Width: _____	
Protective System Used:			

In the following table, please place a Y for Yes, N for No, or N/A for Not Applicable in the right hand column for each item. If No, place the date of correction.

	Subject	Y, N, or NA	Date Corrected
GENERAL INSPECTION OF THE JOB SITE			
1.	Does the competent person have the authority to remove employees from the excavation immediately?		
2.	**ARE SURFACE OBSTRUCTIONS REMOVED OR SUPPORTED?**		
3.	Are employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation?		
4.	Are hard hats worn by all employees?		
5.	Are excavated soil, materials, and equipment placed at least 2 feet from the edge of the excavation?		
6.	Are walkways and bridges over excavations 4 feet or more in depth equipped with standard guardrails and toe-boards?		
7.	Are warning vests or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic?		
8.	Are employees required to stand away from vehicles being loaded or unloaded?		
9.	Is a warning system established and used when mobile equipment operates near the edge of the excavation?		
10.	Are employees prohibited from going beneath suspended loads?		
11.	Are employees prohibited from working on the faces of sloped or benched excavations above other employees?		
UTILITIES			
12.	Were utility companies contacted and/or utilities located?		
13.	Are the exact locations of the utilities marked?		
14.	Are underground installations protected, supported, or removed when excavation is opened?		
MEANS OF ENTERING AND EXITING THE TRENCH			
15.	Is the distance along the trench to an exit no greater than 25 feet in excavations 4 feet or more in depth?		
16.	**IS A SUPPORT SYSTEM, SUCH AS UNDERPINNING, BEING USED?**		
17.	Are ladders used in excavations secured and extended 3 feet above edge of the trench?		
18.	Are structural ramps used by employees designed by a competent person?		
19.	Are structural ramps used for equipment designed by a registered professional engineer?		
20.	Are employees protected from cave-ins when entering or exiting the excavation?		

	Subject	Y, N, or NA	Date Corrected
WET CONDITIONS			
21.	Is water removal equipment monitored by a competent person?		
22.	Is surface water or run-off diverted or controlled to prevent accumulation in the excavation?		
23.	Are inspections made after every rainstorm or other hazard-increasing occurrence?		
HAZARDOUS ATMOSPHERE			
24.	Is the atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficiency, combustible, or other harmful contaminant exposing employees to a hazard?		
25.	Are adequate precautions taken to protect employees from exposure to an atmosphere containing less than 19.5% oxygen and/or other hazardous atmospheres?		
26.	Is ventilation provided to prevent employee exposure to an atmosphere containing flammable gas 10% above the lower explosive limit of a gas?		
27.	Is testing conducted often to ensure that the atmosphere remains safe?		
28.	Is emergency equipment, such as breathing apparatus, safety harness and lifeline, and/or basket stretcher readily available where hazardous atmospheres could or do exist?		
SUPPORT SYSTEMS			
29.	Are materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads?		
30.	Are materials and equipment used for protective systems inspected and in good condition?		
31.	Are protective systems installed without exposing employees to the hazards of cave-ins (including end walls), collapses, or threat of being struck by materials or equipment?		
32.	Are excavations below the level of the base, or footing supported, approved by a registered professional engineer?		
33.	Does the removal of support systems progress from the bottom and members are released slowly? Note any indication of possible failure.		
34.	Is the excavation of material a level no greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth?		
35.	Is there a shield system placed to prevent lateral movement?		

SAFETY INSPECTION CHECKLIST – MOBILE EQUIPMENT SAFETY

Week Ending:	Job No.:	Equipment:

(This form is to be completed daily by the operator. Deficiencies should be addressed immediately.)

Superintendent: _____

	Date:	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.	Comments
Equipment Hours:	***Start:***								
	Stop:								
Fluid Levels*:*									
	Oil								
	Hydraulic								
	Transmission								
	Radiator								
	Grease Fittings								
	Fuel								
Safety Checks:									
	Fire Extinguisher								
	Seat and Safety Belts								
	Warning Devices (backup alarms, lights, etc.)								
	Housekeeping								
	Brakes								
	Mirrors								
	Windshield and Wipers								
	Steering								
	Horn								
	Lights								
	Tires								
	Guards								
	Instruments								
	Exhaust System								
Accessories:									
	Boom or Mast								
	Controls								
	Level Indicators								
	Tracks								
	Other								
Sign-Off:									
	Operator's Initials								
	Supervisor's Initials								

Additional Comments: (Please write any additional comments here. Use the back of this form if necessary.)

√ = OK NR = Needs Repair NA = Not Applicable

HOT WORK PERMIT AND HOT WORK CHECKLIST

Location (facility, well name, rig, etc.):

Description of Hot Work:

I have reviewed the proposed work, agree that hot work is necessary and may proceed without unreasonable risk.

Initial authorization: **Date:** **Expiration time:**

The following precautions must be taken to complete the work safely (attach details of specific procedures or checklist if appropriate).

Check	Yes	NA	Check	Yes	NA	Check	Yes	NA
All lines depressurized?			Area/space gas free?			Standby man/fire watch?		
All liquids drained?			Combustibles removed?			Pre-job safety meeting complete?		
Space cleaned and purged?			Continuous atmosphere monitoring?			Emergency procedure established?		
Space properly ventilated?			Fire extinguisher/water available?			Special PPE required?		
Lockout/tagout complete?			Respiratory protection required?					

Positive Isolation ☐ NA
☐ Blind ☐ Double Block and Bleed
☐ Disconnect ☐ Full thickness Skillet

Electric lighting and equipment properly rated for hazardous area location
☐ Yes ☐ No ☐ NA

Communication Method ☐ NA
☐ Hand signal ☐ Voice
☐ Radio ☐ Horn

PPE

Head: ☐ Hardhat
☐ Other: _____
Eye/Face: ☐ Safety glasses w/side shields
☐ Face shield ☐ Goggles
☐ Other: _____
Arms/ Hands: ☐ Leather gloves
☐ Leather gloves w/long sleeves
☐ Other: _____
Footwear: ☐ Leather Boots
Clothing: ☐ Flame-resistant clothing

Rescue Equipment

Emergency Response Plan?
☐ Yes ☐ No ☐ NA
If no, notify outside rescue services
GPS Coordinates: _____

☐ Full body harness
☐ Lifeline
☐ Personnel basket
☐ Rigid stretcher
☐ Mechanical lift for >5 degrees vertical

Emergency Phone Numbers

Ambulance/EMS:

Rescue Services:

Air Rescue:

Fire Department:

Other:

Atmospheric Testing **Acceptable Conditions**	**Time ➔**	**Results : AM/PM**	**Results : AM/PM**	**Results : AM/PM**	**Results : AM/PM**	**Results : AM/PM**
Oxygen	19.5% to 23.5%					
Flammability	<10% LEL					
H_2S	<10 ppm					
Norm	<50 Micrograms					
Vessel Temperature	<100ºF (43ºC)					
Tester Signature:						
X		Initials	Initials	Initials	Initials	Initials

Direct Reading Monitor | Model and Unit Number: | Calibration Date: / /

This permit is approved for ____ hours on this date ____/_____/___
Signature of On-site Supervisor:
X Start Time: :

Only the On-site Supervisor may extend the permit time (Max. 12 hours)
Time was extended to: _____ hours.
Rep. Initials: _____ Time: :
Permit start time shall be the same as the initial test time.

Cancellation of Permit
Signature of On-site Supervisor: Date: ____/_____/___
X

Permit Retention: 1 year or until audited

Signature of person(s) performing Hot Work:
X
X
X
X

Signature of Fire Watch:
X

Signature of Contract Supervisor:
X

Distribution: Original - Client Representative and Work Site Copy - Initial Authorization

HOT WORK CHECKLIST

Signature	All welding machines **shall** be located in an unclassified area while in use (for offshore welding, machines must be 3 m or 10 feet away from a well-bay or production area and 0.5 m or 18 inches or away from deck drains – refer to Electrical Area Classification drawing).
	Welding machines with AC power convenience receptacles **shall** be labeled as AC power and **shall** be used with ground fault circuit interrupter (GFCI) adapters. The adapters should be placed as close to the welding machine as possible.
	Welding machines with DC power convenience receptacles **shall** be removed or otherwise disabled and must not be used.
	Welding machines used offshore **shall** be equipped with drip pans, shut down devices, and spark arresters.
	All welding leads **shall** be grounded as close as possible to the work area.
	All welding leads and extension cords **shall** be completely insulated, UL rated, and in good working condition.
	Welding rods **shall not** be left in the electrode holder when laid down on steel decks. The stud ends **shall** be put into a container – not on the floor or deck.
	Oxygen and acetylene bottles **shall** be separated by a or 5-foot high metal barrier, secured in a rack. Acetylene bottles shall be kept in an upright position.
	Regulators **shall** be equipped with properly operating gauges.
	Oxygen and acetylene hoses **shall** be leak-free and routed to prevent mechanical damage.
	Oxygen and acetylene hoses **shall not** be hung on cylinders when in use.
	Oxygen and acetylene **shall** be turned off at the cylinder valve and hoses bled anytime the equipment is not in use. Regulators **shall** be removed and protective cylinder caps put in place anytime cylinders are to be moved.
	Acetylene pressure downstream of the regulator **shall** be kept at or below 15 psi.
	Check valves/flame arresters **shall** be installed on the torch and the regulator.
	Only friction spark devices **shall** be used for ignition of cutting torches. Due to a potential ignition source, friction sparkers shall **not** be permitted to be carried throughout the facility.
	When lighting the cutting torch, the fuel gas valve shall be opened before opening the oxygen valve.
	Equipment containing hydrocarbons or other flammable substances has been relocated at least 35 feet horizontally from the hot work site. Similar equipment located at a lower elevation where slag, sparks, or other burning material could fall has been relocated at least 35 feet from the point of impact. When relocation is impractical, the equipment has been either shielded or the contents rendered inert.
	Fire resistant blankets (if used) **shall** be of a good quality and should be installed in a manner that does not create pockets or folds.
	Instrument gas systems and devices isolated or shielded.

On-Site Supervisor: _____ Date: _____

Welder: _____ Date: _____

FALL PROTECTION
MANLIFT DAILY EQUIPMENT CHECKLIST

Equipment/Vehicle #: Week Beginning:

1) Check that all functions of the equipment are operating properly. (Forward, Reverse, Up, Down, Horn, etc.)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Note any problems found during check below:

2) Check all hardware for looseness. (Hose reels, guard rails, doors, covers, etc.)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Note any problems found during check below:

3) Check for hydraulic line leaks, worn hoses or lines, crimped lines or lines in danger of being damaged:

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Note any problems found during check below:

4) Check battery water level, gauge, leads and charger connector.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Note any problems found during check below:

ATTACHMENT C

COMMUNITY AIR MONITORING PLAN

COMMUNITY AIR MONITORING PLAN
FOR THE OLD ERIE CANAL SITE – CLYDE, NEW YORK
DEVELOPED IN ACCORDANCE WITH THE NEW YORK STATE DEPARTMENT OF HEALTH'S GENERIC COMMUNITY AIR MONITORING PLAN

Overview

This site-specific Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of excavation activities. The action levels specified herein require increased monitoring and corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP will help to confirm that work activities do not spread contamination off site through the air.

Designated air monitoring station locations will be established around the perimeter of the site for use as monitoring locations. The site-specific CAMP presented below will be implemented during the soil handling activities at the site which include excavation activities. Each day that this activity is in progress one upwind and two downwind air monitoring stations will be set up to collect data. The instruments that will be used to collect the air monitoring data will have data logging capabilities. The data will be downloaded periodically, stored electronically and will be available to agency personnel for their review.

Reliance on this CAMP should not preclude simple, common sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Real-time air monitoring for VOCs and particulate levels at the perimeter of the site will be necessary, as described below.

Continuous monitoring will be required during all soil handling at the Site including excavation activities.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil samples (if completed). Periodic monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while overturning soil and then taking a reading prior to leaving a sample location.

VOC Monitoring, Response Levels, and Actions

VOCs will be monitored at the downwind perimeter of the site on a continuous basis. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The specific type of air monitoring equipment that will be used at the site for VOC monitoring will be a MiniRae 3000, or equivalent. The equipment will be calibrated in accordance with the manufacturer's guidelines. The equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of VOCs at the downwind perimeter of the site exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
2. If total organic vapor levels at the downwind perimeter of the site persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the designated work area or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
3. If the organic vapor level is above 25 ppm at the perimeter of the site, activities must be shutdown.
4. All 15-minute readings must be recorded and be available for State (New York State Department of Environmental Conservation [NYSDEC] and the New York State Department of Health [NYSDOH]) personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

Particulate/Fugitive Dust Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at one upwind and two downwind monitoring stations on the site perimeter. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The particulate monitor that will be used will be a TSI 8520 DustTrak, or equivalent. The equipment will be equipped with an audible and/or visible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

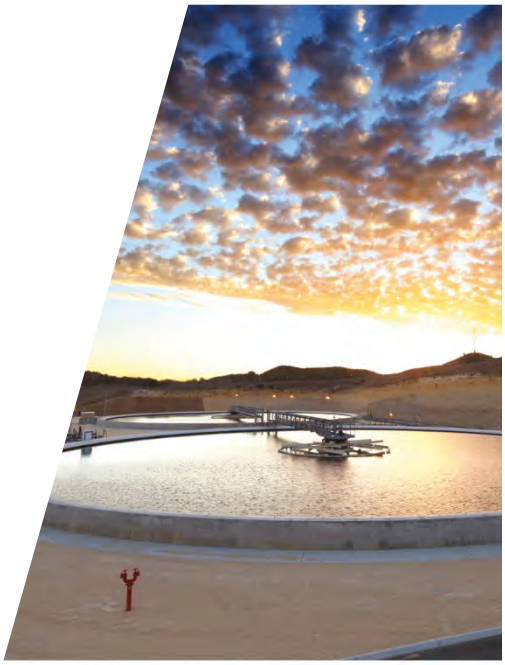
1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the designated work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the designated work area.
2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.
3. All readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review.

The following fugitive dust suppression and corrective procedures will be employed at the site.

1. Reasonable fugitive dust suppression techniques will be employed during all excavation activities, which may generate fugitive dust.
2. The following techniques are generally effective for the controlling of the generation and migration of dust during construction activities and may be employed as necessary:
   (a) Applying water on haul roads
   (b) Wetting equipment and excavation faces
   (c) Spraying water on buckets during excavation and dumping
   (d) Hauling materials in properly tarped or watertight containers
   (e) Restricting vehicle speeds to 10 mph
   (f) Covering excavated areas and material after excavation activity ceases
   (g) Reducing the excavation size and/or number of excavations

   When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

Appendix F
Quality Assurance Project Plan



Appendix F
Quality Assurance Project Plan

Site Management Plan
Old Erie Canal Site
Clyde, New York

General Electric Co. and
Parker-Hannifin Corp.

Quality Assurance Project Plan

Project Title:	Site Management Plan Old Erie Canal Site Clyde, New York
Revision Number:	0
Revision Date:	
Prepared By:	GHD
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List of Acronyms and Short Forms

DO	-	Dissolved Oxygen
DQOs	-	Data Quality Objectives
EPA	-	Environmental Protection Agency
FSP	-	Field Sampling Plan
GC/MS	-	Gas Chromatography/Mass Spectrometry
LCS	-	Laboratory Control Sample
MDLs	-	Method Detection Limits
MS/MSD	-	Matrix Spike/Matrix Spike Duplicate
MNA	-	Monitored Natural Attenuation
GA EDP	-	Georgia Environmental Protection Division
PARCCS	-	Precision, Accuracy, Representativeness, Comparability, Completeness, Sensitivity
PE	-	Performance Evaluation
%R	-	Percent Recovery
%RSD	-	Percent Relative Standard Deviation
QA	-	Quality Assurance
QA/QC	-	Quality Assurance/Quality Control
QAPP	-	Quality Assurance Project Plan
QC	-	Quality Control
RPD	-	Relative Percent Difference
SMP	-	Site Management Plan
SOPs	-	Standard Operating Procedures
USEPA	-	United States Environmental Protection Agency
VOCs	-	Volatile Organic Compounds

1. Introduction

This Quality Assurance Project Plan (QAPP) has been prepared by GHD to govern the collection of environmental data referenced in the Site Management Plan (SMP) and associated documents for the Old Erie Canal Site in Clyde, New York (Site). This QAPP is Appendix F of the SMP. It is expected that this QAPP will provide the framework for soil and groundwater sampling activities at the Site. The QAPP is a planning document that provides a "blueprint" for obtaining the type and quantity of data needed to support remedial design activities and environmental decision making. The QAPP integrates all technical and quality aspects of a project and documents all quality assurance (QA), quality control (QC), and technical activities and procedures associated with planning, implementing, and assessing environmental data collection operations to meet National Contingency Plan requirements as identified at 300.435(b).

This QAPP has been prepared by CRA in accordance with the USEPA QAPP guidance documents "EPA Requirements for Quality Assurance Project Plans", EPA QA/R-5, March 2001, and "EPA Guidance for Quality Assurance Project Plans", EPA QA/G-5, December 2002. In accordance with these documents, there are four basic groups of elements that must be included in a QAPP. These four groups and associated elements follow:

- Group A - Project Management. The elements in this group include all aspects of project management, project objectives, and project history.
- Group B – Data Generation and Acquisition. The elements in this group include descriptions of the design and implementation of all measurement systems that will be used during the project.
- Group C – Assessment/Oversight. The elements in this group encompass the procedures used to ensure proper implementation of the QAPP.
- Group D – Data Validation and Usability. The elements in this group cover the QA activities that occur after the data collection phase of the project is completed.

The elements associated with the project management, data generation and acquisition, assessment/oversight, and data validation and usability for the monitoring activities that are being conducted for the soil and groundwater programs at the Site are presented in this QAPP.

2. Project Organization

The responsibilities of management, QA personnel, field personnel, and laboratory personnel are provided in the following subsections. Additionally, any special training/certification requirements for the project are identified.

2.1 Management Responsibilities

The Supervising Contractor Project Manager is ultimately responsible for ensuring that the project objectives are achieved working under direction of the coordinating contractor. The Project Manager is responsible for coordinating the project team currently consisting of technical personnel

(engineering, hydrogeology, chemistry, and data management), QA personnel, and the analytical laboratory. The Project Manager and the other team members specific responsibilities follow:

Project Manager

- Technical representation on behalf of the Client
- Advising on corrective actions
- Overview of field activities
- Ensures all resources are available on an as-required basis
- Preparing and reviewing reports
- Coordinating technical group

A New York State certified laboratory will be used for the analytical portion of the investigation. The analytical laboratory's Project Manager is responsible for ensuring the project objectives are achieved by the laboratory. The specific responsibilities follow:

Laboratory Project Manager

- Coordinate laboratory analyses
- Supervise in-house chain-of-custody
- Data review of final analytical reports
- Approve final reports prior to submission to the Supervising Contractor

2.2 Quality Assurance Responsibilities

Project team members with QA responsibilities include the QA Officer, the Field QA Officer, and the laboratory QA Officer. These team members and their specific responsibilities follow:

Quality Assurance Officer

- Review laboratory QA/QC
- Coordinate and review data validation and assessment
- Advise on laboratory corrective action procedures
- Preparation and review of QA reports
- QA/QC representation of project activities

Field Quality Assurance Officer

- Overview and review field QA/QC
- Management of field activities and field QA/QC
- Field data assessment
- Internal field technical system audits
- Technical representation of field activities

- Preparation of standard operating procedures (SOPs) for field activities
- Implement and document field corrective actions, if necessary

Laboratory QA Officer

- Coordinate and overview of laboratory systems audits
- Overview of QA/QC documentation
- Conduct detailed data review
- Implement and document laboratory corrective actions, if required
- Technical representation of laboratory QA procedures
- Oversee preparation of laboratory SOPs

2.3 Field Responsibilities

Field sampling and collection of field measurements related to sampling will be conducted during the monitoring activities.

The field sampling will be conducted by technical staff. The Field QA Officer will be responsible for documenting any non-conformances and subsequent corrective actions. The Field QA Officer or any field team member can identify and report non-conformances.

2.4 Laboratory Responsibilities

Specific information regarding the sampling and analysis program for the monitoring program is provided in Section 3.3 of this QAPP.

The specific responsibilities of laboratory personnel involved in the project follow:

Laboratory Director

- Ensures all resources of the laboratory are available on an as-required basis
- Schedule sample analyses
- Oversee data review
- Oversee preparation of analytical reports

Laboratory Sample Custodian

- Receive and inspect incoming sample containers
- Record the condition of incoming sample containers
- Sign appropriate documents
- Verify correctness of chain-of-custody documentation
- Notify project manager of any non-conformances identified during sample receipt and inspection
- Assign a unique identification number to each sample, and enter the client identification number and sample identification numbers into the sample receiving log/information system

- Initiate transfer of the samples to appropriate laboratory sections
- Control and monitor access/storage of samples and extracts

2.5 Project Organization

The organization and lines of communication among the project participants identified in the preceding subsections are presented on Figure 2.1.

2.6 Problem Definition/Background Information

This QAPP focuses on specific QA/QC activities designed to achieve the stated objectives in the SMP. It is a living document and will be updated with specific addenda as needed to reflect new phases of work as they are implemented at the Site. The modifications will be made by the QA Officer and reviewed by the Project Manager.

2.7 Project/Task Description

An overview of the sampling and analysis program is summarized in Table 2.1. Target analytes and targeted quantitation limits are presented in Table 2.2.

2.7.1 Project Schedule

The schedule for various sampling activities will be provided in the associated work plans/addendums, etc. Schedules will be dependent on some critical items such as regulatory reviews and approvals, property access, and weather. All of these critical items may impact the ultimate implementation and completion of scheduled activities.

2.8 Quality Objectives and Criteria for Measurement Data

The quality objectives and measurement performance criteria for data obtained for the monitoring programs are presented in the following subsections.

2.8.1 Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements derived from the outputs of each step of the DQO process. The DQO process is a series of planning steps based on the scientific method that is designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate for the intended application.

There are seven steps in the DQO process that include:

- Stating the problem
- Identifying the goal of the study
- Identifying information inputs
- Defining the boundaries of the study
- Developing the analytic approach

- Specifying performance or acceptance criteria
- Developing the plan for obtaining data

The DQOs for the programs were developed using the objectives for the programs as a problem statement. The resulting statements and DQOs are summarized in the following.

1. Problem	Detecting the presence of Facility-related constituents and determining the effectiveness of monitored natural attenuation (MNA) on the Site groundwater.
2. Goal	Determine if constituents of concern are detected in soil or groundwater at statistically significant levels.
3. Inputs	Data from sample collection activities.
4. Boundaries	To be confirmed based on extent of Site-related detections.
5. Analytic Approach	If Facility-related constituents exhibit statistically significant increases from historical values or exceed New York State Limits, additional activities may be necessary to address the findings.
6. Performance or Acceptance Criteria	Ability to detect constituents at laboratory method detection limits and quantitate constituents at laboratory targeted quantitation limits (refer to QAPP Section 5.0 and Table 2.2).
7. Design	Soil and groundwater sample collection and other Site-related reporting.

2.8.2 Measurement Performance Criteria

The measurement performance criteria for precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) are provided in the following subsections.

2.8.3 Field Precision Criteria

Precision of the field sample collection procedures will be assessed by the analysis of field duplicate samples. Field duplicate samples will be collected at a frequency of 1 per 20 or fewer investigative samples or at a minimum frequency of 1 per sampling event. The samples will be labeled such that the field duplicate sample is “blind” to the laboratory. A relative percent difference (RPD) of 100 percent will be used as an advisory limit for analytes detected in both the investigative and field duplicate soil samples at concentrations greater than or equal to 5 times their quantitation limits. A relative percent difference (RPD) of 50 percent will be used as an advisory limit for analytes detected in both the investigative and field duplicate groundwater samples at concentrations greater than or equal to 5 times their quantitation limits. Professional judgment will be used to qualify associated investigative sample data.

Field precision for field measurements will be assessed through replicate measurement of the same sample, as applicable to the parameter being measured. The precision acceptance criteria for field measurements will be 10 relative percent difference (RPD).

2.8.3.1 Laboratory Precision Criteria

Laboratory precision will be assessed through the calculation of RPDs for laboratory duplicate sample analyses. These will be laboratory duplicate, matrix spike/matrix spike duplicate (MS/MSD) and/or duplicate laboratory control samples (LCS/LCSD) samples. These will be collected/designated a frequency of 1 per 20 or fewer samples. The equation to be used to determine precision is presented in Section 5.3.1 of this QAPP. Laboratory precision acceptance criteria are specified in the methods or are determined statistically by the laboratory; and will be included in the laboratory reports.

2.8.3.2 Field Accuracy Criteria

The criteria for accuracy of the field sample collection procedures will be to ensure that samples are not affected by sources external to the sample, such as inadequate equipment decontamination procedures or sample contamination by ambient conditions or sample cross-contamination. Field sampling accuracy will be assessed by the data from equipment blank samples and trip blank samples.

Field equipment blank samples will be collected at a frequency of 1 per 20 sampling equipment decontamination procedures or at a minimum frequency of 1 per sampling event during which equipment decontamination occurs. Field equipment blank samples (also referred to herein as equipment blank samples) will be collected by routing laboratory-provided deionized water through decontaminated sampling equipment. The samples will be labeled such that the equipment blank sample is “blind” to the laboratory. Equipment blank samples will be analyzed to check for procedural contamination or ambient conditions that may cause sample contamination.

Trip blank samples, consisting of volatile organic-free water poured into sample vials at the laboratory, will be provided by the laboratory for the sampling effort. Trip blank samples will be handled in a manner consistent with actual field samples, but will not be opened, and will be shipped back to the laboratory with the samples. Trip blank samples will provide a measure of potential cross-contamination of samples by VOCs during shipment and handling. One trip blank sample will be included in each shipping cooler containing samples for VOC analysis.

Equipment and trip blank samples should not contain target analytes. The equipment and trip blank sample data will be evaluated using the procedures specified in Section 5.3.2 of this QAPP. Accuracy also will be ensured by adhering to all sample handling procedures, sample preservation requirements, and holding time periods.

Accuracy of field measurements will be assessed by analyzing calibration check samples, as applicable to the parameter being measured. Accuracy acceptance criteria for field measurements obtained during the field activities are +/- 10 percent.

2.8.3.3 Laboratory Accuracy Criteria

Laboratory accuracy will be assessed by determining percent recoveries from laboratory control sample (LCS) analyses. An LCS will be analyzed at a frequency of 1 per laboratory batch of 20 or fewer samples of the same matrix. Accuracy relative to the sample matrix will be assessed by determining percent recoveries from the analysis of matrix spike samples. MS/MSD samples will be collected/designated at a frequency of 1 per 20 or fewer samples of the same matrix or at a minimum frequency of 1 per sampling event. The equation to be used to determine accuracy for this project is presented in Section 5.3.2 of this QAPP. Laboratory accuracy acceptance criteria are specified in the methods or are determined statistically by the laboratory; and will be included in the laboratory reports.

The accuracy of all organic analyses also will be monitored through the analysis of surrogate compounds. Surrogate compounds are added to each sample, standard, blank, and QC sample prior to sample preparation and analysis. Surrogate compounds are not expected to be found occurring naturally in the samples, but behave analytically similar to the compounds of interest. Consequently, surrogate compound percent recovery data will provide information on the effect that the sample matrix exhibits on the accuracy of the analyses. Surrogate compound percent recovery acceptance criteria are specified in the methods and will be included in the laboratory reports.

2.8.3.4 Field Representativeness Criteria

Representativeness is dependent upon the proper design of the sampling program. The representativeness criteria for field sampling will be to ensure that the correct soil/sediment locations/depths, monitoring wells, and surface water locations are sampled and that the proper sampling procedures are followed. The sampling program was designed to provide data representative of conditions at the Site. During development of the monitoring program, consideration was given to existing analytical data and physical setting.

2.8.3.5 Laboratory Representativeness Criteria

The representativeness criteria for laboratory data will be to ensure that the proper analytical procedures are used for sample preparation, sample analysis, and that sample holding times are met. Additionally, the accuracy and precision of the laboratory data affect representativeness. The laboratory representativeness criteria will include achieving the accuracy and precision criteria for the sample analyses.

2.8.3.6 Field Comparability Criteria

The criteria for field comparability will be to ensure and document that the proper sampling procedures are followed.

2.8.3.7 Laboratory Comparability Criteria

The criteria for laboratory data comparability will be to ensure that the analytical methods used for the investigation are comparable to the methods used for previous sampling events, as applicable. The methods identified in Section 3.3.2 of this QAPP are the same or comparable to the methods used to generate previous monitoring data.

2.8.3.8 Field Completeness Criteria

The criteria for field completeness will be 90 percent or more of the field-measured data are usable. The procedure for determining field data usability is provided in Section 3.9.2 of this QAPP. The equation for calculating completeness is presented in Section 5.3.4 of this QAPP.

2.8.3.9 Laboratory Completeness Criteria

The criteria for laboratory completeness will be 90 percent or more of the laboratory data are determined to be usable for the intended purpose. The procedure for determining laboratory data usability is provided in Section 3.9.2 of this QAPP. The equation for calculating completeness is presented in Section 5.3.4 of this QAPP.

2.8.3.10 Laboratory Sensitivity Criteria

The sensitivity criteria for the laboratory analyses are the targeted quantitation limits provided in Table 2.2 of this QAPP.

It should be noted that high concentration of target and non-target analytes and matrix interferences may prevent the targeted quantitation limits from being achieved for all samples. The methods selected for analyzing the samples are USEPA methods routinely used to support environmental investigations and data gathering activities. The laboratory will report detected data down to the method detection limits (MDLs) current at the time of analysis. All data detected between the MDL and the targeted quantitation limits will be flagged as estimated.

2.9 Special Training/Certification Requirements

The contractor field sampling team members are required to have successfully completed relevant field training protocols. They are also required to have received the 40-hour Hazardous Waste Operations and Emergency Response (known as HAZWOPER) safety training and annual 8-hour refresher courses required by 29 CFR Parts 1910 and 1926.

Laboratory personnel training records are maintained by each laboratory. The laboratory is required to be accredited by the National Environmental Laboratory Accreditation Program (NELAP) to demonstrate compliance with USEPA's requirement that the laboratory have a documented quality system that complies with ANSI/ASQC E4-94 ("Specifications and Guidelines for Quality System for Environmental Data Collection and Environmental Technology Programs", January 1995), and EPA QA/R-2 ("EPA Requirements for Quality Management Plans", March 2001).

2.10 Documentation and Records

The documents, records, and reports generated during the monitoring activities are identified in the following subsections.

2.10.1 Field and Laboratory Records

Documents and records generated during the project include sample collection records, QC sample records, field measurement records, laboratory records, and data handling records. A brief

description of these documents and records are provided below. Detailed information on these records is provided in subsequent sections of this QAPP.

Sample collection records that will be used during the program's sampling activities include field logbooks and/or project standard field forms, stratigraphic logs, chain-of-custody records, and shipping papers.

QC sample records that will be used during the project to document the generation of QC samples include field logbooks and/or project standard field forms recording field blank samples, field duplicate samples, and MS/MSD samples. The laboratory will maintain appropriate documentation of trip blank sample preparation. The laboratory will maintain quality records for deionized water sent for field blank samples, and sample integrity information. Records of sample preservation will be maintained in field logbooks and/or on project standard field forms, and by the laboratory.

Field measurements (such as depth to water, pH, temperature, conductivity, dissolved oxygen (DO), turbidity, and sample appearance) will be recorded in field logbooks and/or on project standard field forms. Calibration data, where applicable, will also be recorded in these logbooks and/or on project standard field forms.

Laboratory records that will be maintained for the project include sample receipt documentation, field and laboratory chain-of-custody documentation, sample container cleanliness certifications, reagent and standard reference material certifications, sample preparation records, sample analysis records (e.g., run logs), instrument/raw data, QC data, calibration data, corrective action reports, and final reports.

Data handling records that will be maintained include verification of computer programs used to manipulate or reduce raw data into final results and data validation reports. The laboratory will maintain documentation of data verification and reduction procedures as necessary for the analyses used during the monitoring activities. The contractor will maintain checklists, notes, and reports generated during the external data validation process.

2.10.2 Data Reporting Format

Field data will be recorded in field logbooks and/or on project standard field forms. The details for recording field data are provided in Section 3.2.2.1 of this QAPP. Field data will be generated primarily from direct-reading meters or consist of field readings (e.g., depth to water measurements) or observations. These data will be tabulated and included in project reports or submittals.

Laboratory reports for the monitoring activities will include the data deliverables summarized in Table 2.3.

Raw instrument data (including calibration data and instrument performance checks), method detection limit (MDL) studies, and method performance and validation studies will be maintained by the laboratory.

2.10.3 Data Archiving and Retrieval

All records will be maintained consistent with the contractor and laboratory record retention policies.

3. Data Generation and Acquisition

The design and implementation of the measurement systems that will be used during the monitoring activities, including sampling procedures, analytical procedures, and data handling and documentation, are detailed in the following subsections.

3.1 Sampling Process Design

The rationale for the sampling program was provided in Section 2.6 of this QAPP.

3.1.1 Field Equipment and Sample Container Cleaning Procedures

Dedicated or single-use sampling equipment will be utilized for all sampling activities. Sample containers will be provided by the laboratory. All containers will be precleaned in accordance with the U.S. EPA guidance document entitled "Specifications and Guidance for Contaminant-Free Sample Containers", EPA 540/R-93/051. Certificates of analysis for each lot of containers will be maintained by the laboratory or be available from the vendor upon request.

3.1.2 Field Equipment Maintenance, Testing, and Inspection Requirements

Field equipment will be inspected and tested prior to use in the field. Maintenance logs for all field equipment are kept in field equipment files. Prior to use in the field, the equipment is checked again, generally during field calibration, and the performance information is recorded in the field logbook and/or on a standard field equipment form. All equipment returned from the field is inspected and tested. Any required maintenance is performed and documented prior to the equipment being returned to service.

Critical spare parts for field equipment and replacement field equipment are available and can be delivered to the field when the need is identified. Alternately, field equipment vendors can provide replacement equipment if needed. The replacement equipment can be shipped for overnight delivery as necessary. A list of critical spare parts for field instruments is provided in Table 3.1.

3.1.3 Inspection and Acceptance Requirements for Supplies and Sample Containers

The field supplies for the monitoring activities consist of calibration standard solutions for field instrument calibration and calibration checks, detergent (Alconox) and solvents for equipment cleaning, distilled water for sample collection equipment rinsing, deionized water for final sample collection equipment rinsing and for collecting equipment rinsate blank samples, chemical preservatives for pH adjustment of the appropriate aliquots of samples, and sample containers to collect the samples.

Field calibration standards are traceable to National Institute of Standards and Technology standards. The field QA Officer is ultimately responsible for ensuring that the field calibration standards for the project are acceptable. Calibration standards will be checked prior to being sent to the field to ensure that they have not expired or otherwise degraded. New calibration standards will be purchased if existing standards are found to be expired or degraded. Alconox, a standard

laboratory-grade detergent, and distilled water will be purchased as needed from a variety of vendors.

Deionized water, purge-and-trap grade water, chemical preservatives, and sample containers will be provided by the laboratory. The laboratory will maintain documentation of the purity/cleanliness for these materials. The laboratory QA Officer is ultimately responsible for ensuring these materials are acceptable for the project. The acceptability of these materials for use will be evaluated by reviewing lot analysis certificates (deionized water, chemical preservatives, and containers). Water, preservatives, and containers that do not meet the laboratory's acceptability requirements will not be shipped to the field.

3.2 Sample Handling and Custody Requirements

The procedures for sample handling, labeling, shipping, and chain-of-custody documentation are provided in the subsections that follow.

3.2.1 Sample Handling

Sample aliquots will be containerized in order of decreasing analyte volatility. Table 3.2 identifies the requirements for the number of containers, container volume, container type (material of construction), preservation, holding time periods, and shipping for the analyses.

Samples will be placed in shipping coolers containing bagged, cubed ice immediately following collection. The samples will be grouped in the shipping cooler by the order in which the samples are collected, and then either couriered to the laboratory that day or shipped to the laboratory via an overnight courier service, generally on the day they are collected. The only exceptions to this procedure will be for samples collected after the courier service has picked up the shipment for the day and when samples are collected on a Sunday or holiday. In these instances, the samples will be shipped on the next business day.

3.2.2 Sample Custody

Chain-of-custody is the sequence of possession of an item. An item (such as a sample or final evidence file) is considered to be in custody if the item is in actual possession of a person, the item is in the view of the person after being in his/her actual possession, or the item was in a person's physical possession but was placed in a secure area by that person. Field, laboratory, and final evidence files custody procedures are described in the subsections that follow.

3.2.2.1 Field Custody Procedures

Logbooks and/or project standard field forms will be used to record field data collection activities. Entries will be described in as much detail as possible to ensure that a particular situation could be reconstructed solely from these entries. Field logbooks are bound field survey books or notebooks with consecutively numbered pages. Logbooks will be assigned to field personnel and will be stored by the contractor when not in use. Each logbook will be identified by a project-specific document number.

The title page of each logbook will contain the following information:

- Person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- End date

Entries into the logbook will contain a variety of information. At the beginning of each day's logbook entry, the date, start time, weather, names of all sampling team members present, and the signature of the person making the entry will be entered. The names of individuals visiting the site or field sampling team and the purpose of their visit will also be recorded in the field logbook.

All field measurements obtained and sample collection information will be recorded in a logbook and/or on a project standard field form. Project standard field forms are specifically prepared for each project sample location. These forms are used to record all field measurements obtained and samples collected for each location. All entries will be made in ink, signed, and dated with no erasures. If an incorrect entry is made, the incorrect information will be crossed out with a single strike mark. The correct information will be entered adjacent to the original entry.

Whenever a sample is collected or a measurement is made, an identification and a detailed description (if necessary) of the location will be recorded in the logbook and/or on a project standard field form. Photographs taken at a location, if any, will be noted in the logbook. All equipment used to obtain field measurements will be recorded in the field logbook and/or on a project standard field form. In addition, the calibration data for all field measurement equipment will be recorded in the field logbook or on standard field forms.

The equipment used to collect samples, time of sample collection, sample description, volume and number of containers, and preservatives added (if applicable) will be recorded in the field logbook and/or on a project standard field form. A deviation from sampling procedures will be documented in the field logbook and/or on a project standard field form. Each sample will be uniquely identified.

The sample packaging and shipping procedures summarized below will ensure that the samples arrive at the laboratory with the chain-of-custody intact:

1. The field sampler is personally responsible for the care and custody of the samples until they are transferred to another person or the laboratory. As few people as possible will handle the samples.
2. All sample containers will be identified by using sample labels that include the date and time of collection and analyses to be performed. Sample labels will be completed for each sample using waterproof ink.
3. Samples will be accompanied by a properly completed chain-of-custody form. The sample identification numbers and required analyses will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign and record the date and time on the form. The chain-of-custody form

documents sample custody transfers from the sampler to another person, to the laboratory, or to/from a secure storage area.

4. Water samples will be properly packaged for shipment using bubble wrap or foam sleeves and dispatched to the laboratory for analysis with a separate signed chain-of-custody form enclosed in and secured to the inside top of each shipping cooler. Shipping coolers for water samples will be secured with custody seals for shipment to the laboratory. The custody seal is then covered with clear plastic tape to prevent accidental damage to the custody seal.

5. If samples are split (collocated) with a government agency or other entity, it is the responsibility of that entity to prepare its own chain-of-custody form for the samples. Information regarding the identity of the entity and the sample(s) that are being split will be recorded in the field logbook.

6. All sample shipments will be accompanied by the chain-of-custody form identifying its contents. The chain-of-custody form is a four part carbonless-copy form. The form is completed by the sampling team which, after signing and relinquishing custody to the shipper, retains the bottom (goldenrod) copy. The shipper, if different than the sampling team members, retains the pink copy after relinquishing custody to the laboratory. The yellow copy is retained by the laboratory and the fully executed white copy is returned as part of the data deliverables package.

7. If the samples are sent by common carrier, a bill of lading (e.g., FedEx airbill) will be used and copies will be retained as permanent documentation. Commercial carriers are not required to sign the chain-of-custody form provided the form is sealed inside the sample cooler with the custody tape intact.

3.2.2.2 Laboratory Custody Procedures

Laboratory sample custody begins when the samples are received at the laboratory. Each laboratory's sample custodian will assign a unique laboratory sample identification number to each incoming sample. The field sample identification numbers, laboratory sample identification numbers, date and time of sample collection, date and time of sample receipt, and requested analyses will be entered into the sample receiving log. The laboratory's sample log-in, custody, and document control procedures will be consistent with its standard operating procedure.

Following log-in, all samples will be stored within an access-controlled location and will be maintained properly preserved (as defined in Table 3.2) until completion of all laboratory analyses. Unused sample aliquots and sample extracts/digestates will be maintained properly preserved for a minimum of 30 days following receipt of the final report. The laboratory will be responsible for the disposal of unused sample aliquots, sample containers, and sample extracts/digestates in accordance with all applicable local, state, and federal regulations.

The laboratory will be responsible for maintaining analytical logbooks and laboratory data.

3.2.2.3 Final Evidence Files Custody Procedures

The final evidence file for the project will be maintained by de maximis or the client approved contractor and will consist of the following:

1. Project plans
2. Project logbooks
3. Field data records
4. Sample identification documents
5. Chain-of-custody records
6. Correspondence
7. References, literature
8. Final data packages
9. Miscellaneous - photos, maps, drawings, etc.
10. Reports

The final evidence file materials will be the responsibility of the evidentiary file custodian with respect to maintenance and document removal.

3.3 Analytical Method Requirements

The field and laboratory analytical methods that will be used during the monitoring activities are detailed in the following subsections.

3.3.1 Field Analytical Methods

Field measurements obtained during sampling may include pH, temperature, conductivity, turbidity, and dissolved oxygen. These data will also be used to determine when groundwater or surface water is suitable for the collection of representative samples, as applicable to the monitoring program. Field-portable meters will be used to analyze the samples.

3.3.2 Laboratory Analytical Methods

The analytical methods that will be used are presented in Table 2.1. The quantities and types of QC samples to be collected are included in Table 2.1.

The turnaround time required for the analyses required for each batch of samples will be noted on the chain-of-custody documents submitted with the samples and will be communicated to the laboratory prior to the sampling event, as necessary.

3.4 Quality Control Requirements

The field and laboratory QC requirements for the monitoring activities are discussed in the following subsections. Specific QC checks and acceptance criteria are provided in the referenced analytical methods.

3.4.1 Field Sampling Quality Control

Field QC requirements include analyzing reference standards for instrument calibration and for routine calibration checks. Field QC samples for this project include equipment blank samples to determine the existence and magnitude of sample contamination resulting from ambient conditions or sampling procedures, field duplicate samples to assess the overall precision of the sampling and analysis event, and trip blank samples to monitor cross-contamination of samples by VOCs. The frequency of collection of these field QC samples is summarized in Table 2.1 of this QAPP. The evaluation of field QC data is provided in Section 3.9.2 of this QAPP.

3.4.2 Analytical Quality Control

The laboratory QC requirements for the analyses include analyzing method blanks, instrument performance checks, initial calibration standards, calibration verification standards, internal standards, surrogate compound spikes, interference check samples, serial dilution samples, MS/MSD samples, and LCSs. The acceptance criteria are specified in the methods or are determined statistically by the laboratory and will be included in the laboratory reports. The analysis frequency will be consistent with the referenced methods in Table 2.1.

3.5 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The procedures used to verify that instruments and equipment are functional and properly maintained are described in the following subsections.

3.5.1 Field Instrument Maintenance

The field equipment for this project may include water level, pH/temperature, conductivity, DO, and turbidity meters. Specific preventive maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use, as applicable. The maintenance schedule and trouble-shooting procedures for field instruments are presented in Table 3.1 of this QAPP.

3.5.2 Laboratory Instrument Maintenance

As part of its QA/QC program, each laboratory conducts routine preventive maintenance to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees will regularly perform routine scheduled maintenance and repair of (or coordinate with the instrument manufacturer for the repair of) all instruments. All maintenance that is performed will be documented in the laboratory's maintenance logbooks. All laboratory instruments are maintained in accordance with manufacturer's specifications.

Table 3.1 provides examples of the frequency at which components of key analytical instruments or equipment will be serviced.

3.6 Calibration Procedures and Frequency

The procedures for maintaining the accuracy for all the instruments and measuring equipment that will be used for conducting field tests and laboratory analyses are described in the following

subsections. These instruments and equipment will be calibrated prior to each use or according to a periodic schedule.

3.6.1 Field Instruments/Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used during field sampling will be examined to confirm that it is in operating condition. This includes checking the manufacturer's operating manual for each instrument to ensure that all maintenance requirements are being observed. Individual calibration records for each field instrument that will be used for the project will be reviewed to ensure that any prior equipment problems have not been overlooked and all necessary repairs to equipment have been completed.

3.6.2 Laboratory Instruments

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing these quality control activities. These records generally will be filed at the location where the work is performed and will be subject to a QA audit. The laboratory will have trained staff and in-house spare parts available for instrument repair or will maintain service contracts with vendors. Specific calibration procedures and frequencies are detailed in the referenced methods.

3.7 Inspection/Acceptance Criteria for Supplies and Consumables

The procedures that will be used to ensure that supplies and consumables used in the field and laboratory will be available as needed and free of contaminants are detailed in the following subsections.

3.7.1 Field Supplies and Consumables

Supplies and consumables for field measurements and sampling will be obtained from various vendors and may include standards for pH, turbidity, and conductivity meter calibration, sample containers, preservatives, solvents and detergent, water for equipment decontamination, and equipment blank water. The vendors and inspection and acceptance criteria for these field supplies were presented in Section 3.1.4 of this QAPP. Additional field supplies and consumables may include pump tubing and personnel protective equipment (PPE). Pump tubing will be constructed of pre-cleaned high density polyethylene. These materials will not introduce contaminants into the samples or interfere with the analyses. All field supplies will be consumed or replaced with sufficient frequency to prevent deterioration or degradation that may interfere with the analyses.

3.7.2 Laboratory Supplies and Consumables

The laboratory's vendors for general labware and reagents may include VWR Scientific Products and Fisher Scientific. Vendors for chromatography supplies and organic standards may include Ultra Scientific, Supelco, Accustandard, Restek, ChemService, Cambridge Isotopes, and Aldrich

Chemical. The lot numbers of reagents and standards will be recorded and dates of receipt, first use, and expiration will be documented by the laboratory. Certificates of analysis will be maintained on file to document reagent/standard purity.

The referenced methods provide details on identifying contaminants in reagents and standards, determining deterioration of reagents and standards, and the corrective actions required if contaminants or deterioration are identified. The laboratory QA Officer is ultimately responsible for the ensuring the acceptability of supplies and consumables.

3.8 Data Acquisition Requirements (Non-Direct Measurements)

Data generated during the sampling events are verified and validated. Data from other sources are not required for these sampling events.

3.9 Data Management

The procedures for managing data from generation to final use and storage are detailed in subsections that follow.

3.9.1 Data Recording

Field data will be recorded in field logbooks and/or on project standard field forms and consist of measurements from direct reading instruments or direct measurements. Field staff are responsible for recording field data and the Field QA Officer is responsible for identifying and correcting recording errors.

Laboratory data are recorded in a variety of formats. Data from instruments are recorded on magnetic media, strip charts, or bench sheets. The referenced methods provide the data recording requirement for each preparation and analysis method.

3.9.2 Data Validation

Validation of field data for this project will primarily consist of checking for transcription errors and reviewing data recorded in field logbooks. Data transcribed from the field logbook into summary tables for reporting purposes will be verified for correctness by the Field QA Officer or his designee. Any limitations on the use of field data will be identified in the required reports.

Validation of the analytical data will be performed based on the relevant and applicable evaluation criteria outlined in "USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review", EPA 540-R-08-01, June 2008 and "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review", EPA-540-R-10-011, January 2010. The evaluation and action criteria specified in these documents (referred to hereafter as the National Functional Guidelines) will be used for validating the data. Qualifiers assigned to the data will be consistent with the data qualifiers specified in the National Functional Guidelines.

The results of the data validation process will be documented in a report that specifies all limitations on the usability of the analytical data.

3.9.3 Data Transformation/Data Reduction

Field data reduction procedures will be minimal in scope compared to those implemented for laboratory data. Only direct reading instrumentation will be employed in the field. The use of field instruments will generate data read directly from the meters following calibration. These data will be recorded into field logbooks and/or on project standard field forms immediately after the measurements are obtained.

Laboratory data reduction consists of producing the final results from raw data. The procedures, calculations, and specific equations used by the laboratory for data reduction are detailed in the referenced methods.

3.9.4 Data Transmittal/Transfer

Field data will be entered into a standard Microsoft Excel spreadsheet or similar format. The Field QA Officer is responsible for verifying the correctness of the field data after the data are transferred to a spreadsheet format. Geographical data are maintained in a database that is described below.

The laboratory will provide data in electronic format as electronic data deliverables (EDDs). EDDs are generated directly from the laboratory information management system (LIMS), thereby eliminating the possibility of manual transcription errors. Laboratory EDDs are imported into the EQuIS database, and the data are maintained in the database for manipulation and presentation.

The contractor shall verify the correctness of the analytical database after the laboratory data for each event have been imported. This is accomplished by comparing the data from the database to the hardcopy analytical reports for a minimum of 10 percent of the sample results. If discrepancies between the database and hardcopy analytical reports are detected, a complete verification of the database will be performed or a new EDD will be submitted, imported, and verified as described previously.

3.9.5 Data Analysis

Data will be analyzed to determine flow direction, contours, and concentration gradients. It is anticipated that commercially-available GIS software may be used to facilitate the evaluation/visualization of the data. The actual software used and input parameters/assumptions will be identified in project reports, as necessary. There are no extreme or unique computer hardware requirements to use this software.

3.9.6 Data Assessment

Assessment of laboratory data will be performed using the procedures detailed in each analytical method. These assessments included determining the mean, standard deviation, relative standard deviation, percent difference, RPD, and percent recovery for certain QC elements.

Assessment of QC data for data validation purposes will include determining the percent recovery, RPD, and percent completeness. The statistical equations to determine these parameters are provided in Section 5.3 of this QAPP.

3.9.7 Data Tracking

Data generated in the field, such as water level measurements, will be recorded in field logbooks and/or on project standard field forms. There are no unique or special tracking requirements for these data. The data will be transcribed for analysis and reporting as discussed in Section 3.9.4, and the field logbooks and forms will be maintained in the final evidence file.

The laboratory's LIMS will provide the means for tracking data in the laboratory. The Laboratory Director is ultimately responsible for data tracking in the laboratory.

Tracking of analytical data in the database includes recording the laboratory generating the data, the dates when the EDD was received and imported, the date when qualifiers were applied to the results, the level of data review performed, and the data review guidance used to evaluate the data. The Project Manager is ultimately responsible for tracking data from entry to reporting.

3.9.8 Data Storage and Retrieval

Laboratory data will be stored in hardcopy and/or electronic format for a minimum period of 5 years. Electronic instrument data will be maintained for this same time period. All laboratory records for this project will be maintained consistent with the storage requirements stated in Section 2.10.3 of this QAPP.

The Project Manager is responsible for project data storage and retrieval. Final evidence files, which will include a copy of all laboratory data, will be maintained by de maximis, inc. or the client approved contractor.

3.9.9 Data Security

Laboratory data security is the responsibility of the Laboratory Director. Archived data cannot be accessed without authorization, and the name and purpose of personnel accessing archived data are recorded. The laboratory's LIMS is password protected and access rights are restricted by job function. Consultant data security procedures include limiting project database access to database managers and analysts, in addition to general building security procedures.

4. Assessment/Oversight

The following subsections describe the procedures used to ensure proper implementation of this QAPP and the activities for assessing the effectiveness of the implementation of the project and associated QA/QC activities.

4.1 Assessments and Response Actions

Assessments consisting of internal and external audits may be performed during the project. Internal technical system audits of both field and laboratory procedures will be conducted to verify that sampling and analysis are being performed in accordance with the procedures established in the QAPP. External field and laboratory audits may be conducted.

An internal field technical system audit of field activities, including sampling and field measurements, will be conducted by the Field QA Officer or his designee at the beginning of the field sampling activities to identify deficiencies in the field sampling and documentation procedures. The field technical system audit will include examining field sampling records, field instrument operating records, field instrument calibration records, and chain-of-custody documentation. In addition, sample collection, handling, and packaging in compliance with the established procedures will be reviewed during the field audit. Any deficiencies identified will be documented and corrective actions will be taken to rectify the deficiencies.

Corrective action resulting from internal field technical system audits will be implemented immediately if data may be adversely affected from the use of unapproved methods or the improper use of approved methods. The field QA Officer will identify deficiencies, if any, and recommended corrective action to the Project Manager. Implementation of corrective actions will be performed by the Field QA Officer and field team. Corrective action will be documented in the field logbook and/or the project file. Follow-up audits will be performed as necessary to verify that deficiencies have been corrected and that the QA/QC procedures described in this QAPP are maintained throughout the project.

An external field technical system audit may be conducted by NYSDEC any time during the field operations. These audits may or may not be announced and are conducted at the discretion of the agency.

An internal laboratory technical system audit will be conducted by the laboratory's QA Officer or designee. The laboratory technical system audit typically is conducted on an annual basis and includes examining laboratory documentation regarding sample receiving, sample log-in, storage and tracking, chain-of-custody procedures, sample preparation and analysis, instrument operating records, data handling and management, data tracking and control, and data reduction and verification. The laboratory's QA Officer will evaluate the results of the audit and provide a report to section managers and the Laboratory Director that includes any deficiencies and/or noteworthy observations.

Corrective action resulting from deficiencies identified during the internal laboratory technical system audit will be implemented immediately. The Laboratory Director or section leaders, in consultation with the laboratory supervisor and staff, will approve the required corrective action to be implemented by the laboratory staff. The laboratory QA/QC Officer will ensure implementation and documentation of the corrective action. All problems requiring corrective action and the corrective action taken will be reported to the Laboratory Project Manager. Follow-up audits will be performed as necessary to verify that deficiencies have been corrected.

An external laboratory audit may be conducted at the discretion of the client. These audits may or may not be announced. External laboratory audits, if conducted, may include, but not be limited to, reviewing laboratory analytical procedures, laboratory on-site audits, and/or submitting performance evaluation samples to the laboratory for analysis.

4.2 Reports to Management

Quality assurance information will be summarized following completion of a monitoring event's activities. This information will consist of the results of external performance evaluations and system

audits, results of periodic data quality validation and assessment, data use limitations, and any significant QA problems identified and corrective actions taken.

The QA Officer will be responsible within the organizational structure for compiling this information. The Project Manager will be provided with this information, to be included, as appropriate, in required reports.

5. Data Verification/Validation and Usability

The QA activities that will be performed to ensure that the data are scientifically defensible, properly documented, of known quality, and meet the project objectives are described in the following sections.

5.1 Data Review, Verification, and Validation Requirements

All field and laboratory data will be reviewed, verified, and validated. These terms are defined as follows:

- Data review is the in-house examination to ensure that the data have been recorded, transmitted, and processed correctly.
- Data verification is the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual specifications.
- Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond method, procedure, or contractual compliance (i.e., data verification) to determine the quality of a specific data set relative to the end use.

The procedures and criteria used to verify and validate field and laboratory data are presented in Section 5.2. Field data and logbooks will be reviewed to ensure that the requirements of the sampling program, including the number of samples and locations, sampling, and sample handling procedures, were fulfilled.

Laboratory data review consists of raw data being reduced to results and checked by the responsible analyst. A second review of the data reduction procedure is conducted by another analyst or senior chemist. After the data are verified (see Section 5.2), a draft report is reviewed by the laboratory Project Manager. Final reports are generated, signed, and transmitted after approval of the draft by the Project Manager.

5.2 Verification and Validation Methods

Field data will be verified by reviewing field documentation and chain-of-custody records. Data from direct-reading field instruments will be verified by reviewing calibration and operating records and the QC data specified in Section 2.8.2 of this QAPP.

Verification of sample collection procedures consists of reviewing sample collection documentation for compliance with the requirements of the QAPP. If alternate sampling procedures were used, the acceptability of the procedure will be evaluated to determine the effect on the usability of the data.

Data usability will not be affected if the procedure used is determined to be an acceptable alternative that fulfills the measurement performance criteria in Section 2.8.2 of this QAPP.

The laboratory will internally verify its data by reviewing and documenting sample receipt, sample preparation, sample analysis (including internal QC checks), and data reduction and reporting. Any deviations from the acceptance criteria, corrective actions taken, and data determined to be of limited usability (i.e., laboratory-qualified data) will be noted in the laboratory reports.

Verification of laboratory data will consist of reviewing the final reports to ensure that the methods used to analyze the samples were consistent with the requirements of this QAPP. Sample handling records will also be reviewed to ensure that sample integrity remained intact from collection to laboratory receipt and that samples were properly preserved. Chain-of-custody documentation and sample condition upon laboratory receipt will be reviewed. Laboratory results, holding time periods, and QC data will be reviewed to determine compliance with the measurement performance criteria in Section 2.8.2 of this QAPP and the analytical methods.

Data validation will be conducted consistent with the procedure identified in Section 3.9.2 of this QAPP. The results of the data validation procedure will identify data that do not meet the measurement performance criteria in Section 2.8.2 of this QAPP. Data validation will determine whether the data are acceptable, of limited usability (qualified as estimated), or rejected. Data qualified as estimated will be reviewed and a discussion of the usability of estimated data will be included in the data validation memoranda. The results of data verification/validation will be summarized in data validation memoranda provided to the Project Manager for use in interpreting the results and for use in project reports.

Data determined to be unusable may require corrective action to be taken. Potential types of corrective action may include resampling by the field team or reanalysis of samples by the laboratory. The corrective actions taken are dependent upon the ability to mobilize the field team and whether or not the data are critical for project DQOs to be achieved. The Project Manager will be responsible for approving the implementation of any corrective action deemed to be necessary during data verification/validation.

5.3 Usability/Reconciliation with Data Quality Objectives

The overall usability of the data for the investigation will be assessed by evaluating the PARCCS of the data set to the measurement performance criteria in Section 2.8.2 of this QAPP using basic statistical quantities, as applicable. The procedures and statistical formulas to be used for these evaluations are presented in the following subsections.

5.3.1 Precision

Precision of field sampling procedures will be evaluated by assessing the RPD data from field duplicate samples. Analytical precision will be evaluated by assessing the RPD data from either duplicate spiked sample analyses, laboratory duplicate analyses, or duplicate LCS analyses. The RPD between two measurements is calculated using the following simplified formula:

$$RPD = \frac{|R_1 - R_2|}{R_1 + R_2} \times 200$$

where:

R_1 = value of first result
R_2 = value of second result

RPD data will provide the means to evaluate the overall variability attributable to the sampling procedure, sample matrix, and laboratory procedures. It should be noted that the RPD of two measurements can be very high when the concentrations approach the quantitation limit of an analysis. RPDs for field duplicate samples will only be calculated when the concentrations of an analyte detected in both samples are greater than or equal to 5 times the quantitation limit for the analyte. The variability of analytes detected at concentrations less than 5 times their quantitation limits will be determined by visually examining the results for the investigative and field duplicate sample, but RPDs will not be calculated in these instances.

5.3.2 Accuracy/Bias

The data from method blank samples, trip blank samples, MS/MSD samples, surrogate compound spikes, and LCSs will be used to determine accuracy and potential bias of the sample data.

The data from method blank samples provide an indication of laboratory contamination that may result in bias of sample data. Sample data associated with method blank contamination will have been identified during the data verification/validation process. Sample data associated with method blank contamination are evaluated during the data validation procedure to determine if analytes detected in samples associated with contaminated method blanks are "real" or are the result of laboratory contamination. The procedure for this evaluation involves comparing the concentration of the analyte in the sample to the concentration in the method blank sample taking into account adjustments for sample preparation and dilution factors. In general, the sample data are qualified as not detected if the sample concentration is less than 5 times (10 times for common organic laboratory contaminants) the method blank concentration. Typically, the quantitation limit for the affected analyte is elevated to the concentration detected in the sample.

The data from equipment and trip blank samples provide an indication of field conditions that may result in bias of sample data. Sample data associated with contaminated equipment, field, and trip blank samples will have been identified during the data verification/validation process. The evaluation procedure and qualification of sample data associated with equipment and trip blank contamination are performed in a similar manner as the evaluation procedure for method blank sample contamination.

Matrix spike sample data provide information regarding the accuracy/bias of the analytical methods relative to the sample matrix. Matrix spike samples are field samples that have been fortified with target analytes prior to sample preparation and analysis. The percent recovery data provide an indication of the effect that the sample matrix may have on the preparation and analysis procedure. Sample data exhibiting matrix effects will have been identified during the data verification/validation process.

Surrogate spike recoveries provide information regarding the accuracy/bias of organic analyses on an individual sample basis. Surrogate compounds are not expected to be found in the samples and are added to every sample prior to sample preparation. The percent recovery data provide an indication of the effect that the sample matrix may have on the preparation and analysis procedure. Sample data exhibiting matrix effects will have been identified during the data verification/validation process.

Analytical accuracy/bias will be determined by evaluating the percent recovery data of LCSs. LCSs are artificial samples prepared in the laboratory using a blank matrix fortified with analytes from a standard reference material that is independent of the calibration standards. LCSs are prepared and analyzed in the same manner as the field samples. The percent recovery data from LCS analyses will provide an indication of the accuracy and bias of the analytical method for each analyte or analyte group.

Percent recovery is calculated using the following formula:

$$\%R = \frac{SSR - SR}{SA} \quad X \quad 100$$

where:

SSR = Spiked Sample Result
SR = Sample Result or Background
SA = Spike Added

The percent recovery for surrogate compounds and LCSs are determined by dividing the measured value by the true value and multiplying by 100.

Accuracy/bias will be determined by comparing the percent recovery data to the measurement performance criteria in Section 2.8.2 of this QAPP.

5.3.3 Sample Representativeness

Representiveness of the samples will be assessed by reviewing sample holding times, the results of field audits, if conducted, and the data from field duplicate samples. Sample representativeness will be considered acceptable if holding time periods are met, the results of field audits indicate that the approved sampling methods or alternate acceptable sampling methods were used to collect the samples, and the field duplicate RPD data are acceptable.

5.3.4 Completeness

Completeness will be assessed by comparing the number of valid (usable) sample results to the total possible number of results within a specific sample matrix and/or analysis. Percent completeness will be calculated using the following formula:

$$\% \text{ Completeness} = \frac{\text{Number of Valid (usable) measurements}}{\text{Number of Measurements Planned}} \times 100$$

Completeness will be considered acceptable if 90 percent of the data are determined to be valid. However, valid sample data will not be rendered unusable if this completeness goal is not met.

5.3.5 Comparability

The comparability of data sets will be evaluated by reviewing the sampling and analysis methods used to generate the data for each data set. Comparability will be determined to be acceptable if the sampling and analysis methods specified in this QAPP and any approved QAPP revisions or amendments are used for generating the data.

Comparability of data from split samples (samples that are collected at the same time from the same location and split equally between two parties using sample containers from the same source or vendor), if collected, will be evaluated by determining the RPD of detected analytes in both samples following data verification/validation. Analytes that are detected in only one of the two samples will be assessed by reviewing the data validation reports for both data sets and determining the cause of the discrepancy, if possible. Comparability of split sample data will be considered acceptable if the RPD for detected analytes with concentrations greater than or equal to 5 times their respective quantitation limits does not exceed RPD acceptance criteria for field duplicate samples.

5.3.6 Sensitivity and Quantitation Limits

Laboratory reports will include method reporting limits and method detection limits. These limits will be reviewed for the samples to ensure that the sensitivity of the analyses was sufficient to achieve the program requirements. All relevant QC data will be reviewed to assess compliance with the measurement performance criteria specified in Section 2.8.2 of this QAPP.

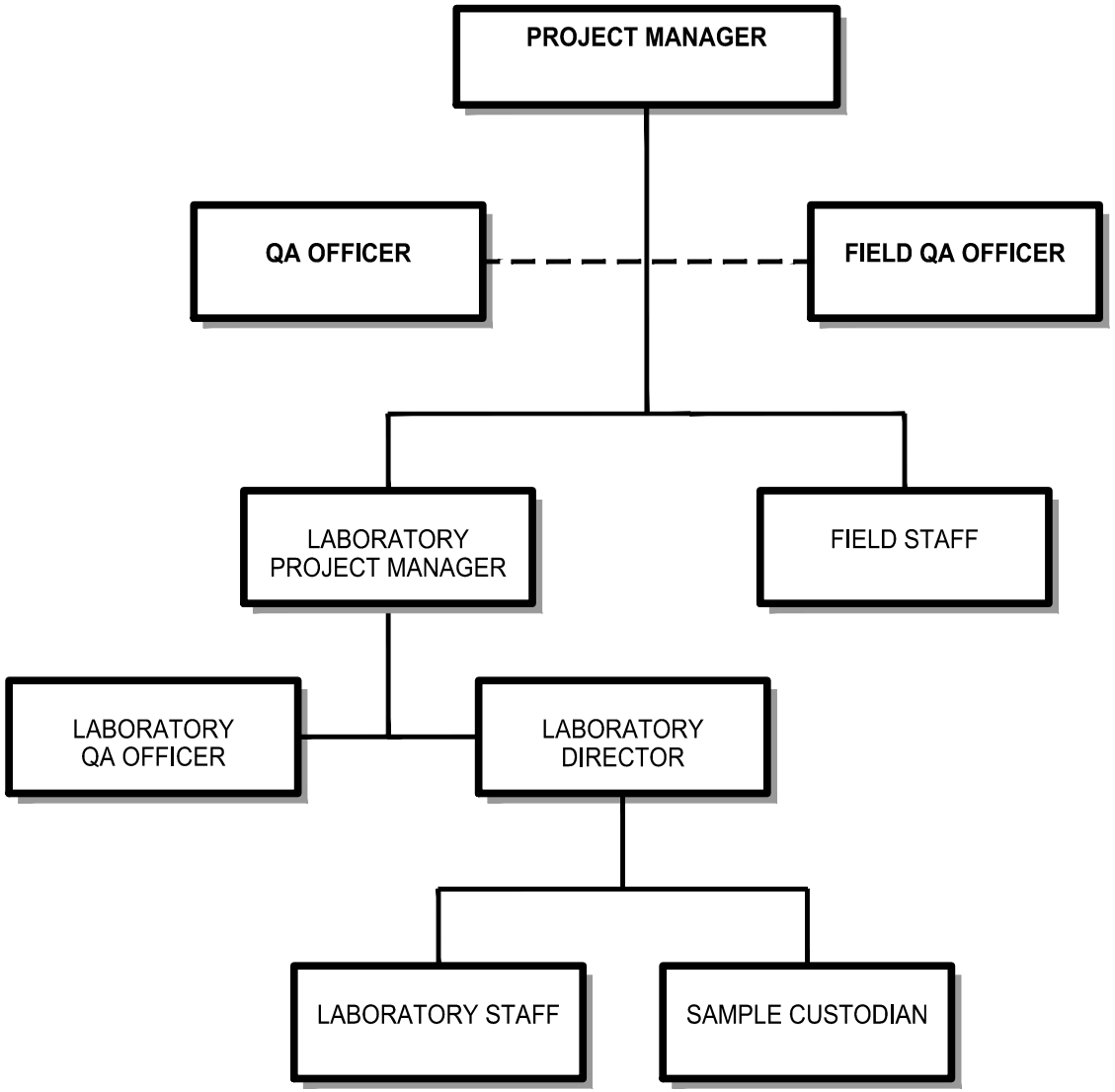
It should be noted that quantitation limits may be elevated as a result of high concentrations of target compounds, non-target compounds, and matrix interferences (collectively known as sample matrix effects). In these cases, the sensitivity of the analyses will be evaluated on an individual sample basis relative to the applicable evaluation criteria.

5.3.7 Data Limitations and Actions

Data use limitations will be identified in data validation reports. Data that do not meet the measurement performance criteria specified in this QAPP will be identified and the impact on the project quality objectives will be assessed and discussed in these reports and project reports. Field information will be reviewed to ensure that all sampling procedures and field measurements were conducted in accordance with the requirements of this QAPP. Field measurements obtained or data

from samples collected using procedures inconsistent with the requirements of this QAPP will be evaluated using the procedures in Section 5.1 of this QAPP. Specific actions for field or laboratory data that do not meet the measurement performance criteria depend on the use of the data, and may require that additional samples are collected or the use of the data be restricted.

Figures



OLD ERIE CANAL SITE

PROJECT QA ORGANIZATION

Project No. **35048**
Report No. **009F**
Date **JUL 18**

Figure F2.1

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Tables

TABLE 2.1

SAMPLING AND ANALYSIS SUMMARY
SITE MANAGEMENT PLAN
OLD ERIE CANAL SITE
CLYDE, NEW YORK

Matrix	*Analytical Parameters*	*Analytical Methods*	*Estimated Number of Samples*	*Field Duplicates*	*Equipment Blanks (4)*	*Trip Blanks*	*MS/MSD/Dup*
Soil	TCL VOCs	SW 8260C (1)	TBD	1 per 20	1 per 20	1/cooler	1 per 20
Soil	TCL SVOCs	SW 8270 (1)	TBD	1 per 20	1 per 20	0	1 per 20
Soil	Metals	SW 6010 (1)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	TCL VOCs	SW 8260C (1)	TBD	1 per 20	1 per 20	1/cooler	1 per 20
Groundwater (MNA)	C^{13} Compound Specific Isotope Analysis on TCE, cic-1,2-DCE and VC	CSIA	TBD	1 per 20	1 per 20	1/cooler	1 per 20
Groundwater (MNA)	Total & Dissolved Iron, Manganese, Sodium	SW 6010 (1)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	Ammonia	EPA 350.1 (2)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	Sulfate	EPA 300 (2)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	Sulfide	SM 4500 S^{2-} (3)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	Nitrate	EPA 300 (2)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	Orthophosphate	EPA 365.1 (2)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	Dissolved Gases	RSK-175 (5)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	Dissolved Organic Carbon	SM 5310B (3)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	Chloride	EPA 300 (2)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	Alkalinity	SM 2320B (3)	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	DHC presence/absence by PCR	qPCR	TBD	1 per 20	1 per 20	0	1 per 20
Groundwater (MNA)	Vinyl chloride reductase by PCR	qPCR	TBD	1 per 20	1 per 20	0	1 per 20
Vapor, Indoor Air, Ambient Air	VOCs	TO-15	TBD	1 per 20	1 per 20	0	0

Notes:

(1) - "Test Methods for Solid Waste Physical/Chemical Methods", SW-846, 3rd Edition, September 1986 (with all subsequent revisions)
(2) - "Methods for the Chemical Analysis of Water and Wastes", EPA-600/4-79-220, March 1983 (with revisions).
(3) - "Standard Methods for the Examination of Water and Wastewater", 20th Edition, 1999.
(4) - No equipment blank collection is necessary if dedicated sampling equipment is used.
(5) - Analysis of Dissolved Methane, Ethane, and Ethylene in Ground Water by a Standard Gas Chromatographic Technique. ADA, 1997. (Region 1 Library)

Dup - Duplicate
MS - Matrix Spike
MSD - Matrix Spike Duplicate
TCL - Target Compound List
VOCs - Volatile Organic Compounds
TBD - To be determined.
MNA - Monitored Natural Attenuation

TABLE 2.2

ANALYTE LIST AND QUANTITATION LIMITS
SITE MANAGEMENT PLAN
OLD ERIE CANAL SITE
CLYDE, NEW YORK

	CAS Number	*Groundwater Quantitation Limits*	*Soil Quantitation Limits*
Volatile Organic Compounds		***µg/L***	***µg/Kg***
1,1,2,2-Tetrachloroethane	79-34-5	1.0	10
1,1,2-Trichloroethane	79-00-5	1.0	10
1,1-Dichloroethane	75-34-3	1.0	10
1,1-Dichloroethylene	75-35-4	1.0	10
1,2-Dibromo-3-chloropropane	96-12-8	1.0	10
1,2-Dibromoethane	106-93-4	1.0	10
1,2-Dichloroethane	107-06-2	1.0	10
1,2-Dichloropropane	78-87-5	1.0	10
Bromodichloromethane	75-27-4	1.0	10
Bromoform	75-25-2	1.0	10
Carbon tetrachloride	56-23-5	1.0	10
Chlorobenzene	108-90-7	1.0	10
Chloroethane	75-00-3	1.0	10
Chloroform	67-66-3	1.0	10
cis-1,3-Dichloropropene	10061-01-5	1.0	10
Dibromochloromethane	124-48-1	1.0	10
Dichlorodifluoromethane	75-71-8	1.0	10
m-Dichlorobenzene	541-73-1	1.0	10
Bromomethane	74-83-9	1.0	10
Chloromethane	74-87-3	1.0	10
Methylene chloride	75-09-2	1.0	10
o-Dichlorobenzene	95-50-1	1.0	10
p-Dichlorobenzene	106-46-7	1.0	10
Tetrachloroethylene	127-18-4	1.0	10
trans-1,2-Dichloroethylene	156-60-5	1.0	10
trans-1,3-Dichloropropene	10061-02-6	1.0	10
Trichloroethylene	79-01-6	1.0	10
Trichlorofluoromethane	75-69-4	1.0	10
Vinyl chloride	75-01-4	1.0	10
4-Methyl-2-pentanone	108-10-1	5.0	10
2-Butanone	78-93-3	5.0	10
Benzene	71-43-2	1.0	10
Ethylbenzene	100-41-4	1.0	10
Styrene	100-42-5	1.0	10
Toluene	108-88-3	1.0	10
Xylene(total)	1330-20-7	1.0	10
1,1,1-Trichloroethane	71-55-6	1.0	10
2-Hexanone	591-78-6	5.0	10
Acetone	67-64-1	5.0	10
Carbon disulfide	75-15-0	1.0	10
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	1.0	10
Methyl Acetate	79-20-9	1.0	10
Methyl tert-Butyl Ether	1634-04-4	1.0	10
cis-1,2-Dichloroethene	156-59-2	1.0	10
Cyclohexane	110-82-7	1.0	10
Methylcyclohexane	108-87-2	1.0	10

TABLE 2.2

ANALYTE LIST AND QUANTITATION LIMITS
SITE MANAGEMENT PLAN
OLD ERIE CANAL SITE
CLYDE, NEW YORK

	CAS Number	*Groundwater Quantitation Limits*	*Soil Quantitation Limits*
Isopropylbenzene	98-82-8	1.0	10
1,2,4-Trichlorobenzene	120-82-1	1.0	10
Semi-Volatile Organic Compounds			
2,4,6-Trichlorophenol	88-06-2	-	330
2,4-Dichlorophenol	120-83-2	-	330
2,4-Dimethylphenol	105-67-9	-	330
2,4-Dinitrophenol	51-28-5	-	830
2-Chlorophenol	95-57-8	-	330
4,6-Dinitro-o-cresol	534-52-1	-	830
o-Nitrophenol	88-75-5	-	330
p-Chloro-m-cresol	59-50-7	-	330
Pentachlorophenol	87-86-5	-	830
Phenol	108-95-2	-	330
p-Nitrophenol	100-02-7	-	830
Bis(2-ethylhexyl) phthalate	117-81-7	-	330
Butyl benzyl phthalate	85-68-7	-	330
Diethyl phthalate	84-66-2	-	330
Dimethyl phthalate	131-11-3	-	330
Di-n-butyl phthalate	84-74-2	-	330
Di-n-octyl phthalate	117-84-0	-	330
2,4-Dinitrotoluene	121-14-2	-	330
2,6-Dinitrotoluene	606-20-2	-	330
Isophorone	78-59-1	-	330
Nitrobenzene	98-95-3	-	330
Acenaphthene	83-32-9	-	330
Acenaphthylene	208-96-8	-	330
Anthracene	120-12-7	-	330
Benzo[a]anthracene	56-55-3	-	330
Benzo[a]pyrene	50-32-8	-	330
Benzo[b]fluoranthene	205-99-2	-	330
Benzo[ghi]perylene	191-24-2	-	330
Benzo[k]fluoranthene	207-08-9	-	330
Chrysene	218-01-9	-	330
Dibenz[a,h]anthracene	53-70-3	-	330
Fluoranthene	206-44-0	-	330
Fluorene	86-73-7	-	330
Indeno(1,2,3 cd)pyrene	193-39-5	-	330
Naphthalene	91-20-3	-	330
Phenanthrene	85-01-8	-	330
Pyrene	129-00-0	-	330
2-Chloronaphthalene	91-58-7	-	330
Hexachlorobenzene	118-74-1	-	330
Hexachlorobutadiene	87-68-3	-	330
Hexachlorocyclopentadiene	77-47-4	-	330
Hexachloroethane	67-72-1	-	330
2,4,5-Trichlorophenol	95-95-4	-	830

TABLE 2.2

ANALYTE LIST AND QUANTITATION LIMITS
SITE MANAGEMENT PLAN
OLD ERIE CANAL SITE
CLYDE, NEW YORK

	CAS Number	*Groundwater Quantitation Limits*	*Soil Quantitation Limits*
2-Methylnaphthalene	91-57-6	-	330
3,3'-Dichlorobenzidine	91-94-1	-	330
4-Chlorophenyl phenyl ether	7005-72-3	-	330
Bis(2-chloroethoxy)methane	111-91-1	-	330
Bis(2-chloroethyl)ether	111-44-4	-	330
Dibenzofuran	132-64-9	-	330
m-Nitroaniline	99-09-2	-	830
N-Nitrosodiphenylamine	86-30-6	-	330
N-Nitrosodipropylamine	621-64-7 1	-	330
o-Cresol	95-48-7	-	330
o-Nitroaniline	88-74-4	-	830
p-Chloroaniline	106-47-8	-	330
p-Cresol	106-44-5	-	330
p-Nitroaniline	100-01-6	-	830
Benzaldehyde	100-52-7	-	330
2,2'-oxybis(1-Chloropropane)	108-60-1	-	330
Acetophenone	98-86-2	-	330
Caprolactam	105-60-2	-	330
1,1'-Biphenyl	92-52-4	-	330
4-Bromophenyl-phenylether	101-55-3	-	330
Atrazine	1912-24-9	-	330
Carbazole	86-74-8	-	330
Metals			
Aluminum	7429-90-5	200	20
Antimony	7440-36-0	60	6
Arsenic	7440-38-2	10	1
Barium	7440-39-3	200	20
Beryllium	7440-41-7	5	0.5
Cadmium	7440-43-9	5	0.5
Calcium	7440-70-2	5000	500
Chromium	7440-47-3	10	1
Cobalt	7440-48-4	50	5
Copper	7440-50-8	25	2.5
Iron	7439-89-6	100	10
Lead	7439-92-1	5	0.5
Magnesium	7439-95-4	5000	500
Manganese	7439-96-5	15	1.5
Mercury	7439-97-6	0.2	0.1
Nickel	7440-02-0	40	4
Potassium	7440-09-7	5000	500
Selenium	7782-49-2	5	0.5
Silver	7440-22-4	10	1
Sodium	7440-23-5	5000	500
Thallium	7440-28-0	10	1
Vanadium	7440-62-2	50	5
Zinc	7440-66-6	20	2

TABLE 2.2

ANALYTE LIST AND QUANTITATION LIMITS
SITE MANAGEMENT PLAN
OLD ERIE CANAL SITE
CLYDE, NEW YORK

	CAS Number	*Groundwater Quantitation Limits*	*Soil Quantitation Limits*
MNA Analytes			
Dissolved Organic Carbon	-	1000	-
Ammonia	7664-41-7	100	-
Sulfate	18785-72-3	1000	-
Sulfide	18496-25-8	1000	-
Nitrate	84145-82-4	20	-
Orthophosphate	98059-61-1	100	-
Dissolved Ethane	74-84-0	10	-
Dissolved Ethene	74-85-1	10	-
Dissolved Methane	74-82-8	10	-
Chloride	-	1000	-
Alkalinity	471-34-1	5	-

Notes:

(1) - Targeted limits are presented for guidance only and may not be achievable for all samples as a result of matrix interferences, low percent solids, or high concentrations of target and non-target compounds.

TCL - Target Compound List

VOCs - Volatile Organic Compounds

MNA - Monitored Natural Attenuation

MNA - Monitored Natural Attenuation

TABLE 2.3

LABORATORY REPORTING DELIVERABLES
SITE MANAGEMENT PLAN
OLD ERIE CANAL SITE
CLYDE, NEW YORK

A. Chain of Custody Documentation and Detailed Narrative[(1)].

B. Sample Information:
   - i) date collected
   - ii) date extracted
   - iii) date analyzed

C. Results [(2)]:
   - i) sample results
   - ii) duplicate
   - iii) blanks
   - iv) laboratory control sample recoveries
   - v) spike; spike duplicate recoveries
   - vi) surrogate recoveries

D. Supporting QA/QC:
   - i) analytical methodology and reference
   - ii) method detection limits

All sample data and its corresponding QA/QC data shall be maintained accessible either in hard copy or on magnetic tape or disc (computer data files).

Notes:

(1) - A detailed report narrative should accompany each submission, summarizing the contents, results, and all relevant circumstances of the work.
(2) - Method or laboratory generated control limits must be provided.
QA - Quality Assurance
QC - Quality Control

TABLE 3.1

ROUTINE MAINTENANCE PROCEDURES AND SCHEDULES
SITE MANAGEMENT PLAN
OLD ERIE CANAL SITE
CLYDE, NEW YORK

Instrument/Equipment	***Maintenance Procedures/Schedule***	***Spare Parts in Stock***
pH/Temperature Meter	1. Check battery (if used in field); and replace if discharged. 2. After use in samples containing free oil, wash the electrode in soap and rinse thoroughly with water. Immerse the lower third of the electrode in diluted HCl (1:9) solution for 10 minutes to remove any film formed. Rinse thoroughly with water. 3. Keep electrode properly filled with appropriate filling electrolyte solution.	1. Standard buffers 2. Electrolyte filling solution 3. Spare electrode
Specific Conductivity, Dissolved oxygen, eH (ORP), and Turbidity Meters	1. Check battery (if used in field); and replace if discharged. 2. After use in samples containing free oil, wash the electrode in soap and rinse thoroughly with water.	1. Standard solution 2. Spare electrodes

TABLE 3.2

CONTAINER, PRESERVATION, SHIPPING, AND PACKAGING REQUIREMENTS FOR LABORATORY ANALYSES
SITE MANAGEMENT PLAN
OLD ERIE CANAL SITE
CLYDE, NEW YORK

Analyses	*Sample Containers* [1]	*Preservation*	*Maximum Holding Time from Sample Collection*	*Volume of Sample*	*Shipping*	*Normal Packaging*
SOIL						
Metals	1 - 4 oz. glass jar	Cool to 0-6 °C	180 days from collection to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap
TCL VOCs	EnCore samplers	Cool to 0-6 °C	14 Days	Fill Completely.	Overnight Courier	Bubble Wrap
SVOCs	1 - 4 oz. glass jar	Cool to 0-6 °C	14 days from collection to extraction; 40 days from extraction to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap
GROUNDWATER						
Total and Dissolved Metals[2]	One 500 mL plastic bottle	HNO3 to pH < 2	180 days from collection to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap
TCL VOCs	Three 40 mL teflon-lined septum vials per analysis	HCl to pH < 2 Cool to 0-6 °C	14 Days	Fill Completely. (No headspace)	Overnight Courier	Bubble Wrap
C^{13} Compound Specific Isotope Analysis on TCE, cic-1,2-DCE and VC	Four 40 mL teflon-lined septum vials per isotope	HCl to pH < 2 Cool to 0-6 °C	7-10 days	Fill Completely. (No headspace)	Overnight Courier	Bubble Wrap
Dissolved Organic Carbon	One 250 mL	H2 SO4 to pH < 2	28 days from collection to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap

TABLE 3.2

CONTAINER, PRESERVATION, SHIPPING, AND PACKAGING REQUIREMENTS FOR LABORATORY ANALYSES
SITE MANAGEMENT PLAN
OLD ERIE CANAL SITE
CLYDE, NEW YORK

Analyses	*Sample Containers* [1]	*Preservation*	*Maximum Holding Time from Sample Collection*	*Volume of Sample*	*Shipping*	*Normal Packaging*
	glass bottle	Cool to 0-6 °C				
GROUNDWATER						
Ammonia	One 250 mL glass bottle	H2 SO4 to pH < 2 Cool to 0-6 °C	28 days from collection to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap
Alkalinity	One 250 mL glass bottle	Cool to 0-6 °C	14 days from collection to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap
Chloride	One 250 mL glass bottle	Cool to 0-6 °C	28 days from collection to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap
Sulfate	One 250 mL glass bottle	Cool to 0-6 °C	28 days from collection to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap
GROUNDWATER						
Sulfide	One 250 mL glass bottle	Zinc acetate and NaOH to pH>9 Cool to 0-6 °C	7 days from collection to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap
Nitrate	One 250 mL glass bottle	Cool to 0-6 °C	48 hours from collection to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap
Orthophosphate	One 250 mL	Cool to 0-6 °C	48 hours from collection to analysis	Fill to neck of bottle	Overnight Courier	Bubble Wrap

TABLE 3.2

CONTAINER, PRESERVATION, SHIPPING, AND PACKAGING REQUIREMENTS FOR LABORATORY ANALYSES
SITE MANAGEMENT PLAN
OLD ERIE CANAL SITE
CLYDE, NEW YORK

Analyses	*Sample Containers* [1]	*Preservation*	*Maximum Holding Time from Sample Collection*	*Volume of Sample*	*Shipping*	*Normal Packaging*
	glass bottle					
GROUNDWATER						
Dissolved Gases	Three 40 mL teflon-lined septum vials per analysis	Cool to 0-6 °C	14 days from collection to analysis	Fill Completely. (No headspace)	Overnight Courier	Bubble Wrap
DHC presence/absence by PCR	One 1000 mL glass bottle	Cool to 0-6 °C	Frozen within 24 hours of collection	Fill Completely. (No headspace)	Overnight Courier	Bubble Wrap
Vinyl Chloride Reductase by PCR	One 1000 mL plastic bottle	Cool to 0-6 °C	24-48 hours	Fill to neck of bottle	Overnight Courier	Bubble Wrap

Notes:

[1] - The laboratory may choose to combine analyses in the same bottles, at their discretion.

[2] - Dissolved metals will be filtered in the field.

TCL - Target Compound List

VOCs - Volatile Organic Compounds

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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Appendix G
Site Management Forms

Site Inspection Form
Old Erie Canal Site
NYSDEC Site #859015
Clyde, New York

INSPECTION DATE: _____

INSPECTED BY: _____

Overall Site

Has the Site use changed since the last inspection? **Yes** _____ **No** _____

If yes, please describe the changes: _____

Have neighboring property uses changed? **Yes** _____ **No** _____

If yes, please describe the changes: _____

Building Slab, Parking Lot, and Roads

Has the building structure/floor slab changed since the last inspection? **Yes** _____ **No** _____

If yes, please describe the changes: _____

Is a corrective action plan required? **Yes** _____ **No** _____

Has the parking lot or roads changed since the last inspection? **Yes** _____ **No** _____

If yes, please describe the changes: _____

Is a corrective action plan required? **Yes** _____ **No** _____

Soil Cover Areas

Is there any evidence of erosion, damage, animal burrows? **Yes** _____ **No** _____

If yes, please describe: _____

Is a corrective action plan required? **Yes** _____ **No** _____

48" Storm Drain Extension

Is the outlet free of debris and obstructions? **Yes** _____ **No** _____

If no, please describe the issues: _____

Is a corrective action plan required? **Yes** _____ **No** _____

Site Inspection Form
Old Erie Canal Site
NYSDEC Site #859015
Clyde, New York

INSPECTION DATE: _____

INSPECTED BY: _____

Is the manhole free of debris and obstructions? Yes _____ No _____

If no, please describe the issues: _____

Is a corrective action plan required? **Yes** _____ **No** _____

Is there any evidence of erosion or damage to the soil back fill/cover? **Yes** _____ **No** _____

If yes, please describe: _____

Is a corrective action plan required? **Yes** _____ **No** _____

Positive Indoor Air Pressure

Have there been any changes to manufacturing operations? **Yes** _____ **No** _____

If yes, please describe the changes: _____

Have there been any changes to the air handling system or units? **Yes** _____ **No** _____

If yes, please describe the changes: _____

Is a corrective action plan required? **Yes** _____ **No** _____

Are all manometers in place, functioning, and providing data to the BACTalk system? **Yes** _____ **No** _____

If no, please describe the issues: _____

Is a corrective action plan required? **Yes** _____ **No** _____

Are pressure differential readings being recorded and the data being used to generate average pressure differentials on a monthly basis? **Yes** _____ **No** _____

Are the records available? **Yes** _____ **No** _____

Is corrective action required? **Yes** _____ **No** _____

Site Inspection Form
Old Erie Canal Site
NYSDEC Site #859015
Clyde, New York

INSPECTION DATE: _____

INSPECTED BY: _____

Is there any evidence of cracking or new penetrations in the building floor slab that could allow soil vapor intrusion? **Yes** _____ **No** _____

If yes, please describe the changes: _____

Is a corrective action plan required? **Yes** _____ **No** _____

Is there any evidence of cracking or damage to the epoxy floor coating? **Yes** _____ **No** _____

If yes, please describe: _____

Is a corrective action plan required? **Yes** _____ **No** _____

Are water traps maintained in floor drains? **Yes** _____ **No** _____

If no, please describe the issues: _____

Is a corrective action plan required? **Yes** _____ **No** _____

Monitoring and Injection Wells

Utilize the inspection form provided as Attachment 1

Off-Site Sub-slab Depressurization System

Utilize the inspection form provided as Attachment 2

Site Inpection Form Attachment 1
Monitoring Well and Inspection Form
Old Erie Canal Site
NYSDEC Site #859015
Clyde, New York

Inspection Date _____ Inspector Name _____

Monitoring Well Inspection Sheet

Monitoring Well	***Well Condition (circle one)***					***Water Depth***	***Well Depth***	***Inst. No.:***
Identification	***Circle appropriate category***			***Riser***	***Details***	***(Feet BTOC)***	***(Feet BTOC)***	***Comments***
MW-1S	Good	Fair	Needs Repair	FM AG				
MW-2S	Good	Fair	Needs Repair	FM AG				
MW-2B	Good	Fair	Needs Repair	FM AG				
MW-3S	Good	Fair	Needs Repair	FM AG				
MW-3B	Good	Fair	Needs Repair	FM AG				
MW-4S	Good	Fair	Needs Repair	FM AG				
MW-4B	Good	Fair	Needs Repair	FM AG				
MW-4C	Good	Fair	Needs Repair	FM AG				
MW-5S	Good	Fair	Needs Repair	FM AG				
MW-5B	Good	Fair	Needs Repair	FM AG				
MW-6S	Good	Fair	Needs Repair	FM AG				
MW-6B	Good	Fair	Needs Repair	FM AG				
MW-7S	Good	Fair	Needs Repair	FM AG				
MW-7B	Good	Fair	Needs Repair	FM AG				
MW-8S	Good	Fair	Needs Repair	FM AG				
MW-9S	Good	Fair	Needs Repair	FM AG				
MW-13S	Good	Fair	Needs Repair	FM AG				
MW-14S	Good	Fair	Needs Repair	FM AG				
MW-15S	Good	Fair	Needs Repair	FM AG				
MW-16S	Good	Fair	Needs Repair	FM AG				
MW-16B	Good	Fair	Needs Repair	FM AG				
MW-17S	Good	Fair	Needs Repair	FM AG				
MW-18S	Good	Fair	Needs Repair	FM AG				
MW-19S	Good	Fair	Needs Repair	FM AG				
EMW-2	Good	Fair	Needs Repair	FM AG				
EMW-3	Good	Fair	Needs Repair	FM AG				
EMW-4	Good	Fair	Needs Repair	FM AG				

Site Inpection Form Attachment 1
Monitoring Well and Inspection Form
Old Erie Canal Site
NYSDEC Site #859015
Clyde, New York

Inspection Date _____ Inspector Name _____

Monitoring Well Inspection Sheet

Monitoring Well	***Well Condition (circle one)***					***Water Depth***	***Well Depth***	***Inst. No.:***
Identification	***Circle appropriate category***			***Riser***	***Details***	***(Feet BTOC)***	***(Feet BTOC)***	***Comments***
EMW-5	Good	Fair	Needs Repair	FM AG				
	Good	Fair	Needs Repair	FM AG				
	Good	Fair	Needs Repair	FM AG				
	Good	Fair	Needs Repair	FM AG				
South of Canal								
MW-10B	Good	Fair	Needs Repair	FM AG				
MW-11S	Good	Fair	Needs Repair	FM AG				
MW-11B	Good	Fair	Needs Repair	FM AG				
MW-12S	Good	Fair	Needs Repair	FM AG				
MW-12B	Good	Fair	Needs Repair	FM AG				

Injection Well	***Well Condition (circle one)***					***Water Depth***	***Well Depth***	***Inst. No.:***
Identification	***Circle appropriate category***			***Riser***	***Details***	***(Feet BTOC)***	***(Feet BTOC)***	***Comments***
IW-1	Good	Fair	Needs Repair	FM AG				
IW-2	Good	Fair	Needs Repair	FM AG				
IW-3	Good	Fair	Needs Repair	FM AG				
IW-4	Good	Fair	Needs Repair	FM AG				
IW-5	Good	Fair	Needs Repair	FM AG				
IW-6	Good	Fair	Needs Repair	FM AG				
IW-7	Good	Fair	Needs Repair	FM AG				
IW-8	Good	Fair	Needs Repair	FM AG				
IW-9	Good	Fair	Needs Repair	FM AG				
IW-10	Good	Fair	Needs Repair	FM AG				
IW-11	Good	Fair	Needs Repair	FM AG				
IW-12	Good	Fair	Needs Repair	FM AG				
IW-13	Good	Fair	Needs Repair	FM AG				

Site Inpection Form Attachment 1
Monitoring Well and Inspection Form
Old Erie Canal Site
NYSDEC Site #859015
Clyde, New York

Inspection Date _____ Inspector Name _____

Monitoring Well Inspection Sheet

Monitoring Well	***Well Condition (circle one)***					***Water Depth***	***Well Depth***	***Inst. No.:***
Identification	***Circle appropriate category***			***Riser***	***Details***	***(Feet BTOC)***	***(Feet BTOC)***	***Comments***
IW-14	Good	Fair	Needs Repair	FM AG				
IW-15	Good	Fair	Needs Repair	FM AG				
IW-16	Good	Fair	Needs Repair	FM AG				
IW-17	Good	Fair	Needs Repair	FM AG				
IW-18	Good	Fair	Needs Repair	FM AG				
IW-19	Good	Fair	Needs Repair	FM AG				
IW-20	Good	Fair	Needs Repair	FM AG				
IW-21	Good	Fair	Needs Repair	FM AG				
IW-22	Good	Fair	Needs Repair	FM AG				
IW-23	Good	Fair	Needs Repair	FM AG				
IW-24	Good	Fair	Needs Repair	FM AG				
IW-25	Good	Fair	Needs Repair	FM AG				
IW-26	Good	Fair	Needs Repair	FM AG				
IW-27	Good	Fair	Needs Repair	FM AG				
IW-28	Good	Fair	Needs Repair	FM AG				
IW-29	Good	Fair	Needs Repair	FM AG				
IW-30	Good	Fair	Needs Repair	FM AG				
IW-31	Good	Fair	Needs Repair	FM AG				
IW-32	Good	Fair	Needs Repair	FM AG				
IW-33	Good	Fair	Needs Repair	FM AG				
IW-34	Good	Fair	Needs Repair	FM AG				
IW-35	Good	Fair	Needs Repair	FM AG				
IW-36	Good	Fair	Needs Repair	FM AG				
IW-37	Good	Fair	Needs Repair	FM AG				
IW-38	Good	Fair	Needs Repair	FM AG				
IW-39	Good	Fair	Needs Repair	FM AG				
IW-40	Good	Fair	Needs Repair	FM AG				

Site Inpection Form Attachment 1
Monitoring Well and Inspection Form
Old Erie Canal Site
NYSDEC Site #859015
Clyde, New York

Inspection Date _____ Inspector Name _____

Monitoring Well Inspection Sheet

Monitoring Well	***Well Condition (circle one)***					***Water Depth***	***Well Depth***	***Inst. No.:***
Identification	***Circle appropriate category***			***Riser***	***Details***	***(Feet BTOC)***	***(Feet BTOC)***	***Comments***
IW-41	Good	Fair	Needs Repair	FM AG				
IW-42	Good	Fair	Needs Repair	FM AG				
IW-43	Good	Fair	Needs Repair	FM AG				
IW-44	Good	Fair	Needs Repair	FM AG				
IW-45	Good	Fair	Needs Repair	FM AG				
IW-46	Good	Fair	Needs Repair	FM AG				
IW-47	Good	Fair	Needs Repair	FM AG				
IW-48	Good	Fair	Needs Repair	FM AG				
IW-49	Good	Fair	Needs Repair	FM AG				

Potential Problems	***Concern***	***Corrective Action***
Missing locks	• Potential access by unauthorized persons	Replace lock
Missing J-plugs	• Potential well contamination from surface water or rain water	Replace J-plug
Concrete surface seal	• Damaged seal can allow water infiltration around casing and contamination of groundwater	Contract drilling subcontractor to have surface seal repaired or replaced
Damaged Protective casing	• Damaged casing can result in damage to riser and integrity of J-plug seal and security of well	Contract drilling subcontractor to have protective casing repaired or replaced

GHD Project No. 035048
Old Erie Canal Site, Clyde, New York

SUBSTRUCTURE DEPRESSURIZATION SYSTEM INSPECTION FORM

Address: _____

_____

_____

Structure ID: _____

	Yes	*No*
1. Was the owner interviewed to discuss satisfaction with system?		
1a. Is the owner satisfied with the system? (If no, indicate issues below)		
2. Is the integrity of the concrete floor vapor barrier intact?		
3. Is the integrity of the concrete wall vapor barrier intact?		
4. Has the system been modified since the original installation?		
5. Is the unit connected and operating/running?		
6. Check the U-tube manometer to ensure the system is under vacuum.		
6a. Indicate the U-tube reading (inches of water)		
7. Check the motor fan – is there any noise or vibration?		
7a. Is the fan securely mounted?		
8. Are the electrical connections secure?		
9. Are the labels on the system in place and intact?		
10. Are pipes sealed at concrete penetration points?		
11. Is the system exhaust free from obstructions?		
11a. Have any intakes been located near the exhaust?		

Notes:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Inspection Performed By: _____ **Date:** _____

Appendix H
Envision for BAC Talk, Version 3.0 Operator's Manual

ALERTON

Operator's Manual

Envision for BACtalk

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Before you begin 1

Envision for BACtalk is an operator workstation software package for BACnet-compliant systems. Envision, which runs on a Windows personal computer, enables BACtalk operators and developers to monitor and control BACnet-compliant devices in their building automation system (BAS). The Envision for BACtalk operator workstation communicates with BACnet-compliant field equipment using BACnet over local area networks (LANs) and wide area networks (WANs).

From the Envision for BACtalk operator workstation, operators can access any BAS data made available on the network using the BACnet protocol standard—even if it originates in another manufacturer's device. Developers can use the Envision for BACtalk operator workstation to program custom direct digital control (DDC) sequences that run locally in BACtalk controllers. They can also configure other site operational details.

In addition to the Envision for BACtalk operator workstation, Alerton offers a complete line of BACnet-compliant equipment controllers (VLCs) and global controllers (BTI, BTI-100, and BACtalk control modules). All BACtalk products exchange messages in compliance with the BACnet protocol and communicate on LANs as specified in ASHRAE Standard 135-2001, BACnet.

Using the Envision for BACtalk documentation set

Documentation for Envision for BACtalk is provided in several forms and formats. It is designed to meet the needs of different users who work with the system in a variety of contexts. This section describes the documentation set and the audience and purpose of each piece.

Envision for BACtalk Operator's Manual (this manual)

This guide focuses on information for BACtalk system users who use the operator workstation to monitor and command their building automation and control system. It provides conceptual information about working with features: zones, schedules, tenant activity, optimum start, demand limiting, alarms, trendlogs, and other features likely to be used in building operations.

The operator's manual uses a sample job, located on a campus setting at State University, to illustrate how you can incorporate these features into your own BACtalk job. Use this manual when you want the "big picture" about how a feature works and runs or when you need reference information for the best way to set up a feature.

How chapters are organized

Chapters in this operator's manual are organized as follows:

- **Feature overview** Describes the feature and its benefits in broad terms.
- **Quick start** A step-by-step overview of feature setup with cross-references to other locations where you can find information.
- **How the feature works and runs** Detailed information about how setup parameters work together and how the system carries out the feature.
- **Setting up the feature** Guidelines and instructions for setting up the feature, with screen shots of feature configuration and in-depth information about settings.
- **Maintaining or monitoring operation** Instructions and tips for working with the feature after it is set up.

Using "examples"

Throughout this manual, you will find information under the heading "Example." These sections typically include sample values to help reinforce your understanding of the concepts discussed. For example, if a feature uses a particular equation, the "example" would demonstrate how the equation works using specific values.

Using "practical applications"

You will also find a number of sections with the heading "Practical application." These sections illustrate how a feature might be implemented and used in the context of the State University sample job. The practical applications are designed to put features in a "real-world" context that you can leverage for your own site.

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Note Use the Envision for BACtalk online Help while using the software to find detailed information and procedural instructions related to setting up and using BACtalk features.

Readme file

This file, Readme.rtf, displays during Envision for BACtalk installation and is saved in the installation under the System folder and on the DVD. It addresses late-breaking operational and installation issues that could not be included in other documentation.

Online Help

Online Help in Envision for BACtalk provides detailed information and procedural steps for setting up and using BACtalk features. Help is designed to answer your questions while you are working with the Envision for BACtalk software.

Installation and Startup Guide (LTBT-TM-ADMIN)

This guide provides critical information and step-by-step instructions for those responsible for installing or upgrading an Envision for BACtalk system. In addition to detailed installation information, it provides guidelines and instructions for job setup and engineering.

Display Developer's Guide (LTBT-TM-DSPDV)

This guide provides information for those responsible for designing and developing data displays for a particular site. It provides guidelines for good design and tips on display strategies. The guide also provides detailed instructions about using display and template editors.

BACtalk Systems Programmer's Guide and Reference (LTBT-TM-PRGRMR)

This guide is intended for those responsible for programming Envision for BACtalk systems. It provides an introduction to the VisualLogic development tool and offers guidelines for effective programming techniques and strategies. This guide also includes a reference for all available DDC functions.

BACtalk Systems Design Guide (LTBT-TM-SYSDSGN)

This guide provides information for those responsible for planning and installing a building automation system (BAS) with Alerton's BACnet-compliant BACtalk products. This guide provides essential information to use as a reference when planning, designing, and configuring a BAS internetwork with BACtalk products.

This guide focuses on strategies for interconnecting BACtalk products. See specific documentation for the product of interest to find installation and LAN configuration instructions.

Your site documentation

Site documentation typically includes job-specific information, including controller device numbers, equipment device numbers, network types and numbers, riser diagrams, and point lists. The site documentation is a critical information resource used for the ongoing operation, maintenance, and upgrading of the building automation system.

Version information

Information in this manual applies to Envision for BACtalk 3.0. VLCs, building controllers, and global controllers may have operating characteristics specific to firmware or real-time operating code (ROC) version. See the device documentation for details.

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What you need to know

Those who work with Envision for BACtalk should have a thorough understanding of the following topics before they start using the software:

- Working with a Windows personal computer (see your computer's documentation for more information)
- Your site's building automation system (BAS) configuration: its equipment, setup, maintenance, and capabilities
- A basic understanding of how your BAS represents data and control points as BACnet objects and properties

BACtalk BAS architecture and components

To understand the BACtalk system architecture, it is helpful to describe it using the four levels of components shown in the following illustration.

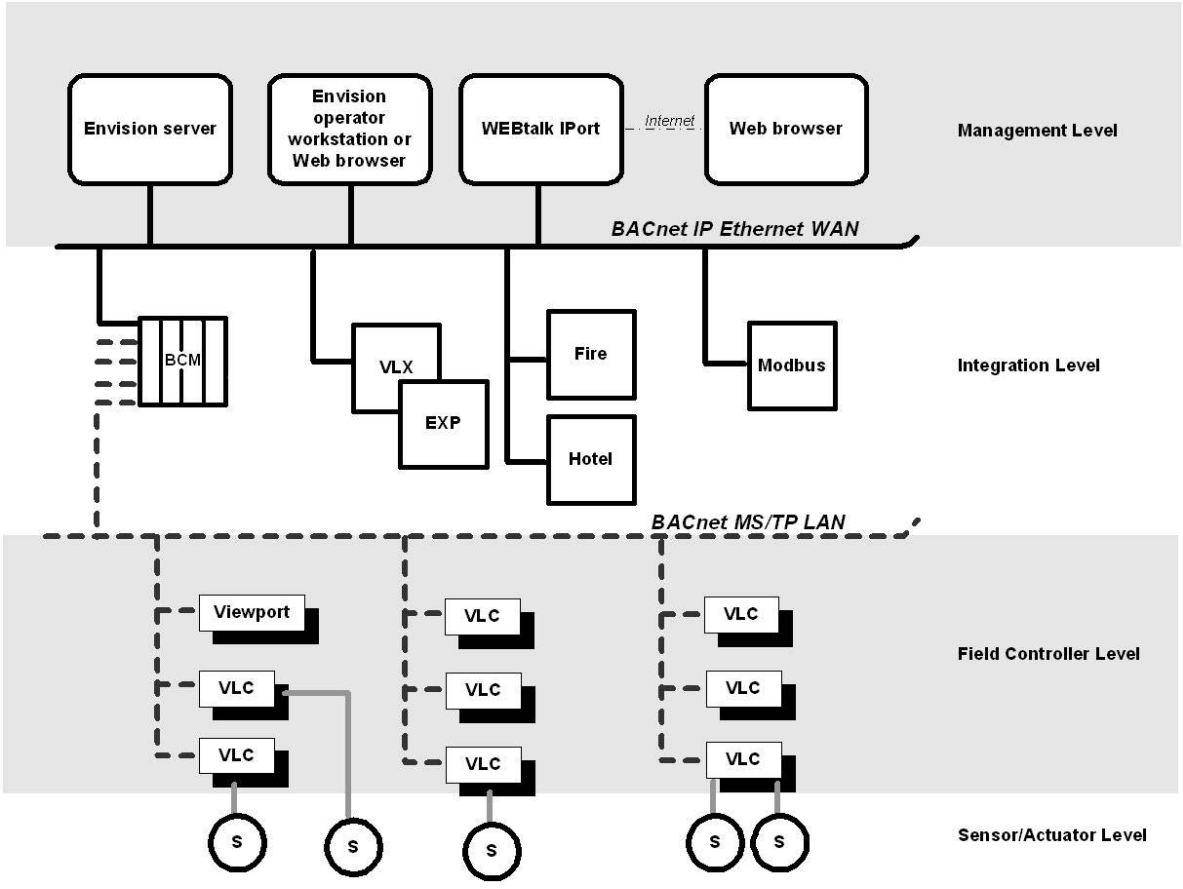

Figure 1.1 BACtalk system architecture. Note: The global controller can be a BTI, BTI-100, or group of BACtalk control modules (BCMs).

Management level

The Envision for BACtalk software and operator workstations are representative of the management level. These easy-to-use, graphical tools provide access to real-time data and energy management features. The management level is where you set up, monitor, and control how your building works.

Integration level

Components such as global controllers and building controllers reside at this level. These intelligent BACnet programmable devices work with the components at the management level to implement control strategies for an entire facility or multiple sites.

Field controller level

Alerton field controllers (VLCs) are native BACnet logic controllers. These programmable devices support a range of applications to control equipment such as air handling units, terminal units such as VAV boxes, heat pumps, and air conditioning units.

Sensor/actuator level

This level includes devices, such as sensors, which can serve as both tenant control centers and field service tools. Alerton's Microset is one example of this type of device. The BACtalk system also supports traditional sensors and actuators commonly used in building automation.

About the BACnet Standard

BACnet is the common term for a communication protocol standard created by the American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE). BACnet stands for Building Automation and Control Network, a non-proprietary protocol standard for the building automation industry, which enables devices to communicate and exchange information regardless of manufacturer.

BACnet prescribes a set of rules for representing and transmitting data between building automation and control devices on a network. The protocol specifies a common "language" that computer-based devices can use to communicate.

The standard prescribes an object-oriented method of representing system data and processes. It also prescribes the physical method of data transmission, relying on existing standards (Ethernet, for example) and standards created with the special needs of a control system in mind.

History

A committee of industry experts, vendors, designers, and users working under the auspices of ASHRAE, first published the standard in 1995. It was adopted by the American National Standards Institute (ANSI) later that year. The standard was updated and then republished as ASHRAE Standard 135-2001 in 2001. It was adopted by the International Standards Organization (ISO) in 2003 as ISO Standard 16484-5. In 2004 the standard was updated and republished as Standard 135-2004.

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From ASHRAE Standard 135-2001, BACnet

"This standard defines data communication services and protocol for computer equipment used for monitoring and control of HVAC & R and other building systems. [It defines], in addition, an abstract, object-oriented representation of information communicated between such equipment, thereby facilitating the application and use of digital control technology in buildings ...

This protocol models each building automation and control computer as a collection of data structures called "objects," the properties of which represent various aspects of the hardware, software, and operation of the device. These objects provide a means of identifying and accessing information without requiring knowledge of the details of the device's internal design or configuration."

A standard, open protocol such as BACnet enables building owners, facility managers, and specifying engineers to choose from a broader range of products and design options. Past systems were often confined to a single manufacturer's products, or developers had to invest in expensive gateways to exchange information between systems. With BACnet, products can be individually evaluated and compared for cost, features, performance, and function.

If you want more detailed information about the BACnet standard, see the following publications and resources:

- The Alerton website–www.alerton.com
- The BACnet website–www.bacnet.org
- The ASHRAE website–www.ashrae.org
- The BACnet Standard–ASHRAE STD 135-2001
  (Available from ASHRAE in print or on CD, this is the standard itself. Intended for programmers and system developers, this document includes highly technical information about the data structures and architectures that comprise the standard.)

About BACnet objects, properties, and services

If you are familiar with BACnet and how it represents system data, you can skip this section.

BACnet objects

BACnet identifies all information in terms of properties and objects. An object might represent a physical input or output, or it may represent something more abstract, such as a setpoint. And each property of the object provides data to describe something about it. All data in a BACnet system is identified in this way. The most important property of almost all objects is the present-value.

The property of an object is equivalent to what is traditionally known in control systems as a *data point.*

Three elements identify the source of a data point in a BACnet system:

- Device instance
- Object ID
- Property

Each object has an instance number that, along with its type, forms the object ID. For example, AI-1, represents Analog Input 1. This object ID, together with the device instance, allows the BACnet system to identify and use data. For example, in a VAV-SD (a VAV box controller), AI-1 is a physical input. Its most important property is the present-value, which represents the room temperature because AI-1 connects to the physical sensor. Other properties of the object convey more information: the units property tells the system that the value is in degrees F; the device-type property indicates that the hardware is a 10k ohm thermistor; and the description property shows that it is space temperature. All objects have some required properties and some that are optional. You can examine the device's protocol information conformance statement (PICS) to determine which objects a device supports.

BACnet properties

Objects are monitored and controlled only through their properties. BACnet specifies 123 properties of objects. Three properties–object-identifier, object-name, and object-type–must be present in every object. BACnet may also require that certain objects support specific additional properties. The type of object and the type of device in which that object resides determine which properties are present. Some properties can accept writes and others can only be read.

BACnet services

When a property is read or written to, that act is known as a *service*. Services are how one BACnet device gets information from another device, commands a device to perform certain actions (through its objects and properties), or lets other devices know that something has happened. The only service that all devices must support is the read-property service. There are a total of 32 standard services.

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Specifying an ID for a property

The Object Specification dialog box appears in Envision for BACtalk whenever you need to specify a data point.

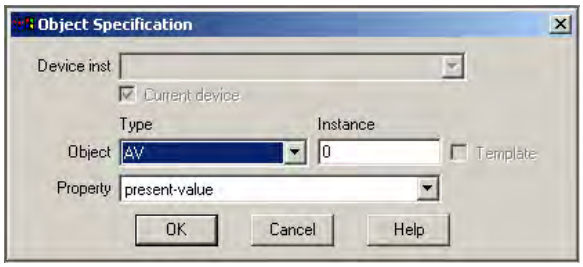

Figure 1.2 Object Specification dialog box

BACnet identifies data points in a control system by object and property. The following elements uniquely identify each property.

Table 1.1 Guidelines for setting up data points

Item	Description
Device Instance	The numerical identifier of a physical device where the property originates.
Template check boxes	The Template check box for Device ID is available when you place an item on a template. Select this check box if you want the pushbutton that summons the template to specify the device instance. Similarly, the Template check box for Object Type and Instance is available only for object templates. Select this check box if you want the pushbutton that summons the template to specify the object type and instance.
Object Type and Instance	Select an object type from the list. See section 12 of ASHRAE SPC-135P for a listing of object types and their properties. Also see the object and properties table for the device referenced in Device ID.
Property	Select a property of the object from the list. Only properties relevant to the selected object type appear.

Binary objects (BIs, BOs, BVs)

The present-value of binary object types is one of two states: ACTIVE (ON) or INACTIVE (OFF). You will find that the most often used and referenced binary data are the present-value properties of binary inputs (BIs), binary outputs (BOs), and binary values (BVs).

Analog objects (AIs, AOs, AVs)

Analog objects in BACtalk devices have present-value properties representing real numbers, depending on the type of object. Analog values (AVs) store data, analog inputs (AIs) are directly associated with physical inputs, and analog outputs (AOs) are directly associated with physical outputs. The following are BACnet-defined ranges for AIs, AOs, and AVs.

AI An unsigned real number in the range 0–4095

AO An unsigned real number in the range 0–100

AV A real number in the range $\pm$ 3.4 X 10^{38}

Inputs and outputs (AIs, AOs, BIs, and BOs)

Inputs (AIs and BIs) are directly associated with physical electrical input connections to the VLC. As such, they will never have values written to them and will appear only on the input side of a DDC function.

Outputs (AOs and BOs) are directly associated with physical electrical output connections to the VLC. Outputs can appear on the input or the output side of a DDC function.

Values (AVs and BVs)

AVs and BVs in a VLC or global controller are used for calculated values, setpoints, timers, and lockouts—virtually any value not directly associated with a physical input or output.

Multistate objects (MIs, MOs, MVs)

Multistate objects in BACtalk have present-value properties representing different states of operation. For example, a fan may have four (or more) states of operation: low, medium, high, and NULL.

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New in Envision for BACtalk

Envision for BACtalk v3.0 supports the following added features and functionality:

- **New Energy Dashboard** Energy awareness dashboard Visually provides energy consumption data on an easy-to-understand dashboard display using a web browser. This educational dashboard shows energy consumption compared to historical or other building data and visually displays it. Studies show visually presenting this information can reduce energy use by more than 5%. It integrates real-time building resource data with Envision for BACtalk. The user-friendly design meets site needs with customizable displays. Dashboard controls can be easily navigated using a touchscreen monitor. This dashboard is ideal for displaying in a lobby or other high-traffic area so visitors and other occupants can see how energy is being used in the building.
- **BACtalk Software License Key** Eliminates the hardware key.
- **Energy Logs** Energy log meter data is now updated at 15-minute intervals. Envision for BACtalk polls trendlogs assigned as meters every 15 minutes to display real-time data on the new energy dashboard.
- **Enhanced Reporting** New reports easily gather site data to be used as site documentation. Device settings can also be exported in report format for future use during troubleshooting. Now supports Crystal Reports 2008 RPT file format. When a file is saved, the generated report uses a system-specified filename. Enhanced Reporting is a mechanism

that allows the installation of new reports without a new release of BACtalk. Version 3.0 ships with the new Trendlog List Report.

- **Multiple Trendlog Viewer** Now supports wild card searches for improved search results.
- **VisualLogic v3.0** Enhanced user interface and toolkit. Compatible with existing DDC drawings. Use with Visio 2007 or later. Visio 2010* recommended. New features include:
- New Toolkit combines all tools into a dockable window that supports auto-hide and is available on every drawing page—reduces DDC development and testing time.
- New Compare feature allows you to compare two DDC drawings and print a report of the differences—saving critical time for troubleshooting warranty issues and service calls.
- New Auto Sequence DDC feature automatically sequences DDC as you place functions on the drawing—saving DDC development time
- New Auto Connect DDC feature automatically connects functions as you place functions on the drawing —saving time in developing DDC
- New Auto Edit DDC feature automatically opens function for editing parameters when you place functions on the drawing—saving DDC development time
- New Auto Propagate DDC feature automatically propagates parameters when you connect DDC functions on a drawing—saving DDC development time
- New Find and Replace feature saves DDC editing time
- Cross Reference Table can be sorted by columns—saving DDC editing and troubleshooting time
- Cross Reference Table supports Object Name property —saving DDC editing and troubleshooting time (BD6 DDC file only)
- Cross Reference Table object description column displays the point description and the point type-instance. The format is <BACnet point description property> (<point type-instance>). For example, Space

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Temp (AI-0)—saving DDC editing and troubleshooting time (BD4 DDC file only)

- Cross-Reference Table automatically updates after editing a DDC function—saving DDC development time
- Send DDC and Save DDC Options can now be saved for each drawing—saving DDC development and commissioning time
- Error checking now delineates between warnings and errors—saving DDC development time and providing an option to report multiple writes in the Options dialog box
- Statistics displays the size of DDC comments separately from geometric info (BD6 DDC only)—saving DDC development time
- **New enhanced VLC/VLCA Device Settings dialog box**
- Propagate and update all drawing tabs with I/O references from connected DDC functions page—saving DDC development and editing time
- Collect point descriptors from drawing I/O tabs and populate Point Setup descriptions page—saving DDC development and editing time
- Send point descriptors from Point Setup and populate drawing I/O tabs page—saving DDC development and editing time
- Export all point setup parameters to Excel spreadsheet—saves time in maintaining a library of applications
- Import all point setup parameters from Excel spreadsheet—saving DDC development time
- Export and Import Microset Field Service Setup data (BD6 DDC Only)
- **Visio 2010***
- Ribbon toolbar buttons repeat all menu functionality for convenience.
- Customize the ribbon toolbar to align tabs and save time during device configuration.

As with all upgrades, reading and following these instructions will substantially ease the upgrade.

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Data displays

2

Your site's data displays are unique. These data displays were customized for your job so that you can easily access site data. Data displays in Envision for BACtalk are very similar to Web pages. You use push buttons on a data display to navigate from one display to another within Envision for BACtalk, just as you would use links on a Web page. The *top display* is the display that first appears when you start Envision for BACtalk. This is like a home page. The top display provides access to all other data displays.

Use data displays to control and monitor BACtalk system parameters and equipment. You can point and click to start equipment, adjust a setpoint, set up a schedule, launch an application, and so on.

About data displays

Data displays are fairly straightforward—items on a display graphically depict equipment operation, provide user feedback and control of operating parameters, or provide access to other data displays or templates. Data displays are typically used to depict campus layouts, risers, floor plans, and central systems.

All displays consist of a background, which can be either a solid color or a graphics file, and the items placed on the background. Displays function in two distinct modes: user mode and edit mode. Displays cannot be altered in user mode. However, you can change values and command parameters for which you have sufficient privileges. For information about editing or creating a custom data display, see your *Envision for BACtalk Display Developer's Guide* (LTBT-TM-DSPDV).

Envision for BACtalk displays are saved in the rep/job folder specified in General System Setup. For information about defining this folder, see “System Administration” on page 315.

IMPORTANT! A rep/job name cannot start with a number. Use letters when creating a rep name.

Viewing and navigating displays

When you start Envision for BACtalk, the top display appears in a window that you can move, size, and minimize. Pushbuttons on the display enable you to view other displays and navigate site information. The top display generally serves as a gateway to other displays. You use this network of data displays to manage your site's equipment and view status.

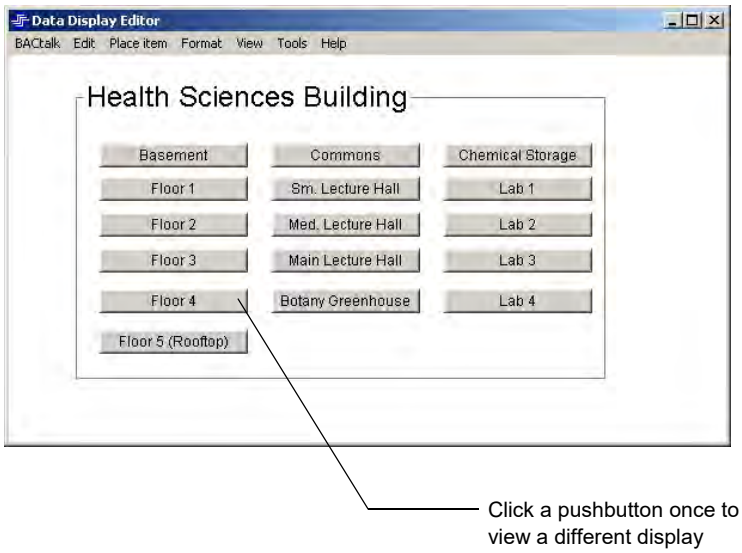
CAUTION When you finish working with data displays, close the display windows. This will help your system performance. Data displays poll the system frequently to update dynamic items, and leaving displays open can cause system performance to degrade because of network usage.

Using pushbuttons to navigate displays

You navigate displays by clicking pushbuttons that the system developer added to the display. Pushbuttons typically have labels that tell you what type of data or what zone they lead to. If you do not have a security level sufficient to use a pushbutton, the pushbutton does not appear on the display.

Usually, a Previous push button enables you to quickly backtrack to the display you last viewed. If a Previous push button does not appear, use the Alt+left arrow keys to backtrack through displays.

You can also navigate between displays by clicking a data display pushbutton once.



Use a Launch Application pushbutton to start other software applications from within Envision for BACtalk software. This pushbutton works like a Windows shortcut on your desktop. You can start another software program or a specific file with just a mouse click.

See your *Envision for BACtalk Display Developer's Guide* (LTBT-TM-DSPDV) and Envision for BACtalk Help for more information about setting up pushbuttons.

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Using the View menu to navigate displays

You can use commands on the View menu to quickly view the top display or the display viewed just previously to the current one.

Working with multiple display windows

Envision for BACtalk enables you to have multiple display windows open at once. This can be useful for simultaneously checking the status of related pieces of equipment, or for checking a piece of equipment along with a related zone or some other status information.

You can open as many display windows as your computer's memory will allow.

When you open additional displays (View>Display>New Display), a new instance of the top display appears.

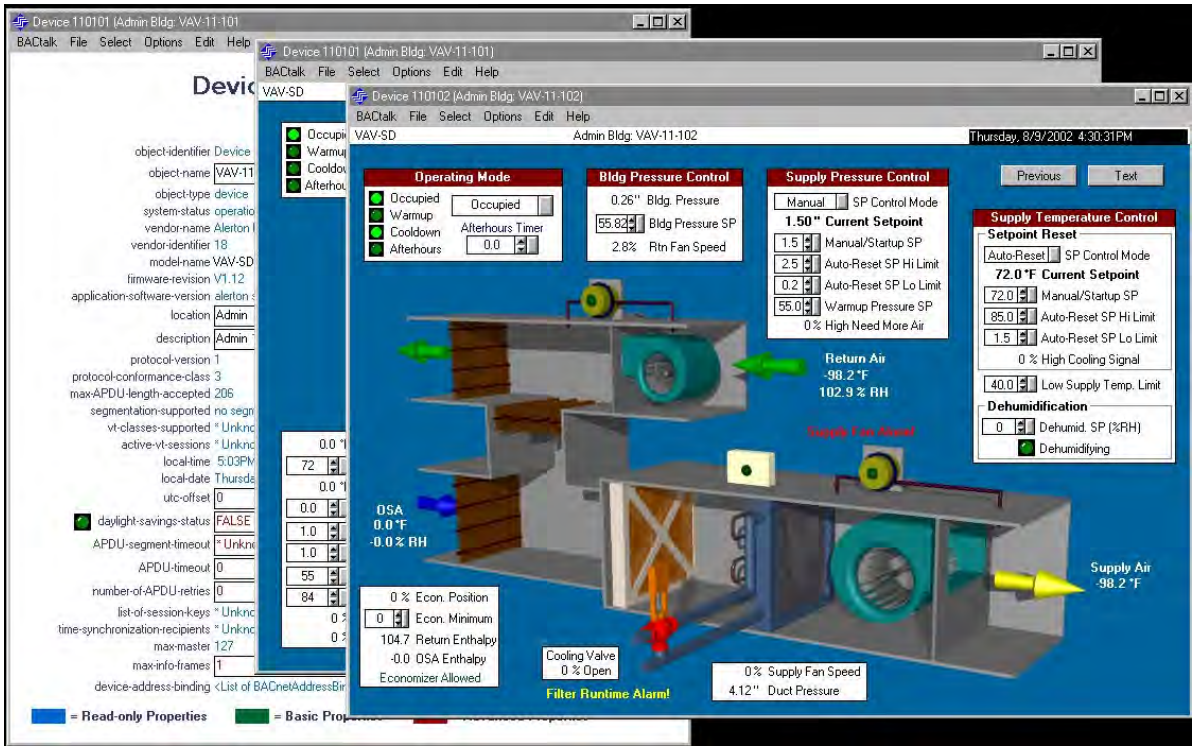

Figure 2.1 Envision for BACtalk with three displays open simultaneously. To switch between displays, click the title bar of an inactive window.

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Identifying and working with items on a display

In addition to push buttons and text labels to help you navigate and understand what you are viewing, Envision for BACtalk presents site data with feedback and control items. These items have special features and are the real power of your BACtalk system. Identifying them will help you take advantage of your system's capabilities.

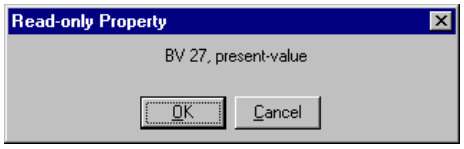
In most cases, the only difference between a control item and a feedback item is the setup when the system was programmed. A pilot light, for example, can be set up as read-only (feedback) or commandable (control).

Improved graphics editing

Starting with v2.5, Envision for BACtalk has an improved graphics editing environment to save on design time. Display items can be copied and then instantly lined up and centered using the new Align menu (Edit> Format>Align). For example, create a push button, copy it 20 times, select all 20 items, align them all along the left side and space them all evenly and simultaneously. The result is twenty new push-button created in seconds. Display items can be created, copied, modified and perfectly positioned with greater ease and efficiency. Development time is drastically reduced and the overall look of data displays is more professional.

Feedback items

Feedback items can appear as graphical simulations of equipment operation or as text. When you double-click a feedback item, Envision for BACtalk shows a dialog box with the device, object, and property where the data originates. Feedback items are also referred to as "read-only" items because you can not use them to command equipment operation or change parameters.



A spinning fan, a value that tells you the fan is operating at 30% of maximum speed, a half open valve, a modulating thermometer, and a temperature reading

are all examples of feedback items. The following data display demonstrates several different types of feedback and control items.

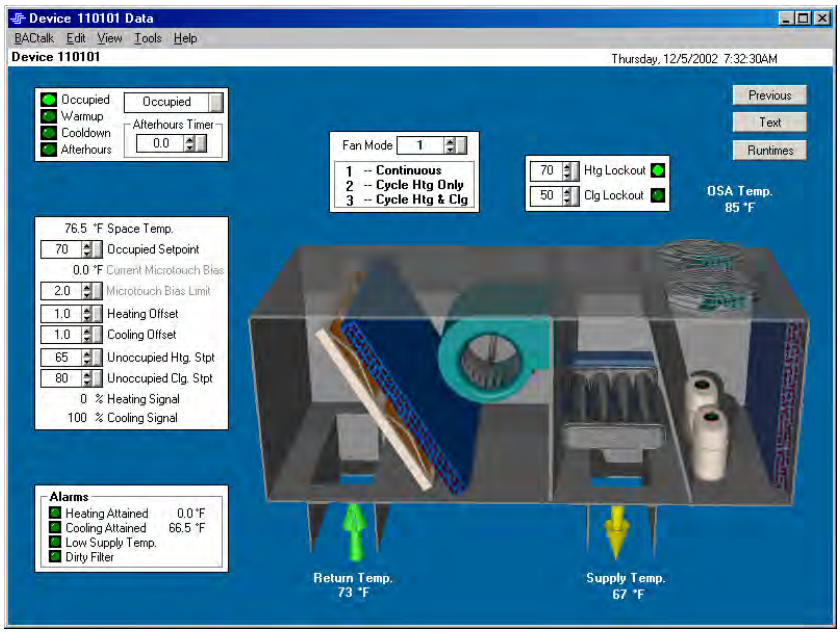


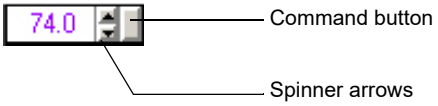
Figure 2.2 Data display for device 110101

Commanding system parameters with control items

Control items appear as virtual, on-screen controls for starting equipment or setting system parameters. Switches, pilot lights, prompted items, and check boxes are all examples of control items.

Prompted items

Prompted items are the most common type of control on a data display. You use prompted items to enter system values. They can affect the status of either analog or binary values. Each has a command button, which you click to change the value. When you click the command button, the Edit Property dialog box appears, where you can type a new value or select a different status. Click a prompted item's command button or use the spinner arrows to change a value in the Edit Property dialog box.



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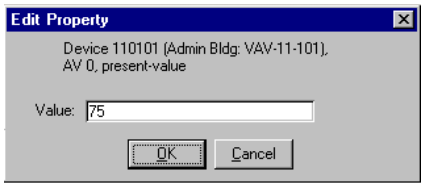
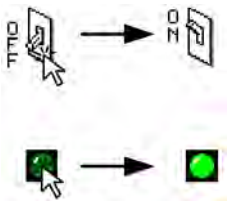
If you click the command button, the Edit Property dialog box opens. You can use this dialog box to type a new value or select an appropriate value from a list. Options depend on the controlled data point.



Note BACtalk controllers use floating point math to calculate values, giving them the ability to handle very large and very small numbers. For these numbers, the value in the Edit Property dialog box is represented in scientific notation. The number appears on the display in traditional notation and you can enter values without using scientific notation.

Graphical control items

Graphical control items, such as switches and pilot lights, are set up to affect binary property types. You click the graphical control to toggle the status from OFF to ON or vice versa. Graphical items may be set up for you to confirm a change after you make it. Click a graphical item once to toggle its status.



Check boxes

Check boxes on a data display also affect binary data points. Usually, the data point assigned to a check box controls an operating mode.

Like a graphical control item, you click a check box once to toggle the status of the data point. A check mark appears in the box when the data point is ACTIVE (ON). Click a check box once to toggle its status.

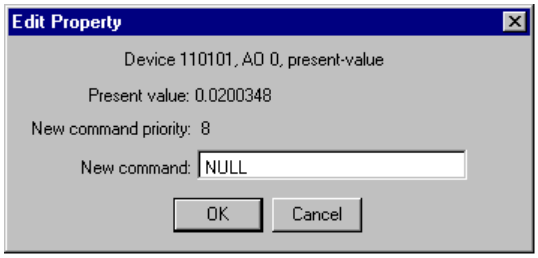
Commanding AOs, BOs, BVs from a data display

Because a number of commands may be issued simultaneously for a present-value property–for instance, an operator may command a fan ON while a schedule calls for it to be OFF–a scheme for prioritizing commands is necessary. This is achieved with the priority-array property.

The present-value of AOs and BOs in VLCs and building controllers results from the object's priority-array. The same is true of BVs in a global controller. BACtalk uses the priority-array to prioritize commands for these objects.

When you command one of these items from a data display, you actually write a value to the object's priority-array at a particular index, rather than writing directly to the present-value. The value displayed for the AO, BO, or BV, however, is the present-value. If a control item is in effect with a higher priority level, you may issue a command with a prompted item and see no effect on the value.

Your developer chose a priority-array index when your displays were created. The priority for each item can be customized. When you open the Edit Property dialog box for an AO, BO, or global controller BV, Envision for BACtalk lists the priority-array index written from the display as the New command priority.



Note For AO items, you can type NULL for the AO value in the Edit Property dialog box to relinquish command to lower priority items. For BOs and BVs, you can select NULL as an option.

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Commanding MOs, MIs, and MVs from a data display

Multistate objects in BACtalk have present-value properties representing different states of operation. For example, a fan may have three (or more) states of operation: low, medium, and high. The NULL value is used to relinquish command to lower priority items of the same property. When the present-value of a multistate object is combined with a state-text property, the special multistate Edit Property dialog box displays a number value with the text label for each state of operation.

If you click the command button, the Edit Property dialog box opens. You can use this dialog box to type a new value or select an appropriate value from a list. Options depend on the controlled data point.

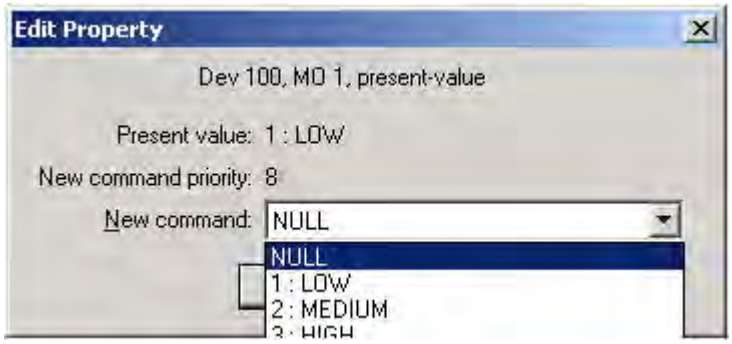


Figure 2.3 The present-value property 1 combined with the state-text property LOW can be used for a fan operating in low mode. The present-value property 3 combined with the state-text property HIGH can be used for a fan operating in high mode.

When the present-value property has a priority array, NULL is displayed at the top of the New command drop down list.

If an MI, MO, or MV object is not associated with a state-text property, only the number values are displayed in the Edit Property dialog box. For example, LOW, MEDIUM, and HIGH would not be displayed.

Menu items for MI, MO, and MV properties are displayed in context menus when you right-click a data display item that has a multistate object associated with it. Selecting the Properties item will open the properties data display.

Using shortcut menus to access automation features

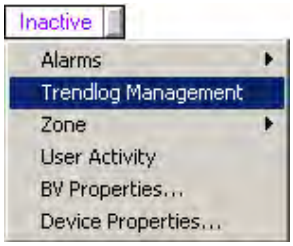
Depending on how your data displays are set up, you may be able to right-click a feedback or control item to access alarms, schedules, trendlogs, or operator activity for the property that the item references. You may also be able to view a property status sheet for the device where the property originates.

When you right-click an item set up with the feature enabled, a shortcut menu appears. The shortcut menu and available commands are set up on an item-by-item basis. Not all menu items may appear.

Note For details about setting up and using alarms, schedules, trendlogs, operator activity, and input, output, value, or device properties, see the appropriate chapter in this manual.

Setting up an alarm, schedule, or trendlog for an item from a data display

Right-click an item to see a context or pop-up menu of all the features you can set up for it through the data display. Only the available options for the selected item are shown. Click the menu command you want to start setting up the option.



Note The Zone option only appears for data points associated with a zone controller. See "Zones" on page 29 for more information.

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Interpreting status messages and alarms on displays

In addition to giving you control and visibility of your site data, feedback and control items provide messages that reveal the status of communications. Also, graphical items may be set up to show an alarm image if the referenced property is set up with an alarm and enters an alarm state. See “Alarms” on page 47 for more information about alarms.

Table 2.1 Status and alarm messages on data displays

Message	Description
75... ACTIVE... [ellipsis after value]	Prompted items only. Ellipses indicate that the command is being written to the data point (or to its priority-array). When the ellipses disappear, the value has been read back from the device.
NR	No response from unit. Communications with the device could not be established.
NR<val>	No response from unit, with <val> equal to the last known value of the property, which is buffered at the operator workstation.
NR NULL	No response from unit, with no known value in the buffer.
(waiting)	Attempting to establish communications with the unit.
Unsupported character set	Appears only for properties that return text string values. Indicates that the character string contains unrecognizable characters.
Unknown property	The property referenced does not exist in the object referenced.
Unknown object	The object does not exist in the device.
no datum	Indicates that the device referenced does not support the read-property-multiple service. To correct this, disable the service in the Advanced Network Settings dialog box (click **General System Setup** on the Tools menu, click the Network tab, click **Advanced**, and then select **Disable Read/Write Property Multiple**).
no entry	Indicates that the device associated with the requested property is not defined in the Device Manager table.
Communications error	Indicates that BACtalk could not establish communications to obtain the property status referenced.
Err(services, other)	Miscellaneous error condition.

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Zones

3

A *zone* is a defined space in a building that is controlled by the BACtalk system. Zones provide a convenient mechanism to monitor, manage, and arbitrate multiple Envision features, such as schedules, optimum start, and tenant activity. The optimum start and tenant activity features (see “Optimum start” on page 119 and “Tenant activity” on page 141) require a zone setup.

You can define zones to accommodate the specific needs of a building. For example, a zone may represent one floor of a building, multiple floors, a particular room or area within a floor, a hallway, foyer, or stairwell. How you define and use zones depends on how space is used and how you want to control the environment or equipment in a space. Typically, a zone is an area serviced by a single terminal unit, such as a variable air volume (VAV) box or a fan-coil unit.

Look at the areas of the building and how they are used before you define your zones. Consider how you want to control each zone. Is this an area that will be controlled by schedules? Is this an area where you want to use optimum start to warm or cool the space before it is occupied? Will you monitor and bill tenants for after-hours energy use in this zone? Like all Envision features and functionality, careful evaluation and planning will help ensure more effective results.

Benefits

Convenient Set up a zone and then assign it to other Envision features: schedules, tenant activity, and optimum start. A zone simplifies operation.

Efficient Set up a zone once and forget it. Copy the zone to set up scheduling, optimum start, and tenant activity for any number of similar controllers.

Reliable Set up a zone and system operation will remain reliable over time.

Practical application

George, the Facilities Manager at State University, wants to use optimum start in the Health Sciences building. This will help ensure that classrooms are comfortable when the first class of the day arrives, no matter how early or late that is. The administration is also thinking about charging individual department budgets for after-hours energy use in their respective buildings. George has suggested using the Health Sciences building as a trial run for the tenant activity feature. Both of these features require that the space be set up in zones.

Health Sciences is a four-story building with 30 VAV controllers on each floor, controlling the conditioning in classrooms, labs, and offices. George will use these VAV controllers to define 120 zones in the Health Sciences building. He can then set up schedules for each zone based on the expected occupancy. For example, standard classroom schedules are Monday, Wednesday, and Friday from 8:00 AM to 2:00 PM. Labs are typically in use on Tuesdays and Thursdays from 8:00 to 10:00 AM and 1:00 to 3:00 PM. Office hours are Monday through Friday from 8:00 AM to 5:00 PM. Defining these zones and schedules are the first steps in setting up optimum start and tenant activity.

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Quick start–zone setup

Use the following table to help you set up zones in Envision for BACtalk. The key steps for creating a zone are listed in order.

Table 3.1 Tasks for setting up a zone

Task		See
1	Identify the areas of your building you want to set up as zones.	• Site documentation
2	Identify the device instance of the field controller that controls the zone's equipment.	• Site documentation
3	Identify the control point that reliably represents the occupied command for that zone. Typically BV-40 for Alerton standard applications.	• Site documentation
4	Identify the global controller or BCM that you want to host the zone.	• Site documentation
5	Use the information you have gathered to set up information on the General tab for the zone. Specify the Advanced Output Settings if the zone device uses multistate objects.	• page 37
6	If you will use optimum start and you will use Celsius, specify this on the Advanced tab.	• page 39
7	If you will use optimum start, on the Optimum Start References tab, set up optimum start data point references for warmup and cooldown commands, heating and cooling setpoints, outside air temperature, and zone space temperature.	• page 41
8	If you will use tenant activity, on the Tenants tab, specify the data point that indicates after-hours override in the zone.	• page 42
9	Save the zone.	• page 33
10	If you will use optimum start or tenant activity, set up a schedule set for the zone.	• page 44
11	Identify similar zones that you want to have the same setup. Use Copy to create multiple zone setups quickly and easily.	• page 44

How zones work

Facilities are typically divided into manageable areas called *zones*. A zone is associated with a single field controller and terminal unit device. In a BACtalk system, each zone must have an occupied command point in that controller.

Why use zones?

Envision for BACtalk specifically requires zones for the optimum start and tenant activity features. You can also assign a schedule set to a zone to control device operations based on the time of day, holidays, and special events.

In the context of a building, a zone is any area you want to control. Within the context of a BACtalk system, a zone is an Alerton-defined object with an associated set of properties. See the *BACtalk Systems Programmer's Guide and Reference* (LTBT-TM-PRGRMR) for more information about objects and properties.

A zone object pulls together the individual properties and references required to support optimum start or tenant activity in a single object. It handles the user-defined inputs specified during the zone setup to monitor and control schedules, optimum start, and tenant activity.

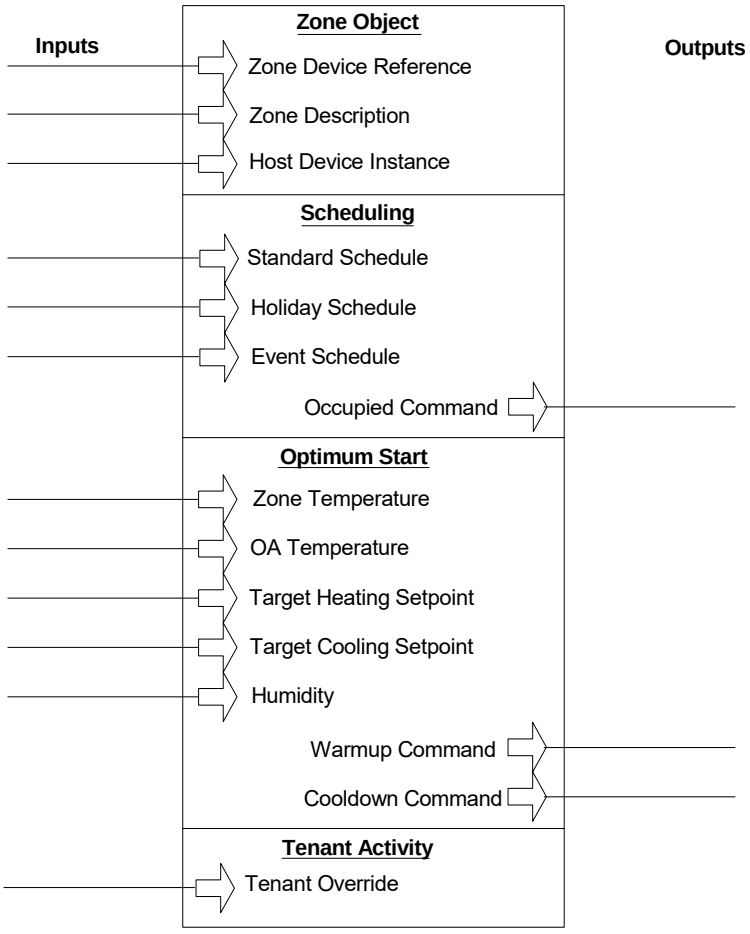

Figure 3.1 Zone object inputs and outputs

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What makes a zone?

Each zone is defined by a *zone device reference* and an *occupied command reference*. The zone device reference identifies the field controller for the equipment that conditions the zone. The occupied command reference indicates whether the zone is occupied or unoccupied; this reference must be a data point within the zone device.

How zones work with schedules and optimum start

When you set up a zone and assign a schedule set to it, the schedules write to properties on the zone object, instead of the command points of the BACnet device controlling the actual hardware. See Figure 3.1 on page 32.

A point may be controlled by one zone or by one schedule, but not both. If you assign a schedule to a zone, do not schedule any of the points that the zone writes to. For example, warmup and cooldown command references are points of control, so they have this restriction.

When you assign a schedule set to control a zone, it writes to the individual properties of the zone, such as the occupied command. This allows Envision for BACtalk to determine which schedule (standard, holiday, or event) controls the zone. In other words, the occupied command is not scheduled directly; the zone controls the occupied command, which in turn is used to help calculate optimum start times.

How zones work with tenant activity

In much the same way that the occupied command associates a zone with optimum start, the tenant override command associates a zone with the tenant activity feature. When you define a zone, you can identify a tenant-override property. The host device detects when this property indicates after-hours activity in a zone and records these events. You can then view or generate bills based on this information.

Zones are a component of the tenant profile. When you define a tenant profile, you assign one or more zones to a tenant. For example, a tenant may occupy two floors of a building and each floor may be divided into several zones. See “Tenant activity” on page 141 for more information about setting up and using the tenant activity feature.

How zones are saved and run

Zones are Alerton objects that are saved in global controllers. This allows features that rely on zones, such as schedules and optimum start, to run even if the operator workstation is offline.

Note The tenant activity feature requires that the Envision for BACtalk server be running to log tenant activity events.

The zone object incorporates all the information that defines a zone, including references to the physical BACnet device controlling the zone and references to the schedules controlling the zone. The zone object manages the various schedule inputs (standard, holiday, and event) that control the physical device. See the *BACtalk Systems Programmer’s Guide and Reference* (LTBT-TM-PRGRMR) for information about the objects and properties.

Synchronizing zone data

When you add or edit a zone definition and click **OK**, the settings are saved to the BACtalk server and to the host device if it is online. You can also send zone settings to devices from Device Manager. When you use the Send feature, Envision for BACtalk displays an option to resynchronize and verify all zone and schedule dependencies. To ensure a complete resynchronization, it is good practice to send all schedules and zones at the same time.

Note If you view the User Request Monitor after choosing to synchronize zone data, you will see that Envision for BACtalk automatically sends all schedules before sending zone data.

Because a point cannot be controlled by both a zone and a schedule set, conflicts may occur. Envision displays an error message if you try to assign a zone to a point that is already controlled by a schedule or vice versa. However, other advanced Envision features can inadvertently create conflicts. For example, conflicts will occur if you back up a job and restore it to a job that does not have exactly the same objects stored in the controller. You will also experience errors if you dial-up a non-server based site without first performing reverse engineering upon connection. Use the Status information in the Zones dialog box to help you identify the devices where conflicts exist. See "Working with zone status information" on page 43 for more information.

CAUTION Be careful when assigning a point to a zone. If DDC is trying to write to a point that the zone is trying to control, no conflict will be apparent.

Example

Health Sciences is a four-story building, which has 30 VAV controllers per floor. These are the field controllers for each of 120 zones in this building. The zones use the same standard application and same data points (for example, BV-40 is the occupied command reference). They also use the same schedule set. You can set up one of the zones, and then copy that setup to the other 119 zone objects in the other zones' global controllers to automatically create the rest of the zones. See "Copying a zone setup" on page 44 for more information.

Practical application

George, the Facilities Manager, has identified all the zones in the Health Sciences building where he wants to use optimum start. For now, he is limiting it to the classrooms and labs because that is where the most people are affected if the room is too warm or too cold for the first class or lab of the day.

Currently, all of the classrooms are controlled by data points and occupied commands. George wants to convert the classrooms to zones so he can enable optimum start. After reviewing the data displays for several of the classrooms, George realizes that they are all engineered in the same way—they use the same schedule set, the same occupied command reference in each device, and so on. George opens the schedule used for the classrooms in the Time Schedule Wizard and selects a data point from the Controlled Points list for a Health Sciences classroom, Dev 310101, BV-40. He right-clicks the point, and then uses the

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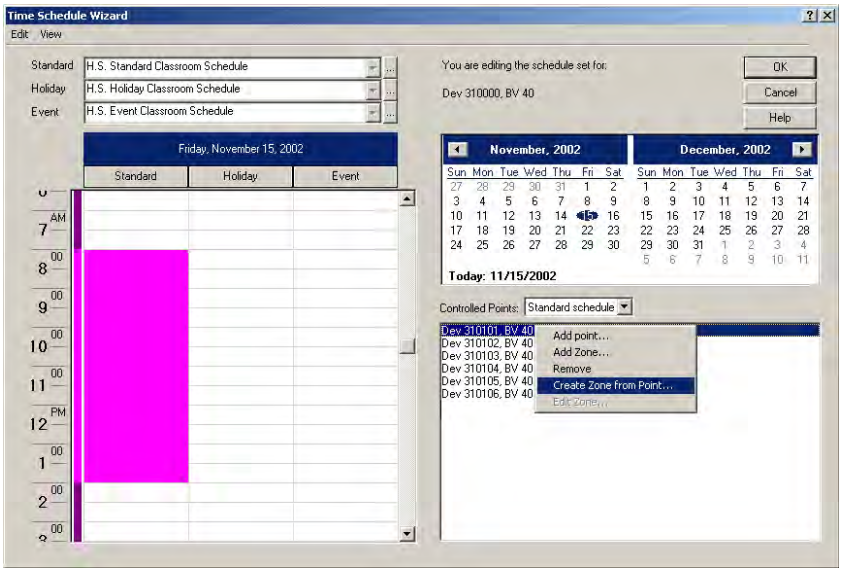
Create Zone from Point option on the shortcut menu to quickly create a zone based on the current data point settings.



George deletes all the other points to be converted from the Time Schedule Wizard's Controlled Points list (Dev 310102, BV 40 - Dev 310106, BV 40). He clicks **OK** to save the new schedule and synchronize the zone with the schedule. He then goes to the Zones list (BACtalk>Zones) and selects the new zone controlling Dev 310101. George uses the Copy button to create zones for the rest of the points (Dev 310102, BV 40 - Dev 310106, BV 40), using the same settings.

Setting up a zone

Zones enable you to monitor and control environmental conditions within specified areas in a facility. Once you have defined a zone, you may not have to modify the zone setup again. You can assign tenants to existing zones and generate tenant bills for after-hours energy use through tenant activity. You can also link schedules and optimum start functionality to existing zones so that Envision calculates when to start HVAC equipment to reach a zone's desired setpoint temperature by scheduled occupancy.

See the Schedules, Tenant Activity, and Optimum Start chapters in this manual or Envision for BACtalk Help for more information about using these features with zones.

When you select the **Zones** option, Envision displays a list of the zones that have been created. The Zones dialog box displays the zone description, the associated output point, and the status of the zone definition. See "Working with zone status information" on page 43 for more information.

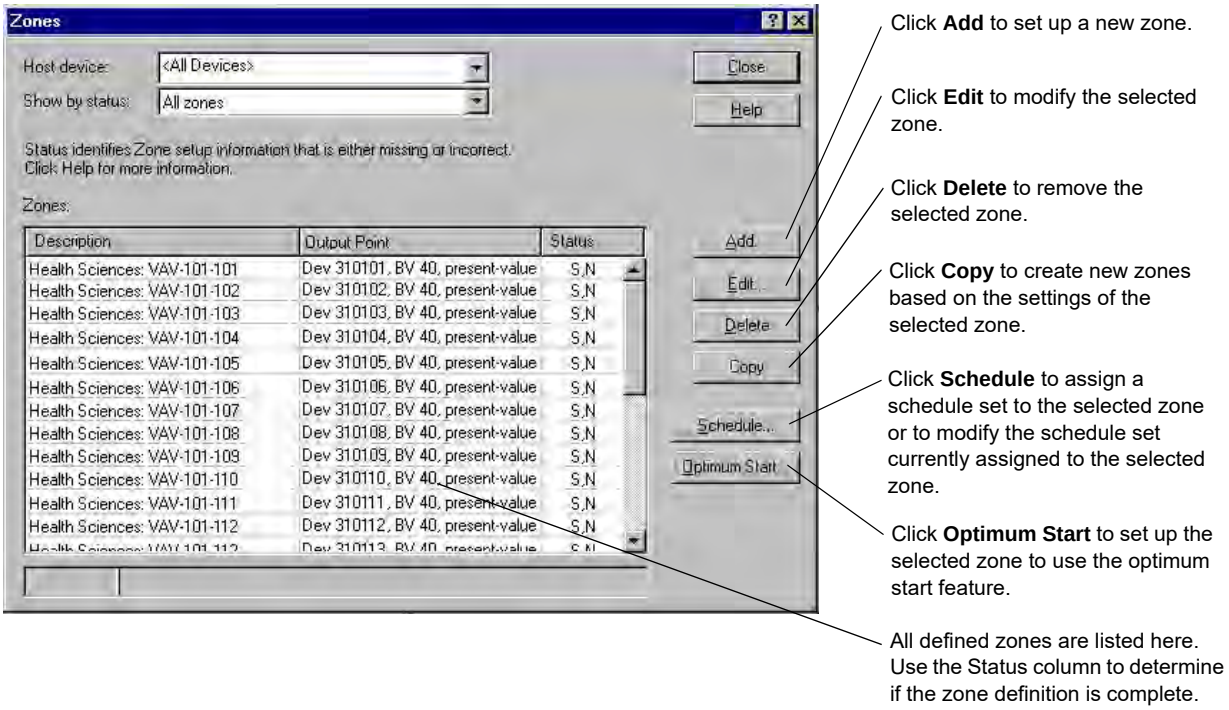


Figure 3.2 Use the Zones dialog box to add, edit, delete, or copy the selected zone's properties. You can also set up schedules and optimum start for the selected zone from this dialog box.

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There are a number of ways you can define zones, depending on how you work with Envision for BACtalk and your objectives. The following lists various strategies you can use:

- Define all zones, then define schedules, optimum start, and tenant activity settings for each different zone as appropriate.
- Define a single zone and all features that you want to use with the zone, such as optimum start and tenant activity. Copy the zone setup for all similar controllers and edit those setups as needed.
- The optimum start and tenant activity features both allow you to define a zone when you define the settings for the feature. For example, if you select **Energy Management** and then **Optimum Start** from the BACtalk menu, the Select Zone for Optimum Start dialog box appears. You can select a zone from the list or create a new zone.
- You can also create a zone from the Time Schedule Wizard. Right-click the Controlled Points list and click **Add Zone** to define a new zone, or select a point from the list and click **Create Zone from Point** to create a zone based on a scheduled point.

Note In the User Setup dialog box, Add, Delete, and Configure Zones must be selected privileges in your user profile to allow you to create or edit zones.

Defining a zone

When you click **Add on** the Zones dialog box, the Edit Zone dialog box is displayed.

Note Zone references automatically update to Alerton Standard applications. That is why certain AVs are always automatically assigned during the zone setup process. These default values are fixed and are not based on device type. For example, outside air temperature default reference is AV-103, present-value. For more information about zone references or Alerton Standard applications, see the *BACtalk Systems Programmer's Guide and Reference* (LTBT-TM-PRGRMR).

General tab

Use the General tab to specify the host where the zone information will be stored, the field controller that controls the zone equipment, and the occupied command property. These references on the General tab define the zone.

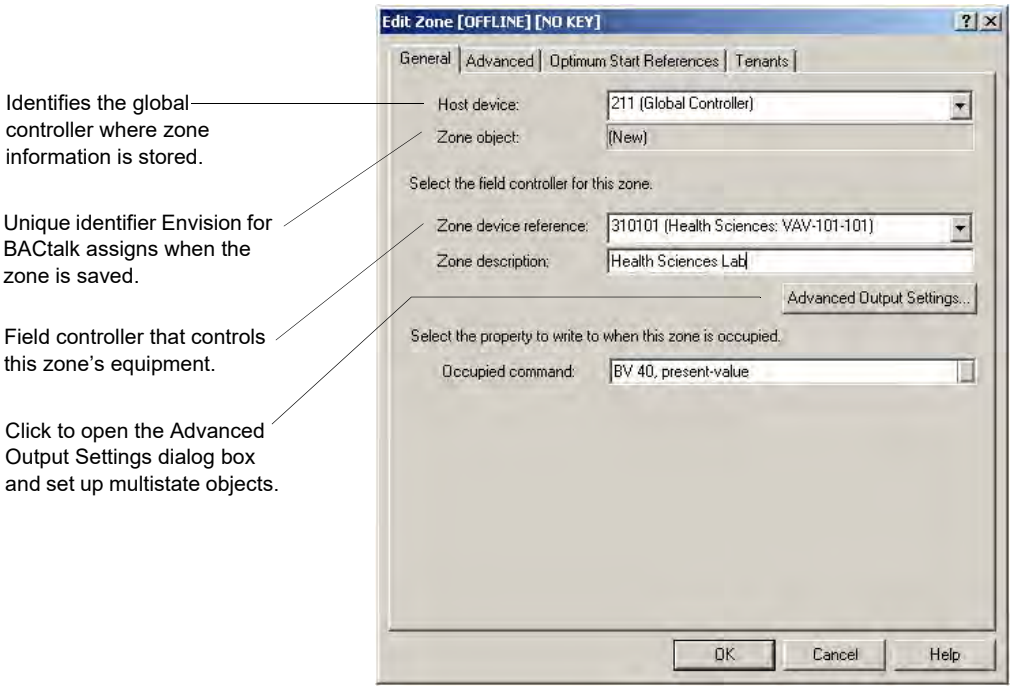

Figure 3.3 Specify controllers, zone location, and the occupied command property on the General tab of the Edit Zone dialog box for a new zone. Use the Advanced Output Settings dialog box to set up multistate objects.

Host device Specify the device instance of the global controller that will store the zone settings and carry out features associated with the zone, such as optimum start. The Host device box lists only devices that are capable of hosting a zone. Once you create and save a zone definition, you cannot change the host device.

Note Device capabilities are set in the device profile using Device Manager. To host a zone, a controller must have "Supports Alerton zone objects with external points" selected on the Capabilities tab in the Add/Edit Device Profile dialog box.

Zone object When you save this zone definition, Envision for BACtalk automatically creates a unique identifier for the zone object, which includes the host device number, a zone number, and the zone description. For example, "Dev 31010, aler-zone 11 (Health Sciences: VAV-101-101)."

Zone device reference This entry identifies the field controller for the equipment that conditions the zone. For example, the device instance of a VLC controller for a fan coil unit. The occupied command is written to this device.

Zone description Enter a meaningful description for this zone, for example, a description of the zone's location (Health Sciences: VAV-101-101). This description is displayed as part of the zone object in lists and displays. It is also the default device description displayed in Device Manager.

Advanced Output Settings Click to open the Advanced Output Settings dialog box and then enable and define a multistate object, such as a fan with low, med, high, and off settings. Select **Enable** box to activate the rest of the fields and

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then select points to write to and values to write for each state (for example, low, medium, and high) that the device supports. Contact the device vendor to obtain the specific points and values to use. Clear the Enable check box to disable the advanced output settings.

Note Saved changes on the Advanced Output Settings dialog box affect settings in the Edit Zone dialog box. For example, the Occupied command field on all tabs is disabled and displays "Advanced output mode." All other fields on the Edit Zone tabs display the current settings until the user changes them. The Warmup command and Cooldown command fields on the Optimum Start References tab are also disabled (see Figure 3.6 on page 41).

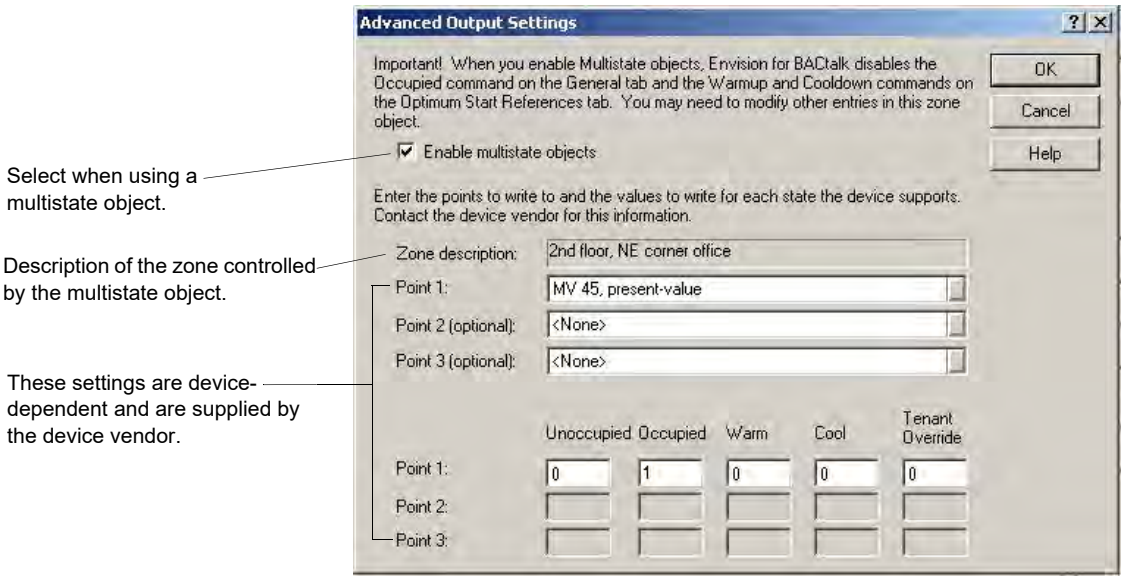


Figure 3.4 Enable multistate objects and define the points to write to and the values to write for multistate objects on the Advanced Output Settings dialog box.

Occupied command The occupied-command property indicates when the zone is occupied or unoccupied. This must be a property on the zone device.

Note The Occupied command field is dimmed and reads "Advanced output mode" when multistate object support is enabled. See "Advanced Output Settings" on page 38 for more information.

WARNING By default, the zone object uses BV-40 for the occupied command and BV-41 and BV-42 for the warmup and cooldown functions used in optimum start calculations whether your system uses the optimum start feature or not.

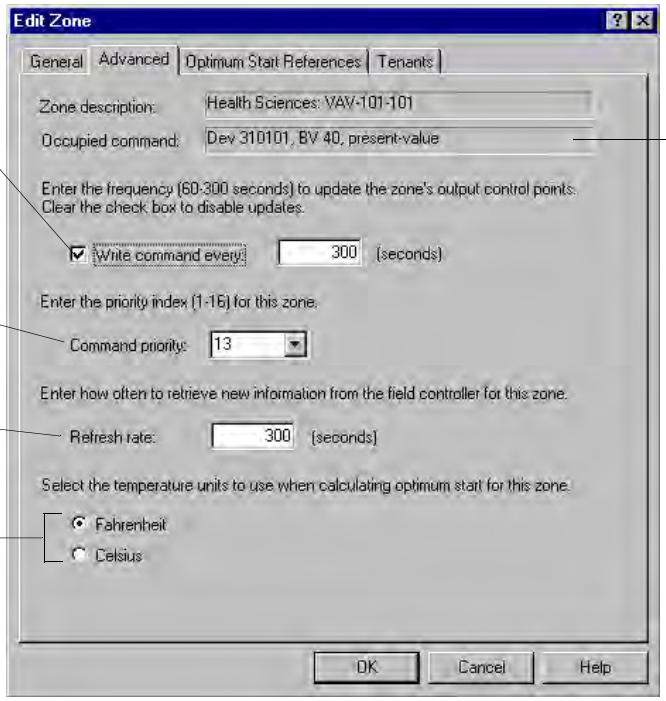
Defining advanced zone settings

Advanced tab

The settings on the Advanced tab determine how the BACtalk system processes zone data. These settings seldom need to be changed.

WARNING Only change the default Advanced tab settings if you have a specific need to do so. While changing the Write Command Every rate and the Refresh rate values from the default to a lower value will increase accuracy and

response times of zones, it will also have a negative effect on BACtalk network traffic due to the increased number of property reads and writes.



The rate at which the output control points of the zone are updated. A zero value disables regular updates of the output control points. Maximum is 300 seconds.

This number (1-16) determines the index at which Envision for BACtalk writes to the priority-array.

This option determines if the referenced property values are still valid. Envision for BACtalk waits this amount of time before recalculating optimum start.

Select the temperature units to use when calculating optimum start.

Note The Occupied command field is dimmed out and reads "Advanced output mode" if multistate object support has been enabled on the Advanced Output Settings dialog box (General tab>Advanced Output Settings).

Figure 3.5 Use the Advanced tab of the Edit Zone dialog box to specify how BACtalk will process zone data.

Write command every This setting determines how often, in seconds, the host controller updates the zone's output control points (for example, occupied command and optimum start references, if enabled). The minimum setting is 60 seconds; the maximum is 300 seconds. When the check box is cleared, outputs are updated when conditions change instead of regular intervals.

Command priority This setting assigns a priority to the zone. This is the priority-array index that the zone object writes to in commandable BACtalk properties, such as occupied command, warmup command, and cooldown command. Valid index values are 1-16. See your *BACtalk Systems Programmer's Guide and Reference* (LTBT-TM-PRGRMR) for more information.

Refresh rate This setting determines how frequently, in seconds, that Envision for BACtalk polls the field controller for data about this zone (space temperature, outside air temperature, target heating and cooling setpoints, and humidity, if defined). Data is refreshed at least every 15 minutes by default. Users can set this rate anywhere between 10 and 900 seconds.

Fahrenheit/Celsius Specify whether your system uses Fahrenheit or Celsius for temperature calculations and references. Changing this setting automatically converts the Outside air limit value on the Optimum Start dialog box to the same units.

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Setting optimum start references

Optimum Start References tab

Use the Optimum Start References tab to define the reference points or values used for optimum start calculations for this zone. For more information about how optimum start calculations work, see “Optimum start” on page 119. You do not need to change the default settings if optimum start is disabled.

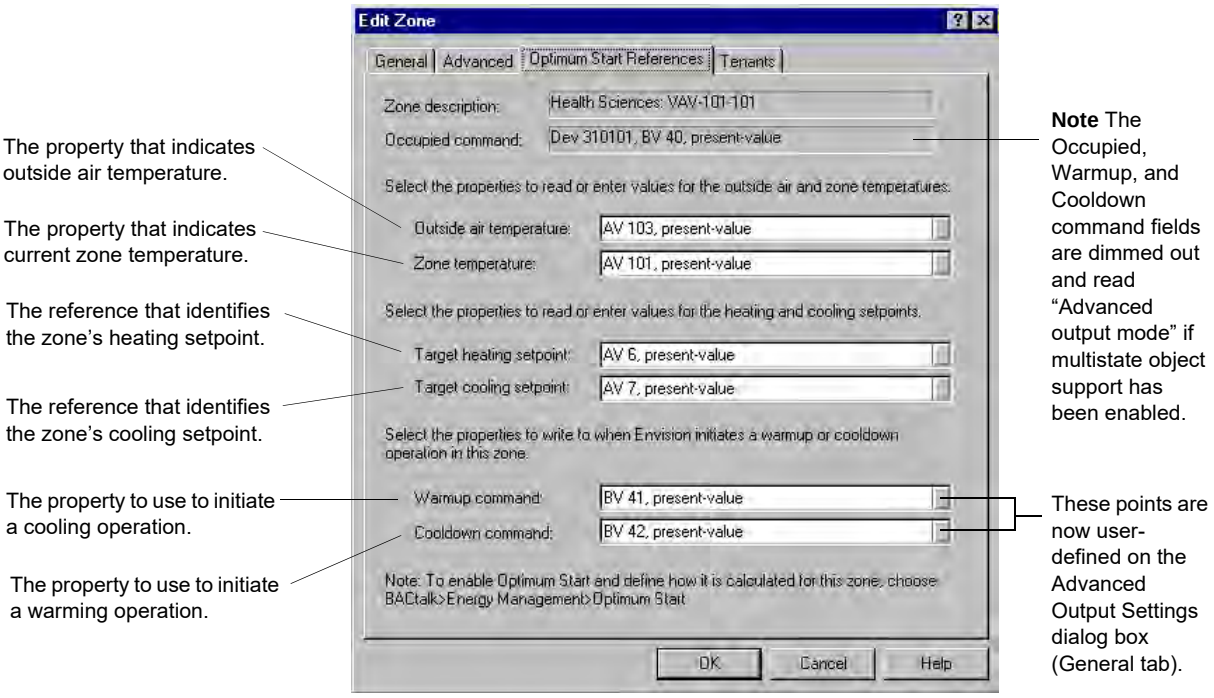


Figure 3.6 Use the Optimum Start References tab to specify the data points and values that this zone uses for optimum start calculations.

Optimum start is a self-tuning feature that uses a set of calculations to determine when to begin heating or cooling operations to reach the desired setpoint by the time the zone is occupied. As a result, the calculations and daily adjustments are more accurate when data point references are used. However, if they are unavailable, you can specify values for each of the references. For more information about how these values are used in optimum start calculations, see “Optimum start” on page 119.

Outside air temperature Select the data point to monitor or enter a value for the temperature of the air outside the facility.

Zone temperature Select the data point to monitor or enter a value for the space temperature for the zone.

Target heating setpoint Select the data point that provides the target heating setpoint for this zone. This is the temperature you want the zone warmed to by the next scheduled occupancy. Typically, this is set to a data point that represents the zone’s occupied heating setpoint. Alternately, this may be set to a data value.

Target cooling setpoint Select the data point that provides the target cooling setpoint for this zone. This is the temperature you want the zone cooled to by the

next scheduled occupancy. Typically, this is set to a data point that represents the zone's occupied cooling setpoint. Alternately, this may be set to a data value.

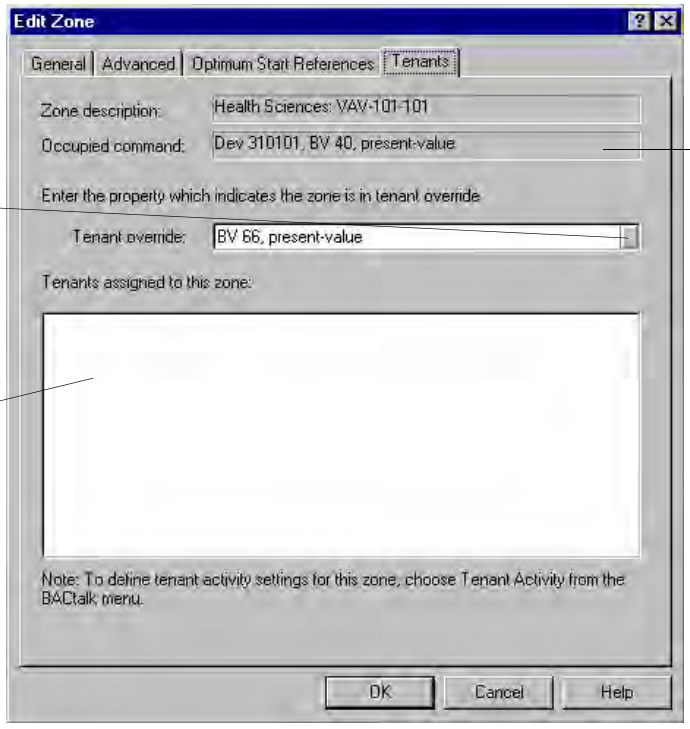
Warmup command Select the data point that optimum start writes to when heating is called for in preparation for scheduled occupancy. Envision assumes heating is required when the zone temperature is less than the target heating setpoint - 0.5 degrees Fahrenheit. If a data point is not specified (None is selected), optimum start will not begin warming the zone prior to scheduled occupancy.

Cooldown command Select the data point that optimum start writes to when cooling is called for in preparation for scheduled occupancy. Envision assumes cooling is required when the zone temperature is greater than the target cooling setpoint + 0.5 degrees Fahrenheit. If a data point is not specified (None is selected), optimum start will not begin cooling the zone prior to scheduled occupancy.

Setting the tenant override reference

Tenants tab

Use the Tenants tab if you will be setting up the tenant activity feature for the selected zone.



The property that will indicate tenant override activity in this zone. For example, in Alerton Standard applications, this is the present-value property of BV-66.

Displays a list of all tenants assigned to this zone.

Note The Occupied command field is dimmed out and reads "Advanced output mode" if multistate object support has been enabled on the Advanced Output Settings dialog box (General tab).

Figure 3.7 Specify the data point that BACtalk will monitor to determine if a zone is in tenant override mode.

Tenant override Select the data point to monitor to determine when the zone is in tenant override mode. If you are not using tenant activity in this zone, you can select None for this property.

See the "Tenant Activity" chapter in this manual or Envision for BACtalk Help for more information about setting up and using Tenant Activity.

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Working with zones

After you have set up a zone, you can adjust the settings, if necessary, or use an existing zone to set up another zone with similar settings. From the Zones dialog box, you can also edit, copy, add, or modify schedules, or enable or adjust optimum start settings for the selected zone. See page 36 for an example of the Zones dialog box.

Editing a zone setup

The zone setup is basically a set-and-forget task, but over time you may want to adjust zone settings. For example, the building where the zone is located may be remodeled and the zone's description may no longer be accurate. You may decide at a later time that you want to use the optimum start feature in a zone and need to set up the references used in optimum start calculations.

Note Once you save a zone definition, you cannot edit the host device. If you need to edit a zone's host device, you must delete the zone and recreate it using the new host device.

Working with zone status information

The Zones dialog box provides useful information about the status of a zone definition. This information can help you determine if additional edits or settings need to be defined for the zone.

The Status column in the Zones dialog box provides the following information.

Table 3.2 Zone status information

Status	Description	Recommended action
C	Conflict with another zone or schedule. Only one zone or schedule can control a single command point.	Check other zones and schedules to make sure that only this zone is controlling the data point for a given device.
I	Incomplete control point information.	Check to make sure all data points are defined for this zone. This status may occur if a point has been removed from a zone.
S	Incomplete schedule information.	Check the schedule set for this zone and verify that standard, holiday, and event schedules are assigned to it.
N	No tenants assigned to this zone.	Optional: Ignore this status code if you are not monitoring tenant activity. To use the tenant activity feature in this zone, you must assign a tenant to the zone on the Zones tab of the Edit Tenant Profile dialog box.
O	Tenants assigned, but no tenant override property.	Optional: Ignore this status code if you are not monitoring tenant activity. To use the tenant activity feature, you must specify a tenant override property for this zone on the Tenants tab of the Edit Zone dialog box.

Deleting a zone

You may decide that a zone is no longer needed or that a particular zone setup is inaccurate and you would like to set it up all over again. Select the unwanted zone from the Zones list in the Zones dialog box, and then click **Delete**.

WARNING Deleting a zone permanently removes that zone from Envision for BACtalk. Make certain the zone is no longer needed, for example, no tenants are assigned to the zone, before deleting it.

Copying a zone setup

If you are setting up zones for a large site, using the copy feature can save a lot of time. For example, you can define all the settings for one zone, and then copy those settings to create zone definitions for areas with similar controllers. When you create zones using the copy feature, keep these guidelines in mind:

- Set up the first zone according to how you want all other zones to be set up, including schedules and optimum start settings.
- If you will be using tenant activity or optimum start, configure those options and enable optimum start before you copy the zone. Note: Tenant assignments are not copied.
- When you click **Copy** in the Zones dialog box, select all the devices that you want to copy the zone setup to. The devices you select should be the field controllers for each zone. Their device instances will appear as the zone device reference in the zone definition.
- Verify that all devices have descriptions in Device Manager.
- All the data references for the zone are copied to the new zones. For example, if the original zone uses BV-40 in the field controller for its occupied command, the new zones will each use BV-40 in their respective field controllers as the occupied command reference. If you entered fixed values, those values are copied to the new zones.
- The copied zones use the same schedule set as the original zone.

Options for scheduling a zone

Zones use schedules to determine when to begin and end operations in the zone. When you link schedules to a zone, you select a standard schedule, a holiday schedule, and an event schedule. Features, such as optimum start, use these schedules to calculate when to begin warming or cooling operations in the zone. See "Schedules" on page 101.

There are several ways to schedule a zone in Envision for BACtalk:

- In the Zones dialog box, select the zone you want to schedule, and then click **Schedule**.
- From a data display, right-click a data point and, from the shortcut menu, click **Zone**, and then click **Schedule**.
- In the Time Schedule Wizard, right-click under Controlled Points, and then click **Add Zone**.

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Setting up and adjusting a zone's optimum start settings

You can set up or edit optimum start settings from the Zones dialog box. Select the zone you want to work with, and then click **Optimum Start** to open the Edit Optimum Start dialog box. For details on configuring optimum start, see "Optimum start" on page 119.

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Alarms

4

Envision for BACtalk *alarms* help you efficiently manage your buildings. Alarms monitor data points in the BACtalk system for conditions you specify, and then generate alarm messages when the condition is met. For example, you might monitor the temperature of a zone, the status (ON/OFF) of a piece of equipment, or compare a command to an actual operating status.

When you set up an alarm, you also set up or select an *alarm handler*, which tells the system where and how to annunciate the alarm. The system can annunciate the alarm in a number of ways:

- Data display items referencing the data point in alarm can show alarm status
- Operator workstations can email an alarm
- Operator workstations can display a popup alarm message indicating the alarm
- The alarm can display a link to a specified URL or a BACtalk display or template when it is annunciated
- The alarm can dial out information to a pager
- The alarm can dial out information to be logged at a remote site
- The Envision for BACtalk server can record an entry in the Alarm History file

See “Reading BACtalk alarm messages” on page 90 for more information about reading and working with alarm messages.

Benefits

Efficient Get critical information about your system while at an operator workstation or on the road.

Customizable Set up your own alarm messages for different alarms. Have alarms sent to pagers, operator workstations, remote systems, or email.

Flexible Use alarm handlers to change alarm recipients without having to edit individual alarms.

Practical application

Marc is the lead facilities engineer for the Administration building at State University and responsible for the regular maintenance of all equipment in the facility. For example, he ensures filters are changed, equipment is tuned, and air ducts are cleaned. Marc also is the "first line of defense" if there is a problem with mechanical equipment. He is usually on site from 8:00 AM to 7:00 PM Monday through Thursday and on-call for emergencies during off-hours. He has a pager so that his night crew, and the system, can contact him for emergencies.

Many alarms were set up for the system when it was turned over to the facilities staff, but Marc quickly learned that alarms help him keep tabs on his building. He occasionally sets up new alarms to annunciate at operator workstations, pagers, remote sites, or email when equipment requires some sort of maintenance.

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Quick start–alarm setup

Use the following table to help you set up an alarm in Envision for BACtalk. The key steps for defining an alarm are listed in order.

Table 4.1 Tasks for setting up an alarm

Task		See
1	Identify the foundation of the alarm setup: • What kind of conditions do you want to define alarms for? • Who should receive the alarms and how should they receive them? • What kinds of alarm conditions require acknowledgement? • What kinds of messages do you want to use for alarms? • Which data points (present-value of AI, AV, AO, BI, BV, BO) do you want to monitor for an alarm state? • What alarm type best suits the objective of each alarm condition? • What global controller do you want to host the alarm setup?	• Site documentation • page 54 • page 55
2	Select the data point you want to monitor for an alarm. Use the Alarm Wizard, Point Alarm Setup, or right-click an item on a display.	• page 62
3	Define alarm setup parameters based on the type of alarm and your decisions from step 1.	• page 69 (fixed limit) • page 72 (floating limit) • page 74 (binary) • page 75 (command fail)
4	Do you want to pop up a data display, template, or Web page?	• page 71
5	Do you want to email an alarm?	• page 84
6	Select an alarm handler for the alarm, or set up a new alarm handler. Verify the recipients of the alarm or set up new recipients.	• page 77
7	Define global alarm settings.	• page 87

How alarms work

There are three items at the core of any alarm in Envision for BACtalk:

- The *monitored property,* which is the status or value that the alarm watches for an alarm state.
- The *alarm setup* (in BACnet, technically known as an *event-enrollment object*), which is saved in a global or building controller. It watches the monitored point to generate an alarm.
- The *alarm handler* (in BACnet, technically known as a *notification-class object*), which determines what operator workstations, pagers, remote sites, and email accounts are notified when an alarm occurs.

This method of generating alarms—with three components working in tandem—is efficient and flexible.

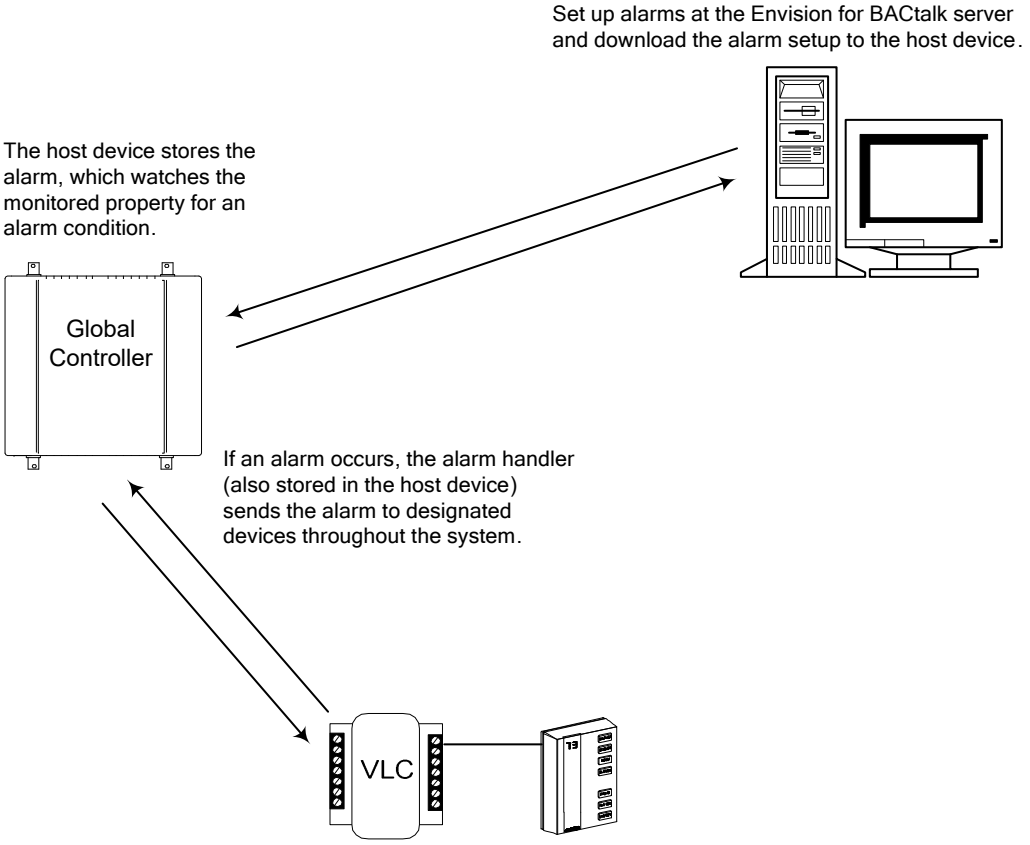

Figure 4.1 BACtalk components work together to generate alarms. Global controllers include: BTI, BTI-100, and BCMs (which act like global controllers in the BACtalk system).

About the monitored property

The monitored property is usually the present-value of an AV, BV, AI, BI, AO, or BO. Although an alarm can monitor any property of any object, these data points are most likely to indicate an alarm condition in your system. The monitored property can originate anywhere in the system, but it is good practice to have the global controller closest to the monitored property host the alarm setup.

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About the alarm setup

The alarm setup is saved in the host device (see “How alarms are saved and run” on page 61). The alarm setup stores a reference to the monitored property and stores the parameters that determine when the property is in alarm. When the alarm setup finds an alarm condition in the monitored property, it changes state. There are three possible states, and each one can have a separate set of rules for alarm handling. These states can be individually enabled or disabled for each alarm. The alarm handler uses these event states to determine where alarm notifications are sent and whether the notification needs to be acknowledged.

The three alarm states are:

- **Alarm (also, off-normal)** This is the most common alarm state. An *off-normal alarm* indicates that the monitored point does not conform to the alarm parameters set up for it. For example, the present-value of an AV is out of range or a BV has changed state.
- **Fault** Currently supported in the VLX and the VLCP only. This alarm state is related to the reliability property of BACnet objects. Although the monitored point is a BACnet object and property combination, this alarm state keys on the reliability property of the object alone. A fault alarm occurs when the reliability property of the monitored object is other than No Fault Detected.
- **Normal** This state indicates that the referenced property returned from off-normal to normal status. A property must return to normal before it can alarm, so this selection does not appear in the alarm setup and is always enabled.

About the alarm handler

Each alarm in Envision for BACtalk has an alarm handler assigned to it. The alarm handler determines which devices are notified when an alarm occurs. These devices are called *alarm recipients*. Alarm recipients can include one or more of the following:

- An operator workstation
- A pager
- A remote BACtalk system
- An email account

The alarm handler maintains a list of *recipient profiles*. Each recipient profile determines the type (off-normal, fault, normal) of alarm the recipient accepts and the actions the recipient carries out. When you set up an alarm handler, you can select existing recipient profiles or set up new ones. Once you create a profile, any alarm handler can use it, and multiple profiles can be set up for a single recipient. Alarm handlers are saved to the Envision for BACtalk server and to the host device.

See “Setting up alarm handlers” on page 77 or Envision for BACtalk Help for information about setting up alarm handlers.

Practical application

As the lead facilities engineer in the Administration building, Marc has four technicians working for him. Marc himself is on site four 10-hour days, 8 AM to 7 PM, with Friday through Sunday off, and he is on call the rest of the time. Marc's daytime technicians work five days a week, 8 AM to 5 PM, Monday through Friday. Night crew technicians work 9 PM to 6 AM Wednesday through Sunday.

Marc has an on-call pager he uses off site. Marc also has his own operator workstation, which also functions as the Envision for BACtalk server. The technicians share two operator workstations, one in the facilities offices and the other in the central plant. There is also a roaming pager, which Marc carries when he is on site, and the shift lead carries otherwise.

Marc uses the alarm handlers and recipient profiles he sets up for all these devices to manage alarm annunciation and ensure that alarms get appropriate coverage.

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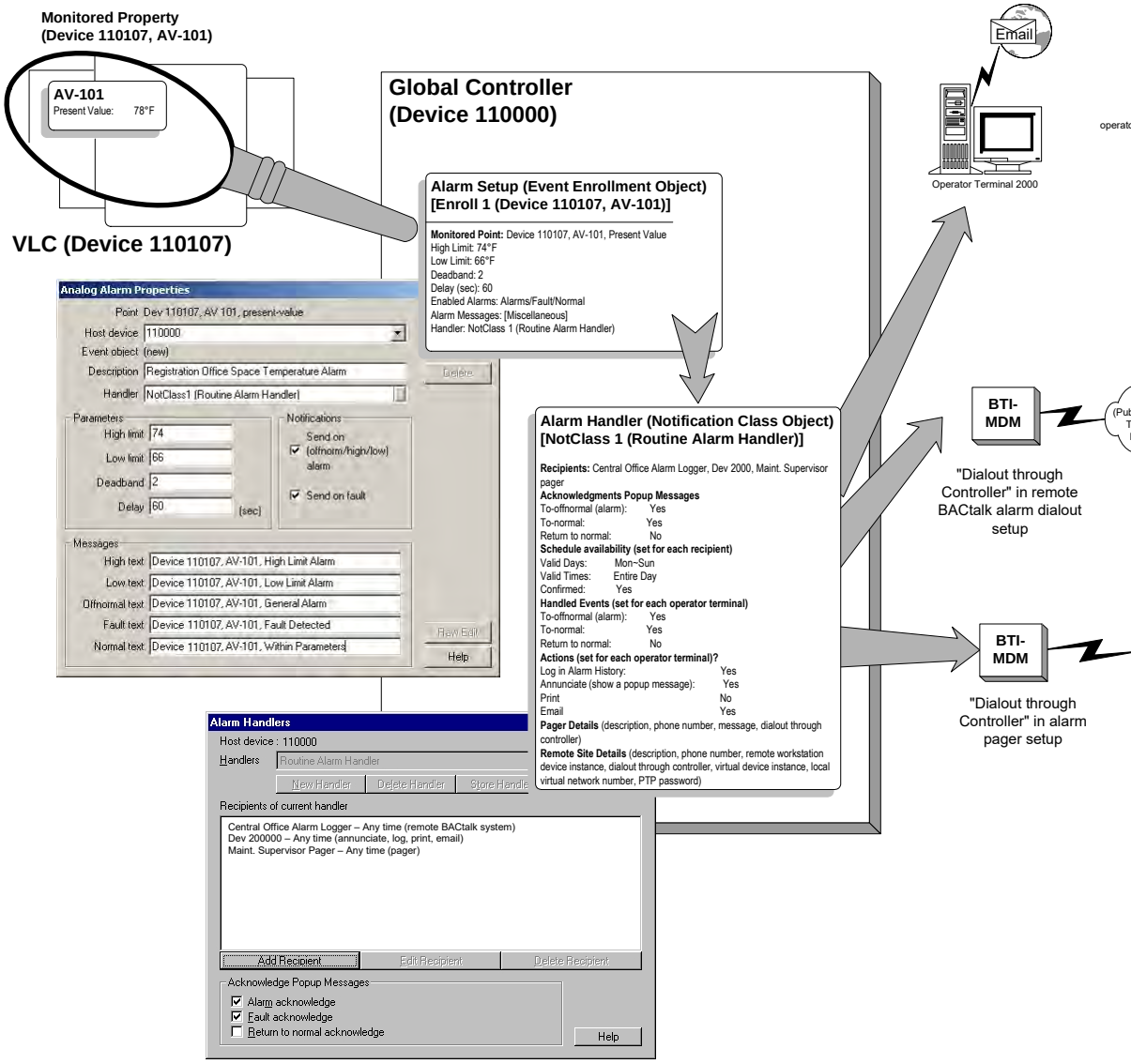

Figure 4.2 The alarm setup and alarm handler work together to monitor alarms and send out notifications.

The importance of alarm descriptions and alarm messages

An alarm description is the name for the alarm setup and the alarm message is the text that is transmitted along with this description when an alarm occurs. Understanding the difference between these items and how to use them is an important aspect of alarm setup.

Alarm descriptions

The alarm description appears in parentheses in listings of alarms, in alarm history records, and in Envision for BACtalk alarm messages.

In every case, the alarm description should include a pointer to the device and object where the alarm originates (for example, "Device 110114, AI 1"). In certain circumstances, the alarm description may be the only way to find the true source of the alarm.

Note In the Alarm Wizard, Envision for BACtalk calls this the Event Enroll Object Description. Because of the importance of the alarm source information, the Alarm Wizard allows you to use variables for the device instance and object ID. See "Using variables for alarm descriptions and messages" on page 67 for more information.

Alarm messages

Alarm messages appear in alarm histories, BACnet Alarm Message dialog boxes, and email alarm notifications. Use alarm messages to characterize the alarm and to indicate in plain language where the alarm is coming from. Different alarm types have different messages you can set up for them. For example, analog alarms include high and low alarm text, and binary alarms have off-normal, fault, and normal alarm text.

Note The Alarm Wizard also lets you use variables for alarm messages. See "Using variables for alarm descriptions and messages" on page 67.

About alarm delays

Each alarm setup includes the option for an alarm delay in seconds. When you set up an alarm delay, the alarm condition must exist for this period of time for an alarm to occur. If the alarm returns to normal within the delay time, no alarm occurs. For more information about using alarm delays, see "Use a Delay" on page 67.

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Types of alarms

There are five types of BACtalk alarms. The type of alarm you use depends on whether the monitored property is analog or binary.

- **Communications alarms**, which the BACtalk system automatically generates if a controller goes off-line
- **Binary alarms**, which occur on a simple change of state (ON-to-OFF, for example)
- **Command fail alarms**, which occur when two binary point values do not match
- **Fixed limit alarms**, which occur when an analog value is above or below fixed high or low limits
- **Floating limit alarms**, which occur when an analog value varies from a setpoint value by a certain amount

About communications alarms

Communications alarms in Envision for BACtalk occur when the operator workstation attempts to communicate with a BACtalk device and the device does not respond.

Note See “Enabling device communication failure alarms” on page 317 for information about alarm annunciation when communication is lost between the operator workstation and a device.

The communications alarm returns to normal when another communication attempt with the device is successful.

Note Normal display update operations do not cause communications alarms. Activities such as background trendlog processing, saving and sending objects, and other processing operations prompt communications alarms if the device of interest is offline.

Alarm descriptions for communications errors in Envision for BACtalk use the following syntax:

Dev <HostDev>, **device** <OfflineDI> [<DevDesc>] **(Communications Error)**

Where:

<HostDev>	The alarm monitoring host device.
<OfflineDI>	The device instance for the device that was offline and caused the communications alarm.
<DevDesc>	The device description (from Device Manager) for the offline device.

Example

Operator workstation 200000 reports a communications error with Device 110000, a BTI, with the description "BTI 110000 - Admin Bldg 11" set in Device Manager:

> Dev 200000, device 110000 BTI 110000 - Admin Bldg 11 (Communications Error)

Operator workstation 200000 reports a communications error with Device 110101, a VLC, with the description "Admin Bldg: VAV-11-101" set in Device Manager:

> Dev 200000, device 110101 Admin Bldg: VAV-11-101 (Communications Error)

About binary alarms

For binary properties, the most common alarm condition to monitor is a change of state from active (ON) to inactive (OFF) or vice versa. You select the transition state that causes the alarm. This is listed as Type in the Alarm Wizard and as Alarm under Parameters in the Binary Alarm Properties dialog box.

Practical application

Each air handling unit controller on campus has DDC associated with a differential pressure transducer. If the differential pressure across a filter is too great, a change filter alarm, BV-201, turns ON in DDC.

Marc has set up an alarm for each BV-201 to annunciate to the operator workstations when they occur. Because this is not a critical alarm, he does not assign his pager to the alarm handler for this alarm.

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About command fail alarms

A command fail alarm checks if a monitored property matches a command reference property. The reference property is called a Command reference property in the Alarm Wizard and Cmd point in the Command Fail Alarm Properties dialog box.

The properties to compare must originate from the same device.

Practical application

The main parking garage at State U is located under the Administration building. It has 10 single-speed exhaust fans. Each fan is controlled by a VLC-550, numbered 110001 through 110010. A scheduled or manual fan ON command turns BO-1 on the VLC-550 ON. Each fan has a proof switch wired to input BI-1, and the proof switch is ON as long as the fan is actually operating.

Using the Alarm Wizard, Marc sets up a command fail alarm for each of the 10 BI-1s, and sets the command reference for each as BO-1. He sets up a delay of 60 seconds, and assigns a high-priority alarm handler to them so that he and the on-site technician get paged when the alarm occurs.

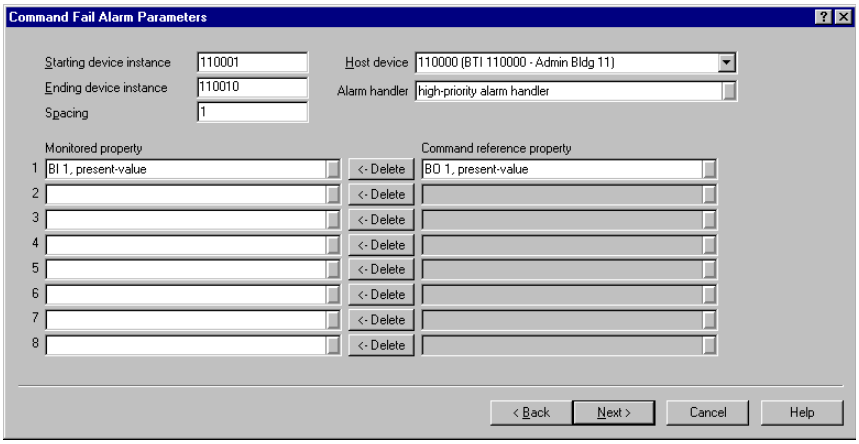

Figure 4.3 Command Fail Alarm Parameters dialog box

About fixed limit analog alarms

For analog properties, the most commonly configured alarm type is an analog (fixed limit) alarm. For example, an alarm can occur if a space temperature goes above 74 degrees F (high limit) or below 66 (low limit) degrees F. An alarm occurs when the value of the monitored property exceeds the high limit or drops below the low limit.

Two factors further affect when the alarm is generated: a delay and a deadband. The monitored property must be in an alarm condition for the time indicated by the Delay setting before an alarm is generated. The deadband is subtracted from

the high limit and added to the low limit to control when the alarm returns to normal.

Practical application

Marc showed his technician how the space temperature for the Registration Office within the Administration building might be set up as a fixed limit alarm and how the deadband setting worked for that type of alarm. He used a diagram to help explain the relationship between alarm settings and system performance.

Marc's diagram is shown in Figure 4.4. It shows a deadband setting of 2 with high and low limits of 74 degrees F and 66 degrees F, respectively. Marc also mentioned that this alarm had a delay of 60 seconds. When the temperature exceeds 74 degrees F, an alarm occurs (provided it remains there for at least 60 seconds). Because of the deadband, the alarm remains until the temperature is less than 72 degrees F. The same applies to the low limit: the alarm occurs at less than 66 and will return to normal only when the temperature is greater than 68. Marc stepped through the diagram from left to right, discussing each of the points called out in the diagram, to show the tech how the alarm generation was based on the monitored property and whether the temperature was moving up or down.

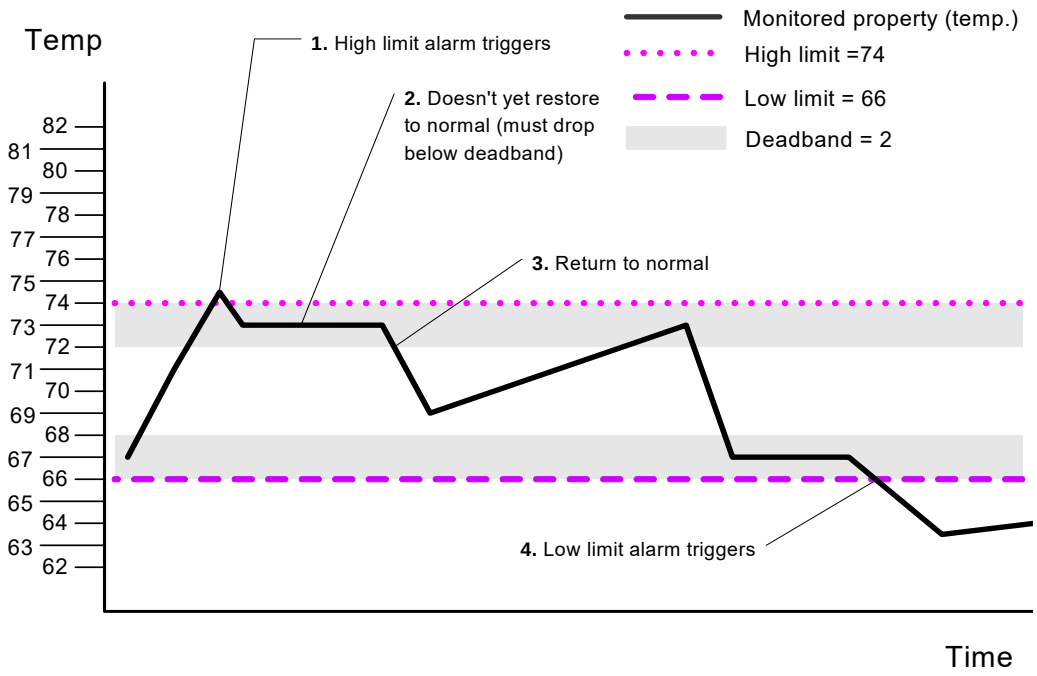

Figure 4.4 Understanding fixed limit analog alarms

About floating limit analog alarms

A floating limit alarm compares a monitored analog property to an analog reference property, which is called the Setpoint reference property in the Alarm Wizard (SP Reference in the Analog Alarm Properties dialog box). If the

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monitored property varies above or below the setpoint-reference property by the high limit offset or low limit offset values you specify, an alarm occurs.

The high limit offset is added to the value of the setpoint-reference property; the low limit offset is subtracted from it. A deadband value determines when the alarm returns to normal. The deadband value is added to the low limit equation and subtracted from the high limit equation.

The following equations describe offset and deadband logic.

Where:

MP = Monitored property

SP = Setpoint

HL = High limit offset

LL = Low limit offset

DB = Deadband

- If **MP** > **SP** + **HL**, a high limit alarm occurs.
- If **MP** < **SP** - **LL**, a low limit alarm occurs.
- If a high limit alarm has occurred and the value of **MP** subsequently changes such that **MP** < **SP** + **HL** - **DB**, the alarm returns to normal.
- If a low limit alarm has occurred and the value of **MP** subsequently changes such that **MP** > **SP** - **LL** + **DB**, the alarm returns to normal.

Practical application

For the five biggest zones located in the Administration building, Marc has floating limit alarms set up that compare the actual space temperature in each zone to the setpoint. When showing one of his technicians how to set up a floating limit alarm, he found it hard to explain the high limit offset, low limit offset, and deadband and how they affect when an alarm occurs and when it returns to normal. The changing of the temperature and the setpoint were even getting him confused.

Once Marc created another diagram based on the equations, it became clear to him, and his tech got it right away. Marc's diagram is presented in Figure 4.5. He used the alarm setup for the space temperature in the Registration Office as his example.

The monitored property is set up as the space temperature for the Registration Office (Dev 110107, AV-101, present-value) and the setpoint reference property represents the space temperature setpoint (Dev 110107, AV-90, present-value). In the alarm setup, the high limit offset is set to 2 and the low limit offset is set to 4. The deadband is set to 0.5. Marc stepped through the diagram from left to right, discussing each of the points called out in the diagram, to show the tech how the alarm generation was based on the setpoint and whether the temperature was moving up or down.

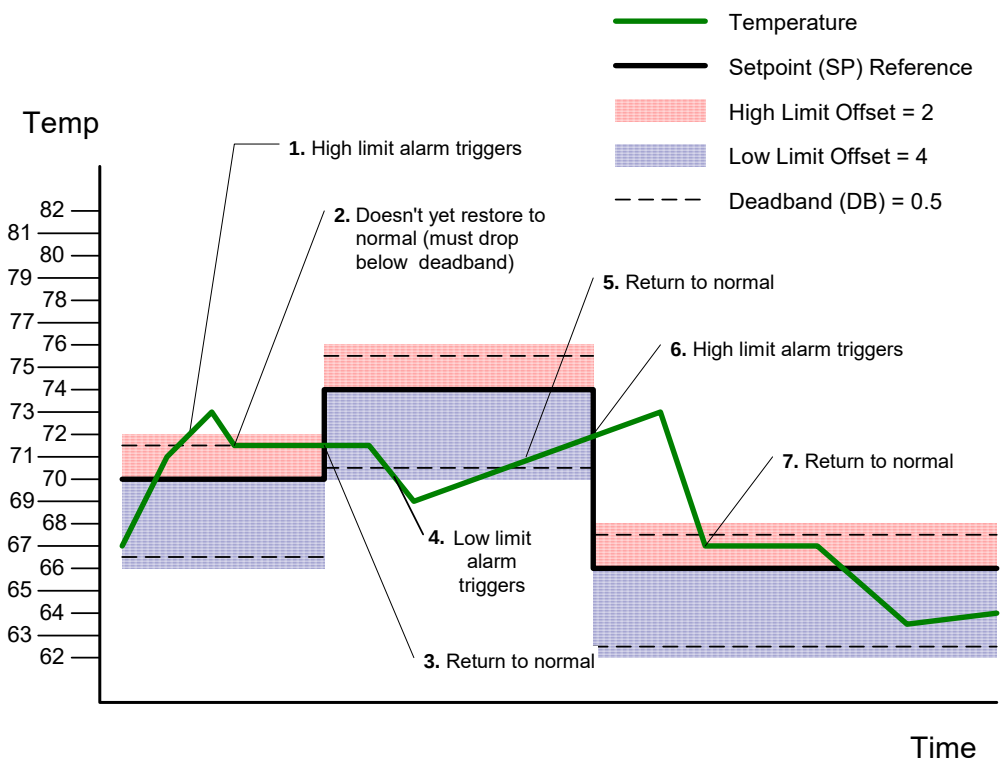

Figure 4.5 Understanding floating limit analog alarms

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How alarms are saved and run

When you create an alarm, the setup is saved to the Envision for BACtalk server and to the global controller that you select to host the alarm. Technically, BACnet identifies the alarm setup as an event-enrollment object. So when you see the alarm listed, its entry appears as Enroll <*num*> **(**<*desc*>**)**, where <num> is a sequential number that the system automatically assigns and <desc> is the description you enter for the alarm.

When you create a new alarm, you select a global controller or building controller as the *host device*. The host device saves the event-enrollment object (the alarm setup) and the notification-class object (alarm handler) associated with it.

Note Envision for BACtalk can automatically assign a host device to a controller when you set up an alarm from a data display. Use the Preferences tab in Device Manager (BACtalk>Device Manager>[select device]>Edit>Preferences) to assign a default host for alarms to the selected controller.

Setting up alarms

Envision for BACtalk offers three ways to set up an alarm:

- Right-click a dynamic item on a data display, and click **Alarms** on the shortcut menu. Use this when you are working with data displays.
- Click **Point Alarms** on the BACtalk >Alarms menu. Use this when you know the point whose alarm you want to set up or edit, but do not necessarily know where it is.
- Click **New Alarm Wizard** on the BACtalk >Alarms menu. Use this when you want to set up a range of alarms that are identical except for their addresses. This is usually used during initial system setup.

Using the shortcut menu on a data display

This is the most common way to set up an alarm in Envision for BACtalk. You do not need to know the ID of the object and property you want to monitor to set it up. All you need to do is right-click the item on a data display.

Note Right-click functionality for a display item must be enabled when the data display is edited and the item placed on it. If the Alarms selection does not appear on the shortcut menu when you right-click an item, this feature is not enabled for the item. see "Using shortcut menus to access automation features" on page 26 for more information on right-click functionality.

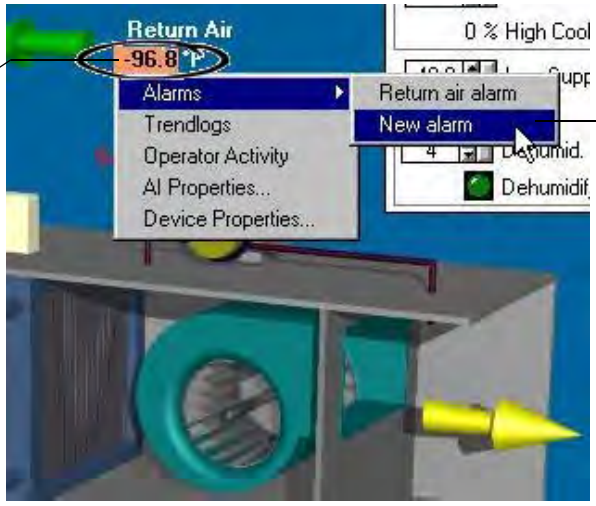

Figure 4.6 Right-click an item to display the shortcut menu.

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Only the types of alarms appropriate for the property's data type (analog or binary) are available.

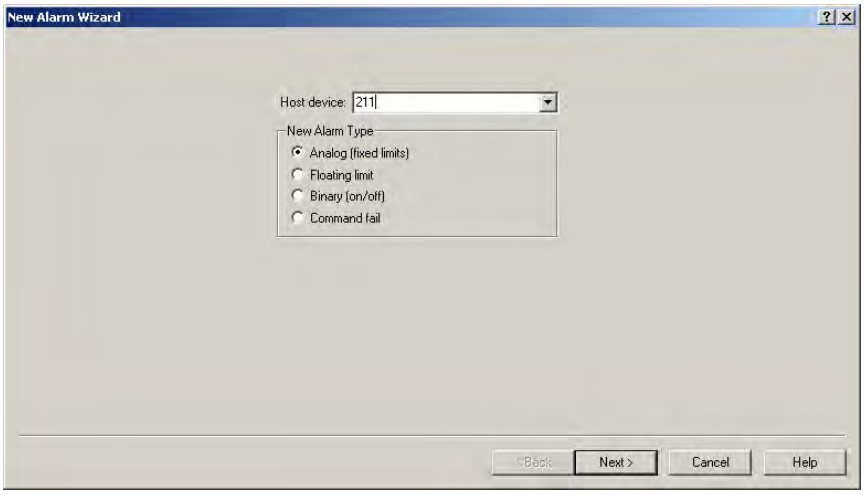

Figure 4.7 New Alarm Wizard dialog box

Select the type of alarm you want to set up, and then set alarm parameters. See the topics on specific alarm setups later in this section.

Using Point Alarms on the BACtalk menu

Use Point Alarms (BACtalk>Alarms>Point Alarms) when you want to edit the parameters of an existing alarm and you know the alarm description. For example, you want to change the recipients of an alarm.

You can also use this feature to set up a new alarm for the present-value of an object when you know the device instance and object that you want to monitor (for example, Device 110107, AI-1), but you do not necessarily know where to find it on a data display.

When you open the Point Alarms dialog box, Envision for BACtalk lists the alarms set up for a host device in your system. Alarms are listed by the device instance and object where the monitored property originates (for example, Dev 110107, AI-1).

Using the New Alarm Wizard

Use the New Alarm Wizard to conveniently set up alarms for the same properties in a range of devices with the same I/O and application configuration. The Alarm Wizard creates an alarm setup for each of the properties and saves them in a host device.

Note If the system includes a BCM-WEB, follow these naming conventions for alarm handlers:

- the alarm handler object name must begin with "Alarm Handler"
- the default alarm handler object name must begin with "Default Alarm Handler"

Select the host device where alarm setups will be saved The host device is the global controller where you want the alarm setups saved when you finish. For Marc, this is the BTI with device instance 110000. If the controller appears in Device Manager, its device instance appears in the list (see Figure 4.9 on page 65); otherwise, you can type the device instance directly in the box.

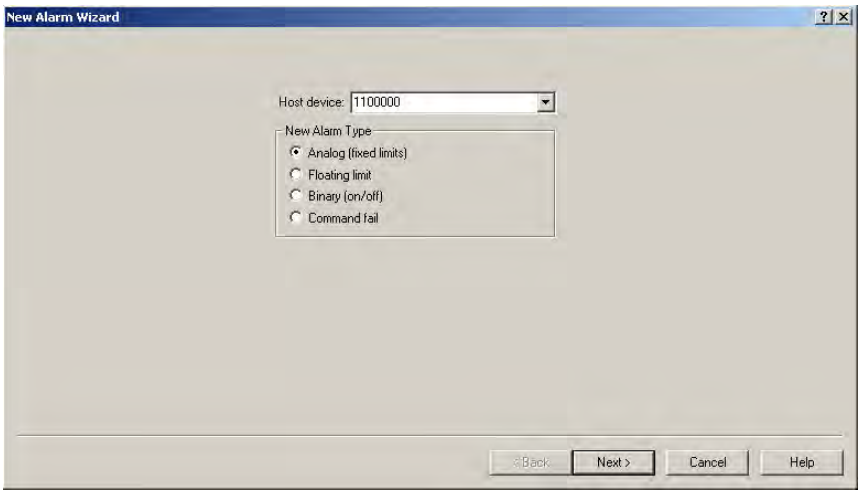

Figure 4.8 Specify the host device and the type of alarm you want to set up on the New Alarm Wizard dialog box.

See "How alarms are saved and run" on page 61 for more information.

If a host device does not appear in the list of available devices, the capabilities in Device Manager may not be set up correctly. For more information about device capabilities, see Help and the *Envision for BACtalk Installation and Startup Guide* (LTBT-TM-ADMIN26).

The following practical application illustrates how to use the New Alarm Wizard to create alarms for several devices at once.

Practical application

State U's Administration building has 90 identical VAV boxes. Each has a controller set up with the same I/O and application configuration. Marc needs to create alarms for each of them so that an alarm triggers if the current (actual) airflow varies from the desired airflow by more than 40 cfm. This tells him that the VAV damper is not performing to expectations. He wants these alarms sent to his operator workstation and logged in Alarm History. Setting up each alarm in

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the Point Alarms dialog box or through data displays takes time so Marc uses the New Alarm Wizard. Marc gathers the following information before he begins:

- Each floor has 30 VAV box controllers (floors 1 through 3).
- VAV box controllers have device instances in the range 110101-110130 (floor 1), 110201-110230 (floor 2), and 110301-110330 (floor 3). Device instances increment by ones (110101, 110102, . . . , 110130).
- All VAV boxes have a global controller with device instance 110000 as their host device.
- In all VAV boxes, the current airflow is read as the present-value of AI-10.
- In all VAV boxes, the desired airflow is written in the application as AV-4.

When Marc starts the New Alarm Wizard, he first selects the type of alarm to set up. Because he needs to compare one analog value to another, he selects **Floating limit** under New Alarm Type (Figure 4.7 on page 63).

Select the range of devices to monitor The Floating Limit Alarm Parameters dialog box appears. In the Starting device instance and Ending device instance boxes, Marc types the range of devices that he wants to monitor for an alarm condition. For the Starting Device Instance, he types 110101. For the Ending Device Instance, he types 110130 (floor 1 only). The Spacing value is the number by which the device instances increment, in this case, 1. (The default is 1.)

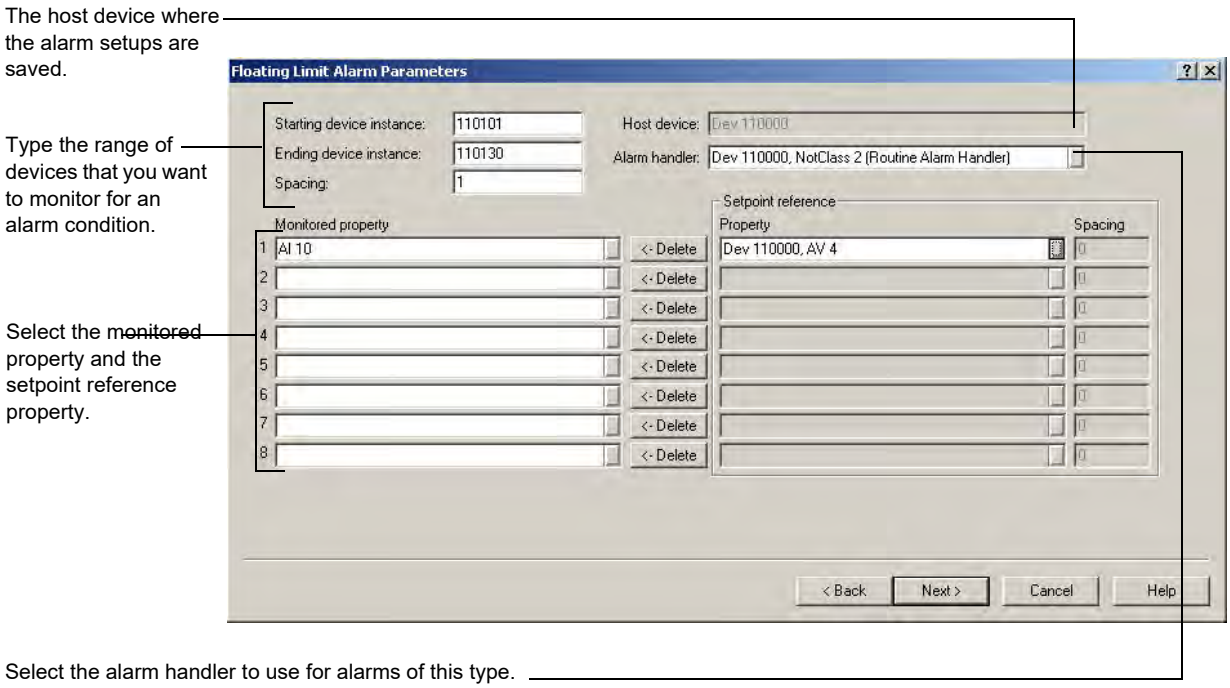

Figure 4.9 Floating Limit Alarm Parameters dialog box of the New Alarm Wizard

Select an alarm handler that sends an alarm message to the operator workstation Marc wants the alarms sent to his operator workstation. He clicks the small button beside the Alarm Handler box to select an alarm handler that is stored in the host device (see Figure 4.9).

If an alarm handler already exists that sends a message to Marc's operator workstation, he can select it from the Handlers list, and the operator workstation will appear under Recipients of the current handler. If one does not exist, he can create a new alarm handler. See "Setting up alarm handlers" on page 77 for more information.

Select the monitored property and the setpoint-reference property The monitored property is the current airflow, which is AI-10. The setpoint reference is the desired airflow, which is AV-4. Marc clicks the small button beside each box, and then selects the properties in the Object Specification dialog box (see Figure 4.9 on page 65).

Select offset values Offsets determine how far the monitored property must vary from the setpoint reference for an alarm to occur. This is 40 cfm both above and below the desired airflow, so Marc types 40 in each of the boxes, leaving the deadband at 0.

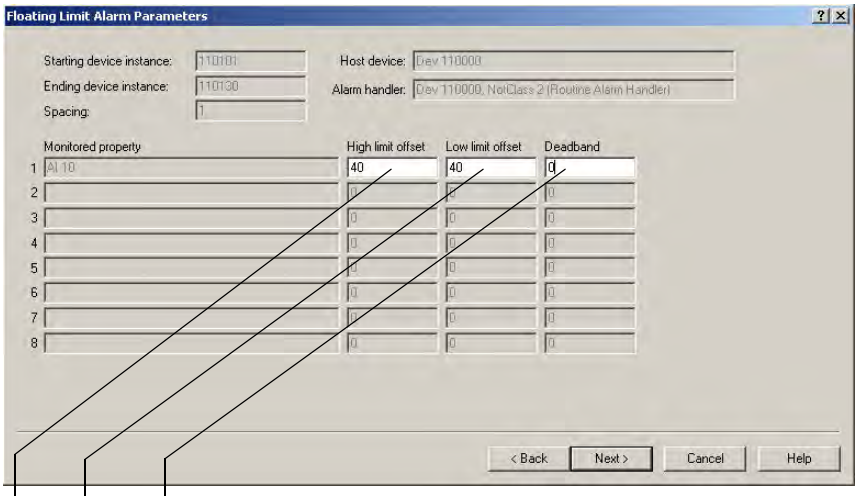

Figure 4.10 Select offset values for the alarm.

Use variables for the description The Event enroll object description is the alarm description. This is what will appear in alarm listings for each of the alarms. The Alarm Wizard allows variables to represent the device instance and property because these references may not be static ("Device 110101," for example, will not apply to all 90 devices). Marc leaves the default of %3, %4. See "Using variables for alarm descriptions and messages" on page 67 for a description of variables you can use. See Figure 4.11 on page 67.

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Use a Delay The alarm condition must exist for a minimum number of seconds (called the *delay*) before an alarm occurs. Marc types a delay of 60 seconds to prevent nuisance alarms when airflow anomalies exist. He leaves Notify on alarm and Notify on fault checked. Clearing Notify on alarm effectively disables the alarm.

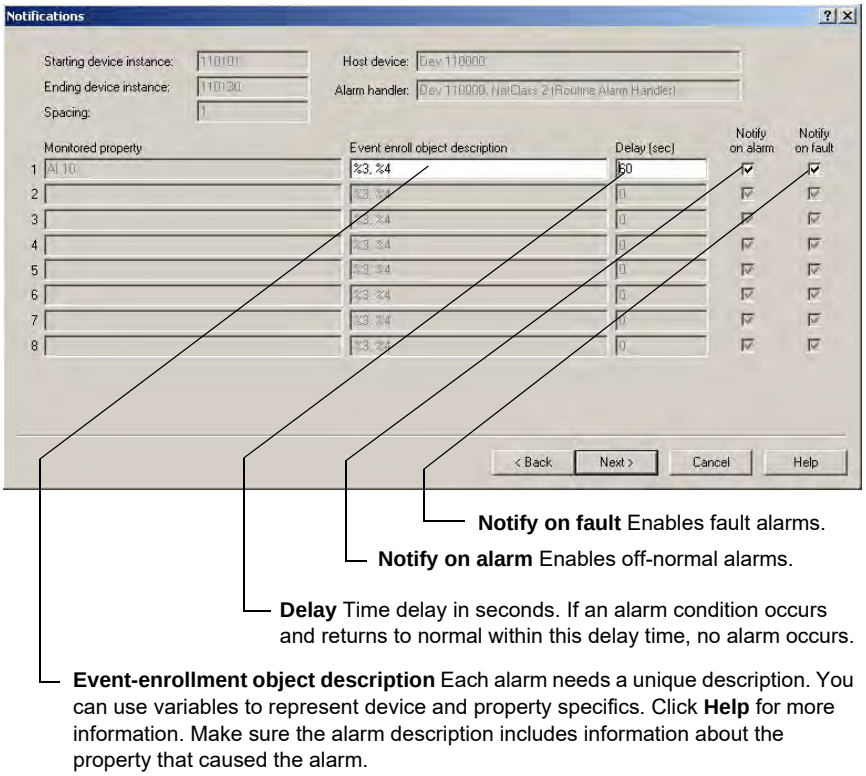

Figure 4.11 Type alarm description (or variables) and set a delay for your alarm.

Type alarm text Marc types the alarm text to appear under alarm (off-normal) conditions. He also types the high and low limit alarm text. Like the description, he can use variables in these alarm messages. See the following section for more information.

When Envision for BACtalk creates the alarm setups, it also saves them in the host device (BTI global controller 110000 in this case). Marc can use the Point Alarms dialog box to confirm creation of the alarms. They are named according to the monitored device instances and objects.

Using variables for alarm descriptions and messages

The Alarm Wizard can build multiple alarms for multiple objects and properties in multiple devices. For this reason, static alarm descriptions and alarm messages that include a device instance or property will not apply. For example, if you use the Alarm Wizard to set up a return air alarm for seven fan-coil controllers numbered 110001 through 110007, and type an alarm description of “Device 110001, AI-3, Return Air Alarm,” it will not be accurate for devices 110002 through 110007.

To help you set up multiple alarms, the Alarm Wizard provides variables you can use in alarm descriptions and alarm messages. By using these variables, you can write a description or message for a range of alarms and include vital information about the origin of the alarm, without having to edit each alarm setup individually. You can mix variables and plain text.

Table 4.2 Variables for use in alarm descriptions and messages

Variable	Adds this to each alarm description or message
%1	The device instance of the monitored property. Example: 110006.
%2	The monitored object, property, and the description of the property in parentheses. Example: AI 3, present-value (return air temp).
%3	The device instance of the monitored property, preceded by the word "Device" and followed by the device's description in parentheses. Example: Device 110006 (Fan-Coil 6 Controller). Included in the default description.
%4	The monitored property without the property's description. Example: AI 4, present-value. Included in the default description.
%5	The device description of the monitored property. Example: Fan-Coil 6 Controller. If the description is empty, returns Device <device instance>. For example, Device 110006.
%6	The description of the object containing the monitored property. Example: return air temp. If the description is empty, returns the monitored object and property. Example: AI 5, present-value.

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Setting up fixed limit analog alarms

Set up a fixed limit alarm to ensure that the value of a monitored property stays within a defined range. If the monitored property exceeds the high limit or drops below the low limit, an alarm occurs. See page 58 for an example of how fixed limit alarms can be used.

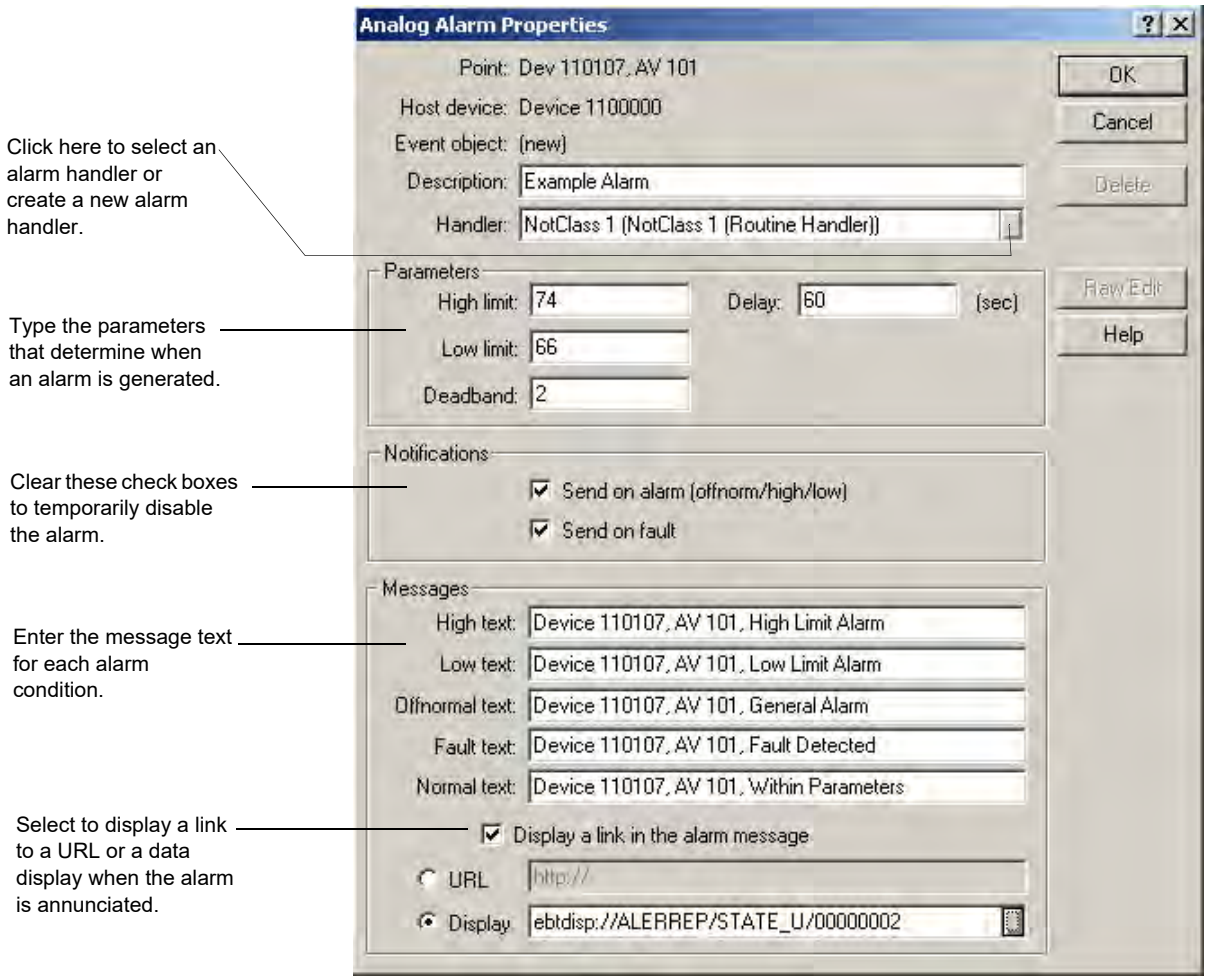

Figure 4.12 Analog (fixed limit) Alarm Properties dialog box set up so the alarm will display a link to a STATE_U job data display.

Point

The monitored point is the status or value that the alarm watches for an alarm state. This is the point you selected from a data display or from the Point Alarms dialog box.

Event object

Envision for BACtalk automatically assigns this description of the event-enrollment object when a new alarm setup is saved. See “How alarms work” on page 50 for more information about the event-enrollment object.

Description

The alarm description you type here appears in lists and alarm messages. See "The importance of alarm descriptions and alarm messages" on page 54 for more information.

Handler

Every alarm must be assigned an alarm handler. The alarm handler controls where the alarm is sent, for example, to an operator workstation or a pager. See "Setting up alarm handlers" on page 77 for more information about alarm handlers and recipients.

Parameters

These parameters determine when the alarm occurs. See "About fixed limit analog alarms" on page 57 for details.

High limit If the monitored point value goes above this limit, a high limit alarm occurs. If a delay is set, the alarm does not occur until the delay time has passed and only then if the alarm condition still exists.

Low limit If the monitored point value goes below this limit, a low limit alarm occurs. If a delay is set, the alarm does not occur until the delay time has passed and only then if the alarm condition still exists.

Deadband Type a deadband value here to establish a range in which no change occurs. The deadband value is subtracted from the high limit and added to the low limit to determine when the alarm returns to normal. For example, if the high limit is 85 and the deadband is 5, the alarm returns to normal at 79. Between 80 and 85, no change occurs.

Delay This setting represents the number of seconds an alarm condition must exist before an alarm occurs. Use the delay to prevent alarms from occurring too frequently due to operating anomalies.

Alarm notifications

As a general rule, leave both of these check boxes enabled. To temporarily disable an alarm, you can clear both check boxes.

Alarm messages

Type the alarm messages you want to appear when an off-normal alarm occurs, when a fault alarm occurs, and when the alarm returns to normal. Use high- and low-limit alarm text for analog alarms. See "The importance of alarm descriptions and alarm messages" on page 54 for details.

Setting up a URL notified or display linked alarm

Set up alarms (global feature in the Alarm Setup and in each alarm) to display a link to a specified URL or BACtalk display or template when the alarm is annunciated. For example, display a URL to a camera view of a door or zone that is in an alarm state to visually check out the alarm condition before travelling to the location. Use the Alarm Properties dialog box (BACtalk>Alarms>Point Alarms) to select either a URL link or a link to a data display (this option is cleared by default). Then use the Select Display or Template dialog box to set up

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the link that will display when the alarm is annunciated at an operator workstation.

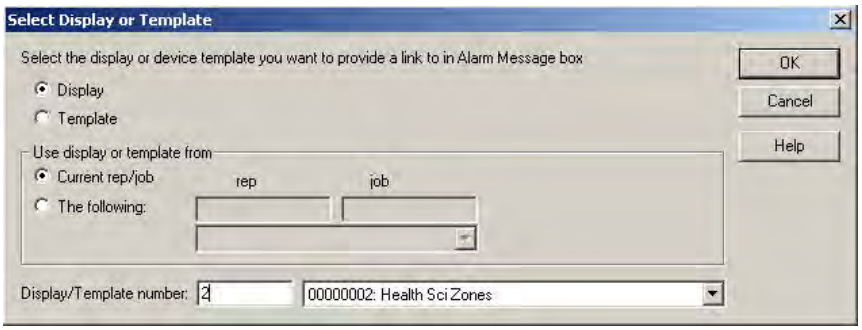

Figure 4.13 This alarm will display a link to the Health Sci Zones data display when it is annunciated at the BACtalk operator workstation.

Note URL notified alarms can also be set up using the New Alarm Wizard (BACtalk>Alarms>New Alarm Wizard) or the Event Enrollment Editor (Tools>Advanced >Event Enrollment>General tab).

Working with URL notified alarms

Envision for BACtalk processes URLs with an http prefix only until you select an option in the Alarm Setup dialog box (BACtalk>Alarms>Alarm Setup) that instructs the system to process all URLs. You can also select an option to automatically open the specified URL associated with an alarm when it is annunciated, instead of just displaying the link.

Note Selecting “Automatically open URL links when alarm messages are processed” on the Alarm Setup dialog box opens alarms in a browser window outside the control of Envision for BACtalk. Therefore, you must explicitly close the browser window when you are done viewing it.

Note See page 87 for more information about using the Alarm Setup dialog box.

Setting up floating limit analog alarms

Set up a floating limit alarm to compare a monitored analog property to a setpoint reference property. See page 59 for an example of how floating limit alarms can be used.

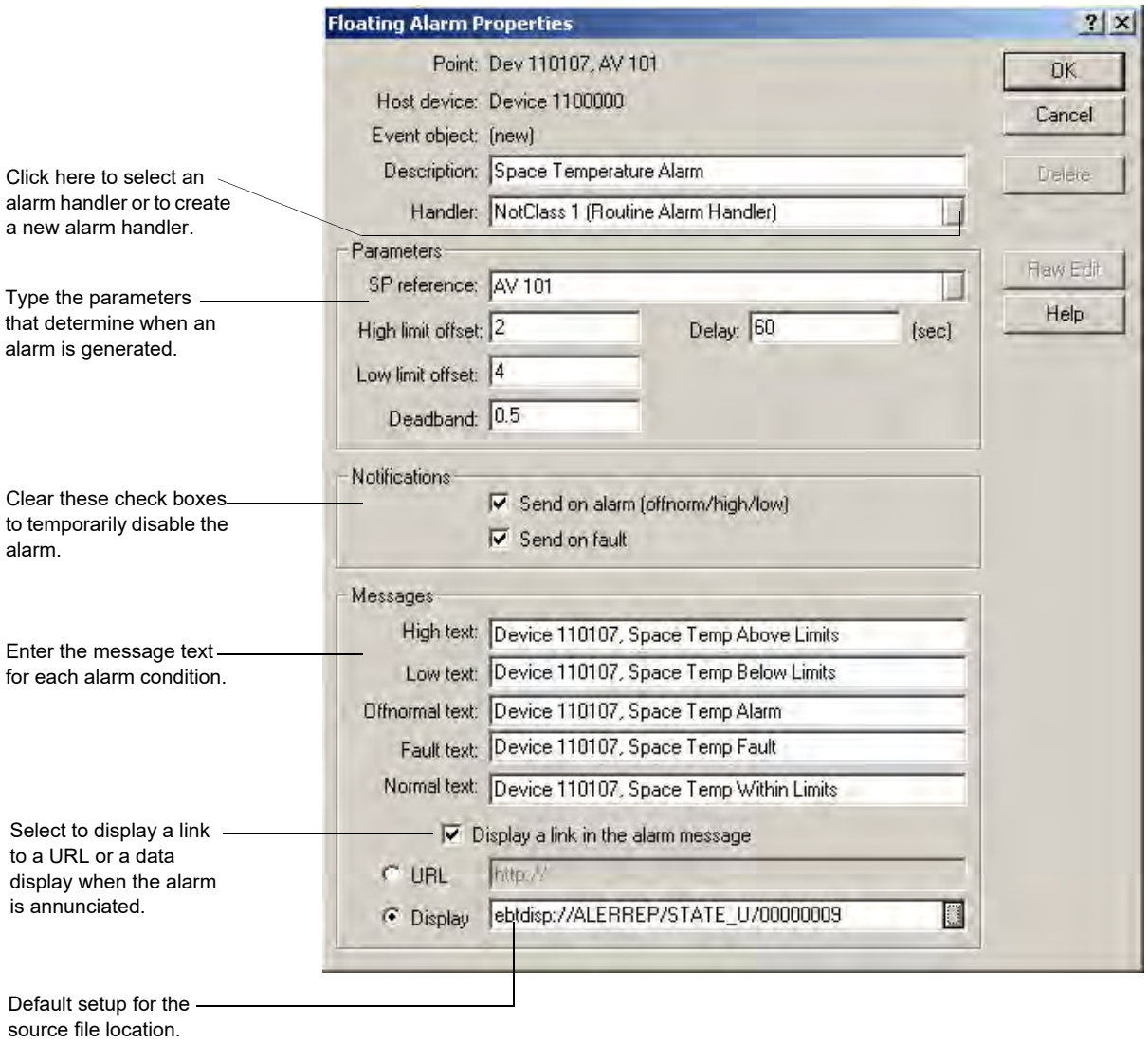

Figure 4.14 Analog (floating limit) Alarm Properties dialog box set up so the alarm will display a link to a STATE_U job data display.

Point

The monitored point is the status or value that the alarm watches for an alarm state. This is the point you selected from a data display or from the Point Alarms dialog box.

Event object

Envision for BACtalk automatically assigns the description of the event-enrollment object when a new alarm setup is saved. See "How alarms work" on page 50 for more information about the event-enrollment object.

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Description

The alarm description you type here appears in lists and alarm messages. See “The importance of alarm descriptions and alarm messages” on page 54 for more information.

Handler

Every alarm must be assigned an alarm handler. The alarm handler controls where the alarm is sent, for example, to an operator workstation or a pager. See “Setting up alarm handlers” on page 77 for more information about alarm handlers and recipients.

Parameters

These parameters determine when the alarm occurs. See “About floating limit analog alarms” on page 58 for details.

Setpoint (SP) reference Select the setpoint-reference property you want to compare to the monitored analog property. If the monitored property varies above or below this setpoint reference by the values specified for the high limit or low limit offsets, an alarm occurs. You can specify an external device point for SP reference when the alarm host supports BACnet event-enrollment objects.

High limit offset Type the value to add to the setpoint-reference property to determine if the monitored property is out of the desired range. If the monitored point value goes above this limit, a high limit alarm occurs. If a delay is set, the alarm does not occur until the delay time has passed and only then if the alarm condition still exists.

Low limit offset Type the value to subtract from the setpoint-reference property to determine if the monitored property is out of the desired range. If the monitored point value goes below this limit, a low limit alarm occurs. If a delay is set, the alarm does not occur until the delay time has passed and only then if the alarm condition still exists.

Deadband The deadband value establishes a range in which no change occurs. The deadband value is added to the low limit equation and subtracted from the high limit equation to determine when the alarm returns to normal.

Delay This setting represents the number of seconds an alarm condition must exist before an alarm occurs. Use the delay to prevent alarms from occurring too frequently due to operating anomalies.

Alarm notifications

As a general rule, leave both of these check boxes enabled. To temporarily disable an alarm, you can clear both check boxes.

Alarm messages

Type the alarm messages you want to appear when an off-normal alarm occurs, when a fault alarm occurs, and when the alarm returns to normal.

Note See “Working with URL notified alarms” on page 71 for more information about setting up a URL-notified or display linked alarm.

Setting up binary (on/off) alarms

Set up a binary alarm to monitor the status of a binary point. See page 56 for an example of how this type of alarm might be used.

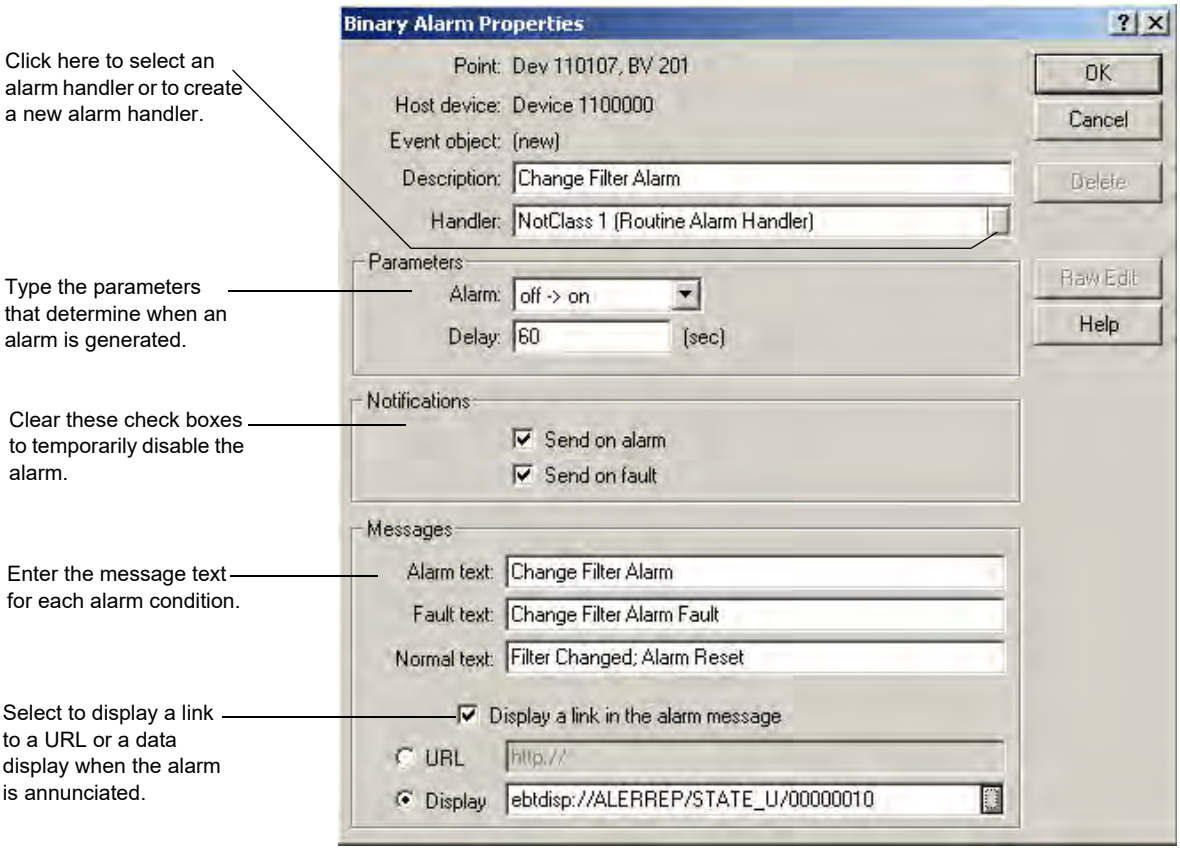

Figure 4.15 Binary Alarm Properties dialog box set up so the alarm will display a link to a STATE_U job data display.

Point

The monitored point is the status or value that the alarm watches for an alarm state. This is the point you selected from a data display or from the Point Alarms dialog box.

Event object

Envision for BACtalk automatically assigns the description of the event-enrollment object when a new alarm setup is saved. See "How alarms work" on page 50 for more information about the event-enrollment object.

Description

The alarm description you type here appears in lists and alarm messages. See "The importance of alarm descriptions and alarm messages" on page 54 for more information.

Handler

Every alarm must be assigned an alarm handler. The alarm handler controls where the alarm is sent, for example, to an operator workstation or a pager. See

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"Setting up alarm handlers" on page 77 for more information about alarm handlers and recipients.

Parameters

These parameters determine when the alarm occurs. See "About binary alarms" on page 56 for details.

Alarm Select the change of state that causes an alarm. Options are OFF (inactive) to ON (active) or ON to OFF.

Delay This setting represents the number of seconds an alarm condition must exist before an alarm occurs. Use the delay to prevent alarms from occurring too frequently due to operating anomalies.

Alarm notifications

As a general rule, leave both of these check boxes enabled. To temporarily disable an alarm, you can clear both check boxes.

Alarm messages

Type the alarm messages you want to appear when an off-normal alarm occurs, when a fault alarm occurs, and when the alarm returns to normal. See "The importance of alarm descriptions and alarm messages" on page 54.

Note See "Working with URL notified alarms" on page 71 for more information about setting up a URL-notified or display linked alarm.

Setting up a command fail alarm for binary points

Set up a command fail alarm to compare the value of the monitored property (point) to a command-reference property value. If they don't match, an alarm

occurs. See page 57 for an example of how this type of alarm might be used.

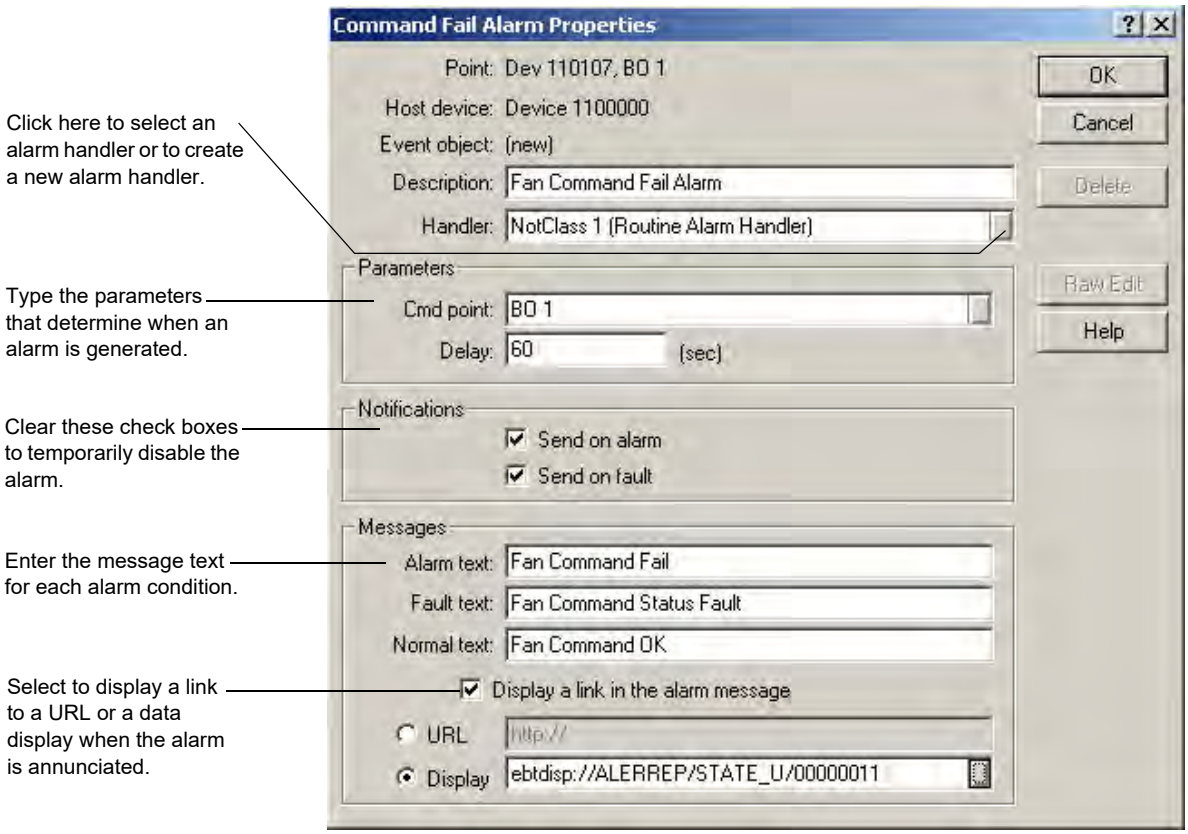

Figure 4.16 Command Fail Alarm Properties dialog box set up so the alarm will display a link to a STATE_U job data display.

Point

The monitored point is the status or value that the alarm watches for an alarm state. This is the point you selected from a data display or from the Point Alarms dialog box.

Event object

Envision for BACtalk automatically assigns the description of the event-enrollment object when a new alarm setup is saved. See "How alarms work" on page 50 for more information about the event-enrollment object.

Description

The alarm description you type here appears in lists and alarm messages. See "The importance of alarm descriptions and alarm messages" on page 54 for more information.

Handler

Every alarm must be assigned an alarm handler. The alarm handler controls where the alarm is sent, for example, to an operator workstation or a pager. See the next section for more information about alarm handlers and recipients.

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Parameters

These parameters determine when the alarm occurs. See “About command fail alarms” on page 57 for details.

Cmd point Select the command point to which you want to compare the value of the monitored point. When they do not match, an alarm occurs. You can specify an external device point for Cmd points when the alarm host supports BACnet event-enrollment objects.

Delay This setting represents the number of seconds an alarm condition must exist before an alarm occurs. Use the delay to prevent alarms from occurring too frequently due to operating anomalies.

Alarm notifications

As a general rule, leave both of these check boxes enabled. To temporarily disable an alarm, you can clear both check boxes. Currently, the Fault setting is inconsequential. See “About the alarm setup” on page 51 for details.

Alarm messages

Type the alarm messages you want to appear when an off-normal alarm occurs, when a fault alarm occurs, and when the alarm returns to normal. See “The importance of alarm descriptions and alarm messages” on page 54 for details.

Setting up alarm handlers

Alarm handlers maintain a list of recipient profiles and provide a centralized method of setting up and configuring alarm recipients. Alarm handlers determine how alarm messages are broadcast, how alarm printing happens, and how alarm logging happens.

Note Because you can assign an alarm handler to any number of alarms, it makes sense to set up a limited number of alarm handlers for different classes of alarms.

There are three ways you can start the Alarm Handlers module to edit alarm recipients:

- On the BACtalk menu, point to **Alarms**, and then click **Alarm Handlers**. Select or type the device instance of the controller where the alarm handler is saved. You can create a new alarm handler or select an existing handler to edit.

CAUTION If you edit alarm handlers this way, make sure you know which alarms the alarm handler is assigned to. Otherwise, you may inadvertently change how an alarm is handled.

- In the Alarm Properties dialog box, click **Handlers**, and then select an existing alarm or set up a new binary alarm from the Point Alarms dialog box (BACtalk>Alarms>Point Alarms).

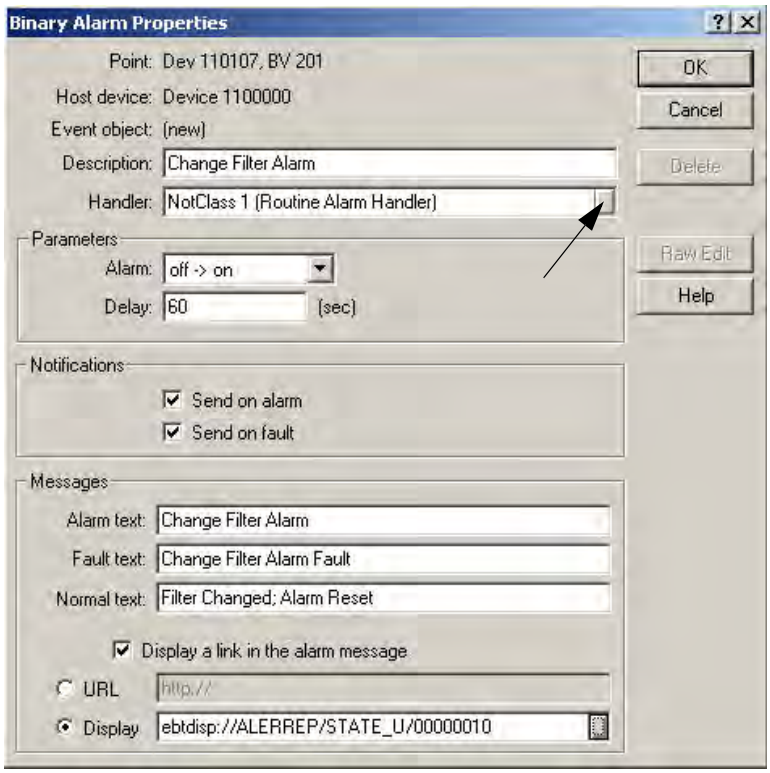

Figure 4.17 Binary Alarm Properties dialog box

- Create or edit alarm handlers as a step in the Alarm Wizard. For more information, see "Using the New Alarm Wizard" on page 63.

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Use the Edit Alarm Handler dialog box to edit an alarm handler and its recipients.

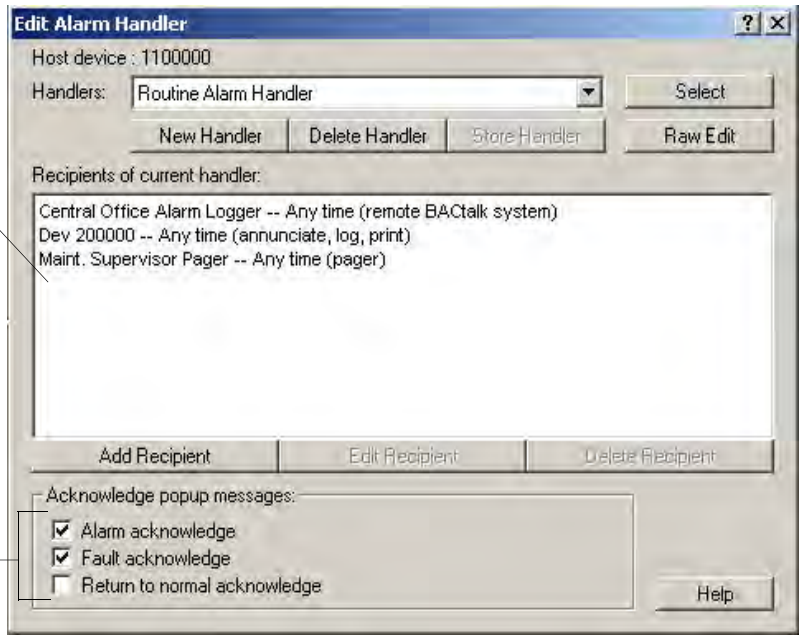


Figure 4.18 Edit Alarm Handler dialog box

The Handlers list shows available alarm handlers; the New Handler and Delete Handler buttons enable you to manage alarm handler setups. This list and these buttons are available only if you edit alarm handlers using the New Alarm Wizard or Point Alarms dialog box (a Select button also appears instead of a Done button). Otherwise, use the Alarm Handler Editor dialog box to manage alarm recipients and popup message acknowledgments.

Reading an alarm handler's recipient list

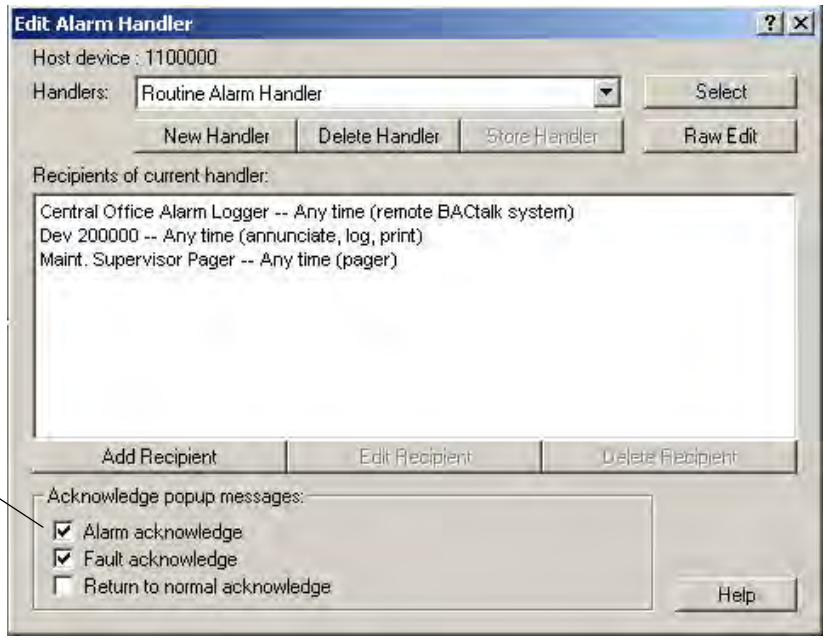
After you select an alarm handler to work with, its recipients appear in the Recipients of current handler list. You can select a recipient profile from the list and edit its setup. You can also create new profiles.

The recipient listing shows:

- The type of recipient (pager, operator workstation, remote BACtalk system, or email).
- The description of the recipient profile. For operator workstations, this is the description assigned in the Device Manager. For pagers, remote systems, and email, this description is assigned in the recipient setup.
- The availability of the recipient (for example: any time or Mon...Fri, 8:00AM...5:00PM).
- For Envision for BACtalk front ends, the actions performed at the operator workstation (annunciate, log, or print).

Choosing alarm messaging options for an alarm handler

Select these check boxes if you want Envision for BACtalk alarm messages to appear at recipient operator workstations and remote operator workstations. (You must also enable the acknowledge action in the recipient profile.) By default, the Return to normal acknowledge check box is cleared so no alarm messages appear when an alarm returns to normal.



Select these check boxes if you want alarm messages to appear at recipient operator workstations and remote operator workstations.

Figure 4.19 Edit Alarm Handler dialog box

Setting a single recipient to be available at different times

To make a single recipient available on different days or at different times of the day, you create multiple recipient profiles for the same alarm recipient. For each recipient profile, you set a unique schedule. You can also set up different handling details.

Setting a recipient to be available at different times for different types of alarms

To create different handling for different alarm states, you create multiple recipient profiles. Within each profile, you set up the types of events the recipient handles. You can combine schedules and handled events to create powerful alarm strategies.

Setting up operator workstation recipients

Use the recipient profile for an operator workstation to set up how an onsite operator workstation treats alarms (BACtalk>Alarms>Alarm Handlers>Add/Edit>Add Recipient>Local workstation). You set up the alarm states and notifications that the operator workstation receives, the actions the operator workstation takes upon receipt, and its scheduled availability.

For operator workstations, each profile for each alarm handler is unique. Edits to one profile do not affect others. You can set up multiple recipient profiles for a single operator workstation (even within a single alarm handler) depending on

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how you want the operator workstation to handle different alarms. Handled events include: alarm (to-offnormal), fault, and return to normal.

On the Workstation Setup dialog box under Actions, select the actions you want the operator workstation to perform when it receives an alarm.

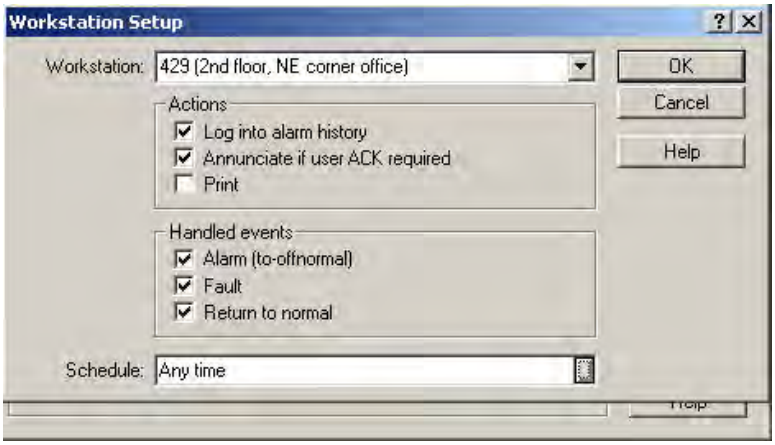


Figure 4.20 Workstation Setup dialog box with default options selected.

Table 4.3 Possible workstation responses to an alarm

Select	To
Log into alarm history	Log the alarm in the operator workstation's alarm history database. See "Working with alarm histories" on page 93 for details about the contents of a log entry.
Annunciate if user ACK required	Display an alarm message at the operator workstation. Make sure you also select the types of alarms (off-normal, fault, or return to normal) for which you want an alarm message to appear (see "Setting up alarm handlers" on page 77). See "How alarms work" on page 50 for details about the elements of an Envision for BACtalk alarm message.
Print	Prints the contents of the alarm message. The same information that appears on an Envision for BACtalk alarm message is printed. The Main Alarm Setup at the recipient operator workstation (see "Using Alarm Setup at an operator workstation" on page 87) must have printing enabled and a printer selected.

Setting up pager recipients

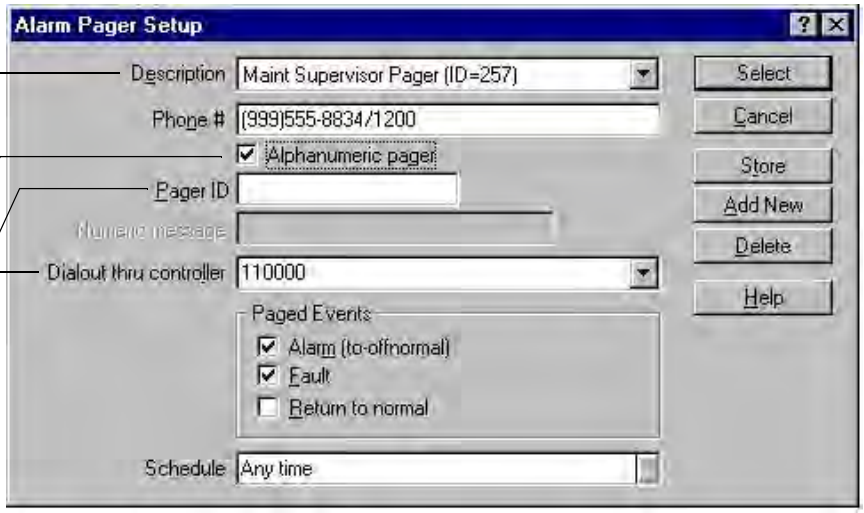
The recipient profile for a pager enables you to set up an alphanumeric or digital pager to receive alarms (Alarm Handlers>Add/Edit>Add Recipient>Pager). Each recipient profile is unique. You can set up multiple profiles for a single device (even within a single alarm handler) depending on how you want the device to handle different alarms. Edits to one profile do not affect others.

Note If you set up two or more pagers in the Alarm Pager Setup dialog box to dial out through two or more different controllers, and then switch between the

two pager setups, the dial out through controller information will not automatically update.

Alphanumeric pagers Envision for BACtalk can send alarm messages, which are typed under Messages in the Alarm Wizard or Point Alarms dialog box, along with other alarm information, to alphanumeric pagers. Alphanumeric pagers display all information that appears in an Envision for BACtalk alarm message at the operator workstation.

Note Alphanumeric pagers are dialed only once for each recipient profile.



Type a description for the pager profile. Envision for BACtalk automatically assigns a process ID to the pager, which appears as part of its description.

Select to set up an alphanumeric pager to receive alarms.

Type the unique identifier for the pager, used after the call connects to the pager modem. This is usually the individual pager phone number, but specifics vary depending on the pager service.

Select the controller at the local site that will dial out the alarm. This controller must have a modem and must have Supports Alerton Process IDs selected on the Capabilities tab in Device Manager. See the *Envision for BACtalk Installation and Startup Guide* (LTBT-TM-ADMIN26) for more information.

Figure 4.21 Setting up a pager recipient profile in the Alarm Pager Setup dialog box

If an extended period of handshaking (the audible squealing a modem emits) occurs but the paging service never receives the alarm, add a /NNNN to the end of the "Phone # string" (where NNNN is the baud rate supported by the paging service—this value can be either /300, /1200, or /2400) in the Alarm Handler's "Alarm Pager Setup" dialog box. This forces the global controller's modem to communicate at NNNN baud rate when connecting to the paging system. For example, if the phone number to the paging service is 18002223333, and the service supports 2400 baud rate connections, the amended phone number string should read 18002223333/2400.

Standard (digital) pagers Standard pagers require a single phone number, which rings the pager directly. Optionally, you can specify a numeric message, which is passed to the pager. This enables you to assign a specific code to an alarm, so the pager recipient can learn the source of the alarm from the numeric message.

Note Digital pagers are dialed only once for each recipient profile.

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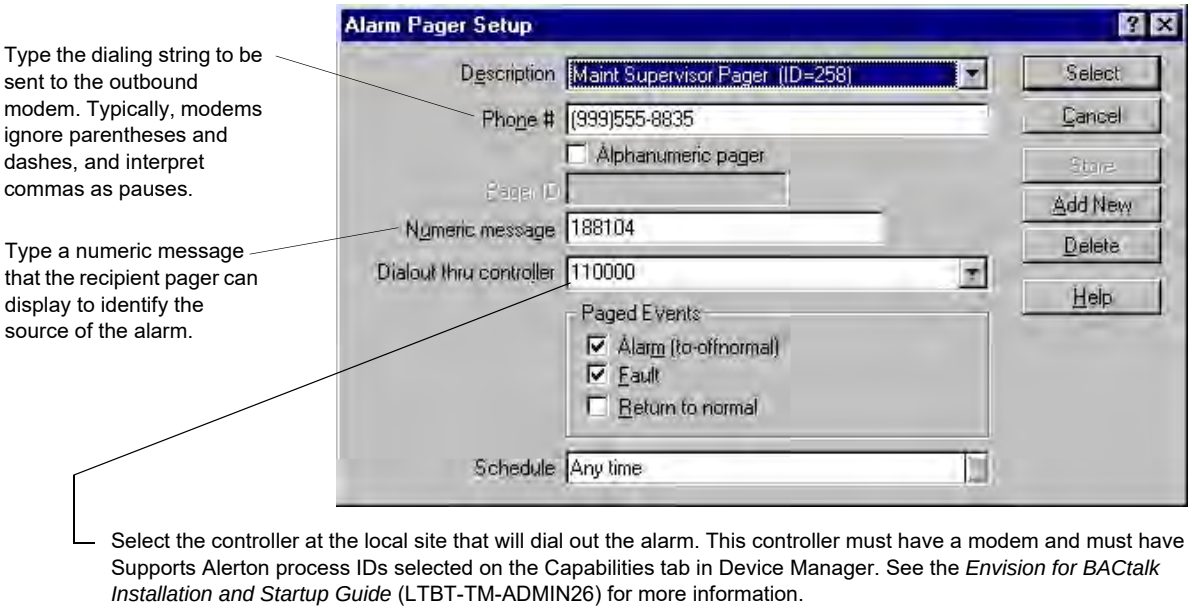

Figure 4.22 Alarm Pager Setup dialog box

Setting up remote site recipients

You can set up an alarm to dial out from a global controller modem at an originating BACtalk site to a global controller modem at a recipient site (BACtalk>Alarms>Alarm Handlers>Edit>Add Recipient>Remote BACtalk system thru controller modem). An operator workstation at the remote site logs alarm messages to the remote alarm history. You can print alarms from within the alarm history. The remote operator workstation cannot annunciate or print the alarm on receipt.

This arrangement enables a single operator workstation at a centralized, remote location to log alarms from a number of geographically dispersed sites. The operator workstation at the remote site must be on and running Envision for BACtalk.

Note Envision for BACtalk supports such connections only between global controller modems—a global controller at the originating site dials a global controller modem at the remote site, which then forwards the alarm to the operator workstation at the remote site.

Each recipient profile is unique. You can set up multiple profiles for a single device (even within a single alarm handler) depending on how you want the device to handle different alarms. Edits to one profile do not affect others.

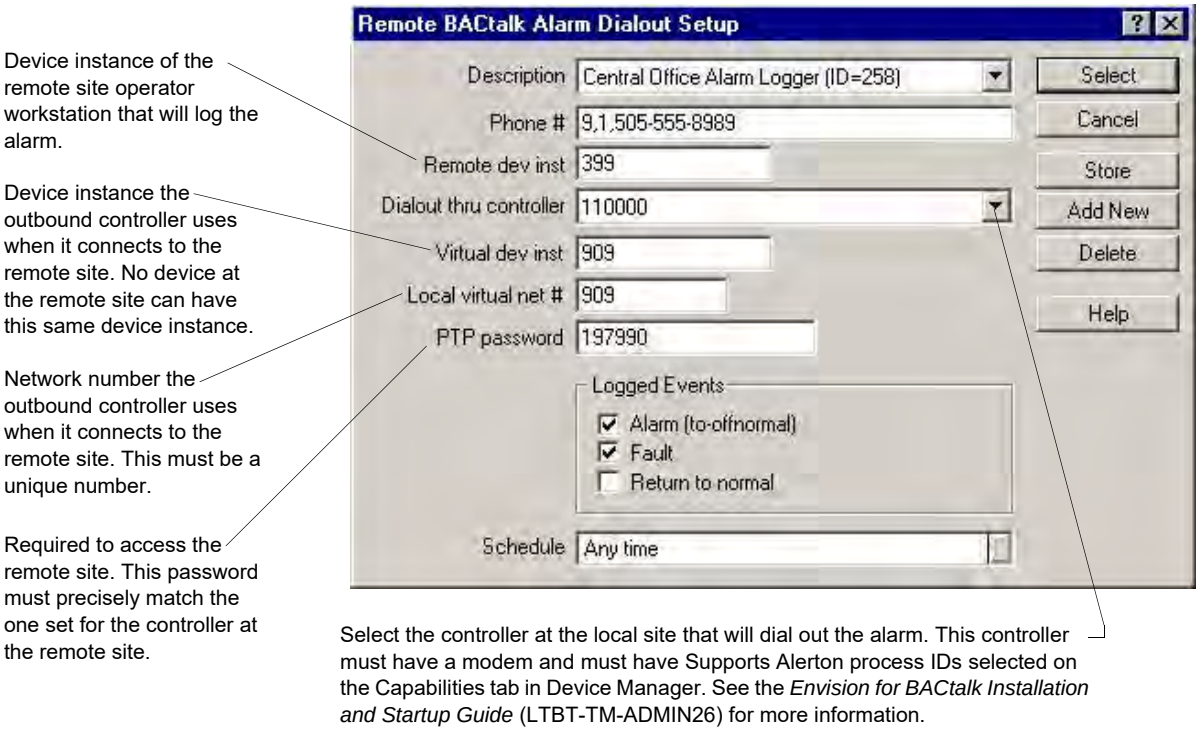

Figure 4.23 Remote BACtalk Alarm Dialout Setup dialog box

Setting up email recipients

You can set up a BACtalk workstation to email an alarm notification to one or more email recipients. Emailed alarm messages include the type of alarm and other text that appears in pop-up alarm notifications. Setting up email alarm notifications involves setting up the alarm, configuring the alarm handler, and specifying an email server.

Setting up an alarm To configure an alarm for email notifications, on the Alarm Setup page (BACtalk>Alarms>Alarm Setup), select **Send email** to email recipients. Click **Email Settings...** and then specify the From, CC, and BCC email addresses. Use commas between email addresses when setting up multiple recipients. The From email address appears as the sender of alarm notifications. CC and BCC recipients will receive copies of all email notifications. BCC recipients' email addresses will not be visible to other recipients.

Configuring an alarm handler To configure the alarm handler, open the Edit Alarm Handler dialog box (see "Setting up alarm handlers" on page 77), click **Add Recipient**, and then select **Email**. The Email Alarm Setup dialog box appears. Type the recipient email address(es) separated by commas. Define the BACtalk workstation that will send out email alarms. Select a workstation with

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network connectivity to an SMTP email server. Select the events for which alarms will be generated. Specify the schedule for alarm notifications.

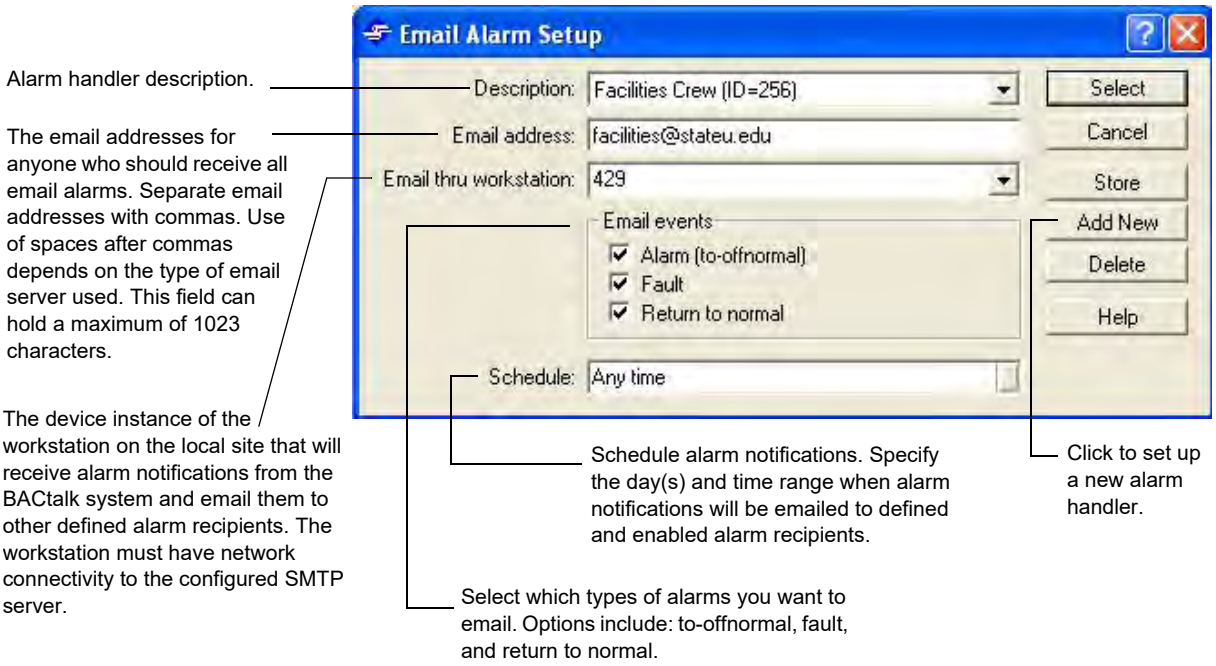

Figure 4.24 Set up for sending email alarms to the facilities group at State U

Specifying an email server To specify an email server, click **General System Setup** on the **Tools** menu and then select the **Email Setup** tab. Type a server host name or IP address and then specify a time-out. You may need to consult with site IT professionals to get these settings. Specify authentication settings and test the connection. See the associated online Help for more detail.

Practical application

Marc has three alarm handlers set up for the State University Administration building. One of these handlers is assigned to each alarm. He is organized them by severity and named the alarm handlers accordingly:

- Emergency alarm handler
- High-priority alarm handler
- Routine alarm handler

By doing this, Marc can change assignments within an alarm handler and have it carried out for all alarms of that type. This is handy if something in the system changes. For example, Marc got a new pager, and he now has to update the system to dial it. He also just installed a new technician's operator workstation in the mechanical room, and he needs to set it up to receive high-priority and routine alarms.

For **emergency alarms**, Marc wants his pager dialed during off hours. He also wants the on-site pager dialed at all times, an alarm message to pop up on all

operator workstations, the server to send out email alarm notifications, and the alarm logged to the alarm history file on the server.

For **high-priority alarms**, Marc wants the on-site pager dialed at all times, an alarm message to pop up on all operator workstations, the server to send out email alarm notifications, and the alarm logged to the alarm history file.

For **routine alarms**, Marc wants alarm messages to appear at the two technician operator terminals and the alarm logged to the alarm history file so he can follow up at the end of the week.

To do this, Marc sets up the following recipient profiles:

- A recipient profile for his pager
- A recipient profile for the on-site pager
- A recipient profile for the server (Device Instance 200000)
- A recipient profile for the office tech workstation (Device Instance 200001)
- A recipient profile for the mechanical tech workstation (Device Instance 200002).

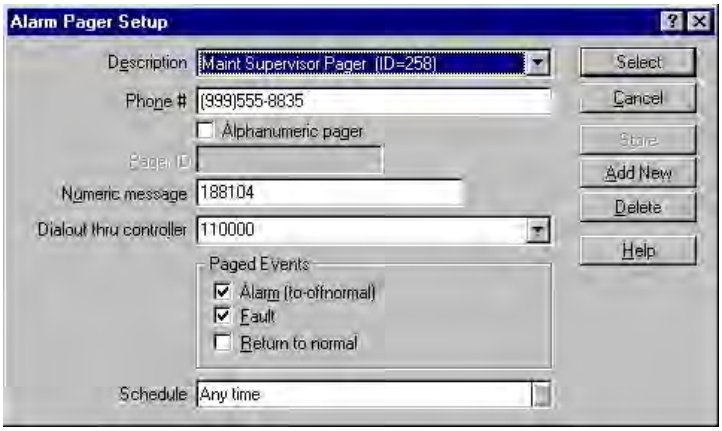

Figure 4.25 Alarm Pager Setup dialog box

About alarm dialout

For each pager or remote site recipient to be dialed, the BACtalk system dials only once. The system pauses two minutes before dialing the next recipient on the list. All recipients on the list are dialed each time an alarm occurs until the alarm is acknowledged.

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Using Alarm Setup at an operator workstation

You use the Alarm Setup dialog box (BACtalk>Alarms>Alarm Setup) to set up the following alarm items for an operator workstation. These are global settings that apply to all alarms as appropriate.

- The site description passed to alarm pagers and remote-site alarm loggers (if alarm dialout is set up)
- Alarm printing specifics (if the operator workstation will host alarm printing)
- Order for alarm display on the operator workstation: oldest on top or newest on top
- Default handling for inbound alarms that have no handling specified
- Alarm set up for displaying a link to a URL or a data display

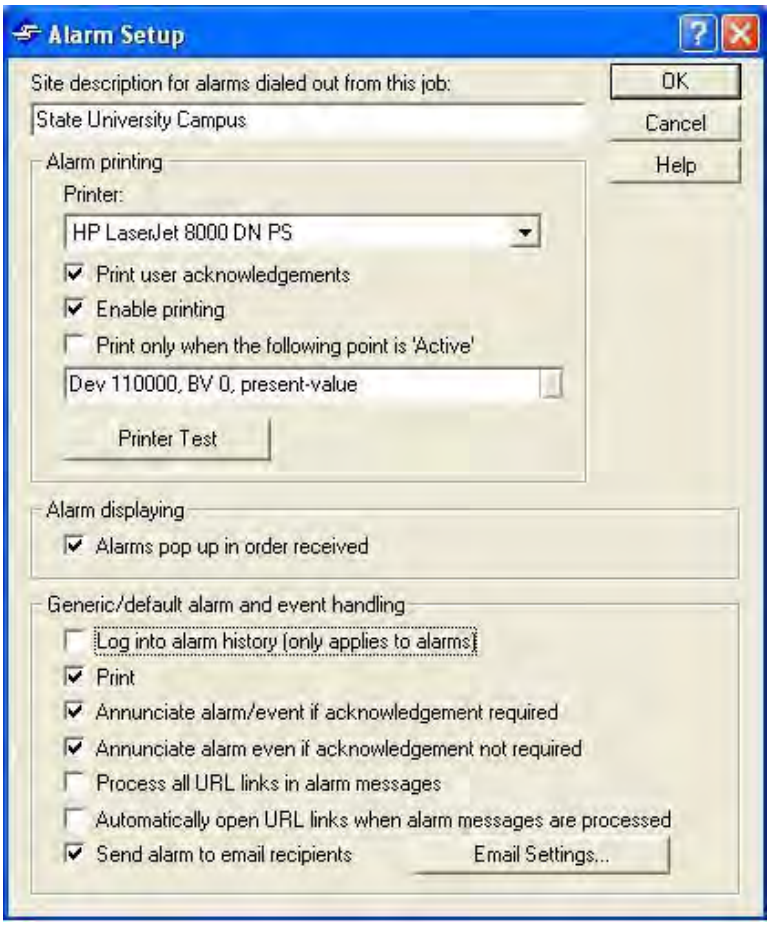

Figure 4.26 Alarm Setup dialog box

Site description

The site description is sent along with alarm information when BACtalk dials an alarm to an alphanumeric pager or a remote BACtalk system. Make sure you choose a description that uniquely identifies the site for transmitted alarms. If no alarms dial out, you can leave the site description blank.

Alarm printing

Use the items under Alarm Printing to designate the printer that Envision for BACtalk uses to print alarms.

Printer Click the arrow and then select a printer from the list. Only printers set up through the Printers utility in the Windows Control Panel are available (see Microsoft Windows documentation for more information).

Print user acknowledgements Select this check box if you want Envision for BACtalk to print alarm messages when they are acknowledged by the user (see "Reading BACtalk alarm messages" on page 90). The recipient profile and type of alarm are irrelevant in this case.

Enable printing Select this check box if you want Envision for BACtalk to print alarms received at this operator workstation upon receipt. The recipient profile used to transmit the alarm must have printing enabled as well.

Print only when the following point is active Select this check box to use a data point to control printer availability. Click the command button to select the point, typically a BV. This point can be scheduled or manually controlled. Alarms print when the point is active (ON) or when the point cannot be read.

Printer test Be sure your printer is connected and online, and then click this button to test your printer options and setup.

Alarm displaying

Use this check box to set the stacking order of alarm popup windows. When the box is selected, the most recent alarm is displayed behind older alarms that have not yet been acknowledged. If the box is cleared, the most recent alarms are displayed on top. After selecting an option, the active alarm messages are resorted accordingly.

Generic/default alarm and event handling

Most alarms and events broadcast with some sort of handling specified (using a BACnet notification class). However, alarms and events occasionally may arrive without handling instructions. Specify what you want the operator workstation to do when this happens.

Table 4.4 Alarm Setup dialog box—user-specified alarm handling options

Item	Remarks
Log into alarm history (only applies to alarms)	Select to log all alarms with no handling specified into alarm history
Print	Select to print all alarms that have no handling specified.
Annunciate alarm/event if acknowledgement required	Select to annunciate events that have the "ack required" flag set.

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Table 4.4 Alarm Setup dialog box—user-specified alarm handling options

Item	Remarks
Annunciate alarm even if acknowledgement not required	Select to annunciate all events even if the “ack required” flag is not set. Applies only to alarms that do not use a BACtalk alarm handler (that is, with process IDs in the range 0-7 or 10-127).
Process all URL links in alarm messages	Select to translate URL text into live links.
Automatically open URL links when alarm messages are processed	Select to go to a URL when the alarm is processed.
Send alarm to email recipients	Select to email an alarm message to specified and configured recipients.

Note See “Working with URL notified alarms” on page 71 for more information about setting up URL-notified or data display linked alarms.

Enable email alarms Select **Send Alarm to Email Recipients**, and then click **Email Settings** to open the Email Setup for Alarms dialog box. Specify how the alarm origination information should be displayed, and then specify the email addresses where you want alarm notifications to be emailed. Note that the email recipients entered here are in addition to recipients set up in the Alarm Handler setup (

Specify the To: email addresses of all the users you want to receive the emailed alarm. Specify the From: email address, and email that will always be carbon copied (cc:). Blind copy (bcc:) users you want to receive alarms but whose email information you do not want displayed. Use commas between email addresses when setting up multiple recipients.

Email settings for alarms must be configured (BACtalk>Alarms>Alarm Setup), email must be added as an alarm recipient (BACtalk>Alarms>Alarm Handlers>Add/Edit>Add Recipient>Email) before alarms can be successfully emailed.

Working with alarms

Alarms are an important component of your BACtalk system. You need to be able to recognize and read alarms to use this powerful feature effectively.

Reading BACtalk alarm messages

Most alarms are set up to require a user acknowledgment at an operator workstation through an alarm message. The alarm message can appear when an alarm or fault occurs, or when an alarm returns to normal.

The following conditions must be met for an alarm message to appear at an operator workstation:

- The monitored property must go into a state that triggers an alarm, as determined by the alarm setup. See "How alarms work" on page 50 for more information about alarm components.
- The alarm setup must have the corresponding alarm state enabled: Off-normal, Fault, or Normal.
- The alarm handler must be set up to require a user acknowledgment for the alarm state that occurs.
- The alarm handler for the alarm must have the operator workstation listed as a recipient.
- The operator workstation's recipient profile must be set up to handle the alarm state that occurs and to annunciate it.

An alarm message conveys substantial information about when, where, and why an alarm occurred.

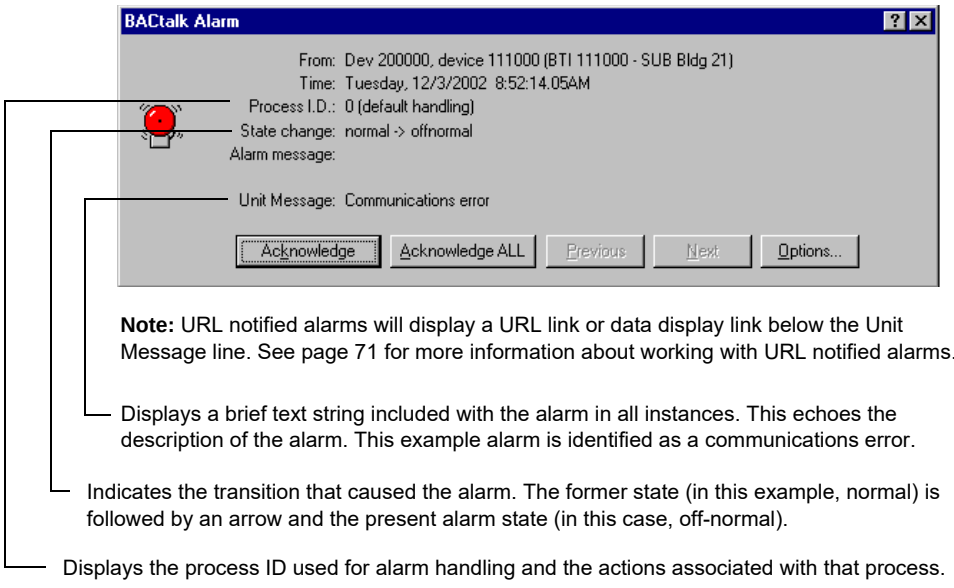

Figure 4.27 BACtalk alarm message

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Buttons along the bottom of the alarm message allow you to manage active alarm messages.

Table 4.5 Alarm message buttons

Button	Function
Acknowledge	Acknowledges the present alarm. This can be either the most recent or least recent alarm, depending on how the alarm display feature is set up. see “Using Alarm Setup at an operator workstation” on page 87 for more information. This acknowledges the alarm at this operator workstation only.
Acknowledge All	Acknowledges all alarms at once. This closes all alarm messages without allowing the user to read the message.
Previous	Scrolls back through the alarm messages. This can be an earlier or later alarm, depending on how the alarm display feature is set up. see “Using Alarm Setup at an operator workstation” on page 87 for more information.
Next	Scrolls forward through the alarm messages. This can be a later alarm or earlier alarm, depending on how the alarm display feature is set up. see “Using Alarm Setup at an operator workstation” on page 87 for more information.
Options	Opens the Main Alarm Setup dialog box. You can set the printing, display, logging, and annunciation of alarms and events here. see “Using Alarm Setup at an operator workstation” on page 87 for more information.

WARNING Acknowledging an alarm in no way ensures that the alarm condition has returned to normal. Use alarm history to check if an alarm condition still exists. If the alarm has not returned to normal, no entry appears in the “End” column. See Figure 4.29 on page 93.

Alarm notices on data displays

In addition to the alarm message at an operator workstation, alarm notices appear on your site displays for properties that are in alarm. The alarm message appears enclosed in asterisks after the current (or last obtained) value or status of the data point. By default, most alarm notices appear in red; however, the system developer selects the color when setting up the item.

Analog data point alarms on a data display

Binary data point alarms on a data display

Working with Current Alarms view

Current Alarms view allows you to view a list of alarms that are not currently in a normal state and alarms that have returned to a normal state but have not been acknowledged (BACtalk>Alarms>Current Alarms). This view enables you to select one or multiple alarms at once and acknowledge them.

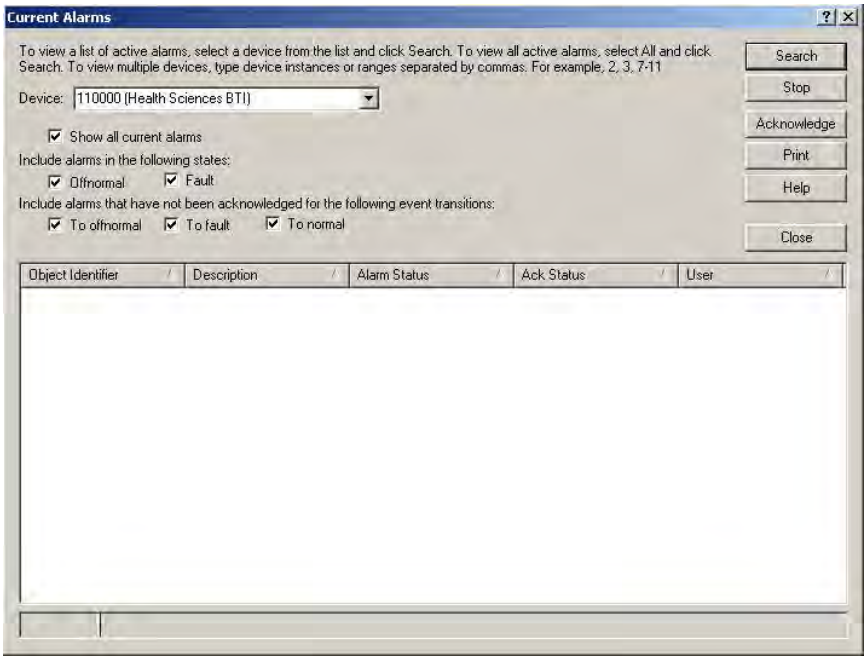

Figure 4.28 View a list of alarms not in normal state and alarms that have returned to normal state without being acknowledged in Current Alarms view.

Select a device from the drop down list and then click **Search** to view a list of current alarms stored in that device. Or, select **All devices** and then click **Search** to view a list of all alarms and all alarms that have returned to normal without having been acknowledged.

Note Click **Search** to refresh displayed data after acknowledging an alarm. Check the Alarm History window for a complete list of alarms that have been logged. These include both entries that have and have not been acknowledged.

Note In order for a device to be scanned, the appropriate capabilities must be selected on the device's Capabilities tab in Device Manager.

Use the check box options on the Current Alarms dialog box to specify the types of alarms to view (all current alarms, offnormal, fault, and unacknowledged alarms).

The Current Alarms list includes informative data columns about each alarm: object identifier, alarm description, alarm state, whether or not the alarm was acknowledged, and the name of the user that acknowledged the alarm if it was acknowledged and has been logged at the Envision for BACtalk server. These columns have "clickable" headings so you can sort and customize the Current Alarms view to better serve your needs.

Use the Print button to send a list of current alarms to a printer.

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Working with alarm histories

Alarm history records (BACtalk>Alarms>Alarm History) show critical information about the alarms that have occurred in your system. To refresh alarm history records, press F5. Select the alarm types you want to view from the Display Filter list, and then select the date range to view under Alarms Time Range. To clear records or print the history, use the File menu.

To be logged in alarm history, the alarm handler for the alarm must be set up to broadcast to this operator workstation. Select **Log Into Alarm History** under **Actions**. See Figure 4.20 on page 81 for more information.

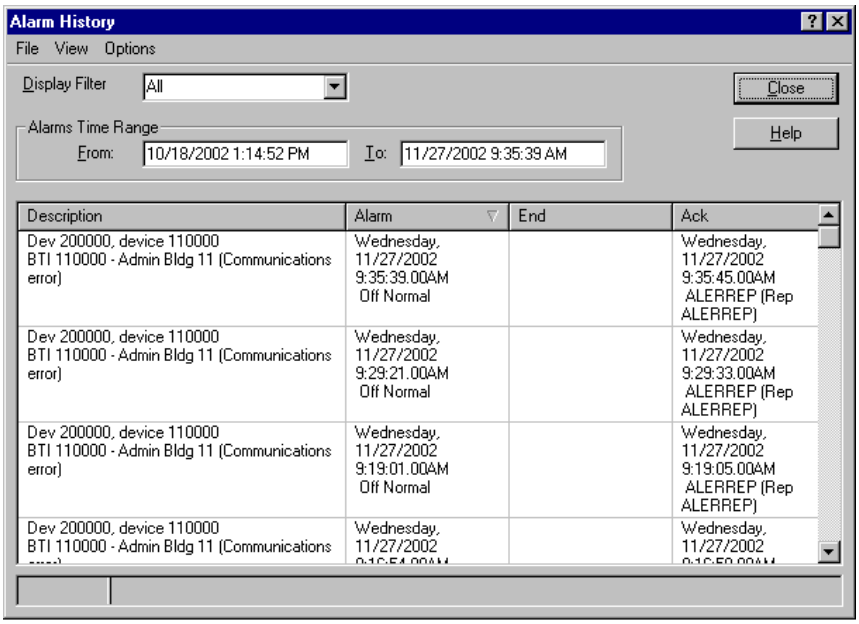

Figure 4.29 The Alarm History dialog box displays a description of the device in alarm, the date and time the alarm occurred, when it returned to a normal state, and when and by whom the alarm was acknowledged.

Display filter

Select the types of alarms to view. Only the selected types will be displayed.

Viewing Current or Archived Data

View current alarm data or select an archive record from the drop-down menu to display it.

Note Archived files are saved to the server.

Alarm history view time interval

Type in a new date and time range to view other archived data. Refresh the window to update the display window.

Description

This column lists both the device instance (usually a global controller) where the alarm is stored, and the alarm description set up when the alarm was created. For communications alarms, the origin and logging device are recorded.

Alarm

This column lists the date and time the alarm occurred with the alarm type immediately below it. This same information appears in the Envision for BACtalk Alarm Message box (if applicable). See Table 4.6 on page 94 for more information.

Table 4.6 Alarm types and when they occur

Alarm Type	Remarks
Off-normal	The most common type of alarm. Generated when an alarm status changes from normal to off-normal (called an event transition).
Fault	Generated when the alarm finds the monitored data point's reliability property to be in a fault state (other than No Fault Detected).
High/Low Limit	Applies to analog values. High limit indicates the present-value of the object has exceeded its assigned high limit. Low limit indicates the present-value of the object dropped below its assigned low limit.

End

The time that the original event state that caused the alarm changed—either returned to normal or to some other state.

Note If the End field is blank, the original alarm condition still exists.

Ack (Local alarm history only)

The time that the operator clicked **Acknowledge** on the Envision for BACtalk alarm message box and the user ID of the operator. If blank, the alarm was either set up with no acknowledgment or has yet to be acknowledged.

Site: rep/job, description (Remote alarm history only)

These fields identify the source of the alarm. The site description is established in the Main Alarm Setup at the remote site, and the rep and job further pinpoint the source.

Practical application

Marc uses the alarm history each Thursday to check alarms that have been acknowledged and to ensure that no alarms remain unresolved. He sorts on the "End" column to look at alarms by status. He knows that any alarms that have nothing listed in the "End" column have not been resolved and may still be active alarms. He uses this as a convenient checklist to follow up.

Marc could also have used the Current Alarms View to quickly check alarm status.

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Auto-archiving alarm history data

Use the auto-archive feature to set BACtalk to automatically archive alarm history records (BACtalk> Alarms> Alarm History> File> Archive Data). Records can be archived daily, weekly, twice a month, monthly, quarterly, twice a year, and yearly. Archived files are saved to the server.

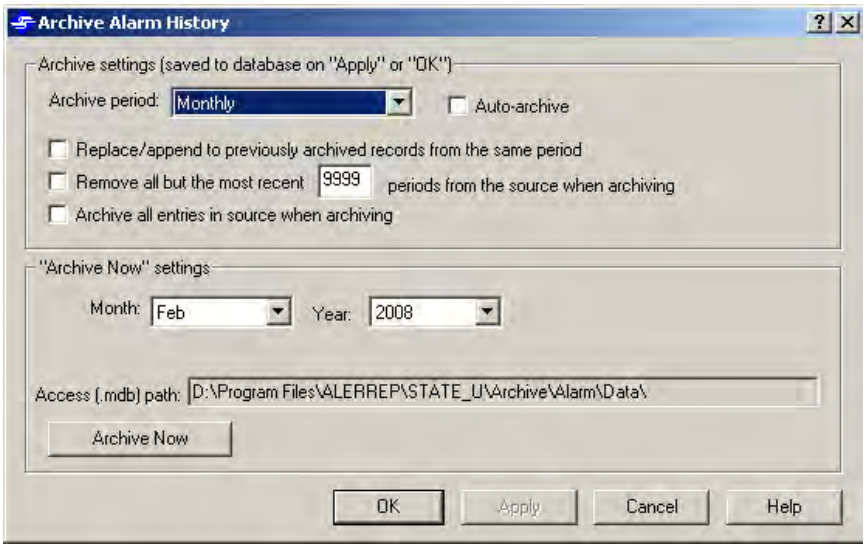

Figure 4.30 Archive Alarm History dialog box set to auto-archive every month

Using remote alarm history

Remote Alarm History entries (BACtalk>Alarms>Remote Alarm History) appear only if this operator workstation is set up to receive alarms from a remote site using a modem. BACtalk creates a record of alarm information in the file Remote Alarm Log.mdb, which is saved in the current rep/job folder.

Note Do not attempt to open an MDB file that is already in use by BACtalk. For example, do not click **Archive Now** for a selected file when BACtalk is already using that file.

Display filter

Select the types of alarms to view. Only the selected types will be displayed.

Viewing Current or Archived Data

View current remote alarm data or select an archive record from the drop-down menu to display it.

Remote alarm history view time interval

Type in a new date and time range to view other archived data. Refresh the window to update the display window.

Site rep/job

Identifies the rep/job of the operator workstation at the remote site where the alarm originated.

Description

The alarm description set up when the alarm was created. Usually, this includes the device, object, and property that generated the alarm. For communications alarms, the origin and logging device are recorded.

Alarm

Lists the date and time the alarm occurred, followed by the event state that caused the alarm to occur, typically off-normal or fault.

End

The date and time that the alarm returned to normal or to some other state, and the state it returned to. If blank, the alarm condition still exists, except for communication alarms.

Auto-archiving remote alarm history data

Use the auto-archive feature to set BACtalk to automatically archive remote alarm history records (BACtalk> Alarms> Remote Alarm History> File> Archive Data). Records can be archived daily, weekly, twice a month, monthly, quarterly, twice a year, and yearly. Archived files are saved to the server.

Note Do not attempt to open an MDB file that is already in use by BACtalk. For example, do not click **Archive Now** for a selected file when BACtalk is already using that file.

Alarm history database files

Alarm history records are saved in databases in the appropriate rep/job folder of the Envision for BACtalk root directory.

The database file for alarm history records is Alarms.mdb and the database file for the Remote Alarm History module is Remote Alarm Log.mdb.

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Sorting records and printing

You can use the Display Filter control to change how you view and print data. Only the records that match the criteria you select display.

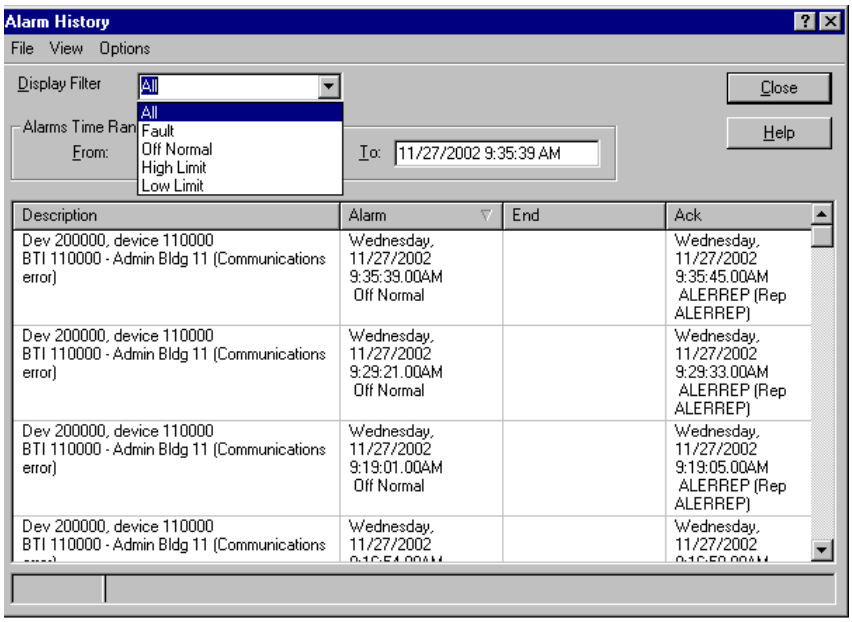


Figure 4.31 Alarm History dialog box using a display filter

Working with Custom Process IDs

When an alarm is broadcast to all devices, every device must handle it the same way. For example, you can not configure some devices to print the alarm and other devices to annunciate the alarm with a URL link displayed. Set up a

custom process ID to broadcast an alarm to all BACnet devices, including those that are not Alerton devices (BACtalk>Alarms>Custom Process IDs).

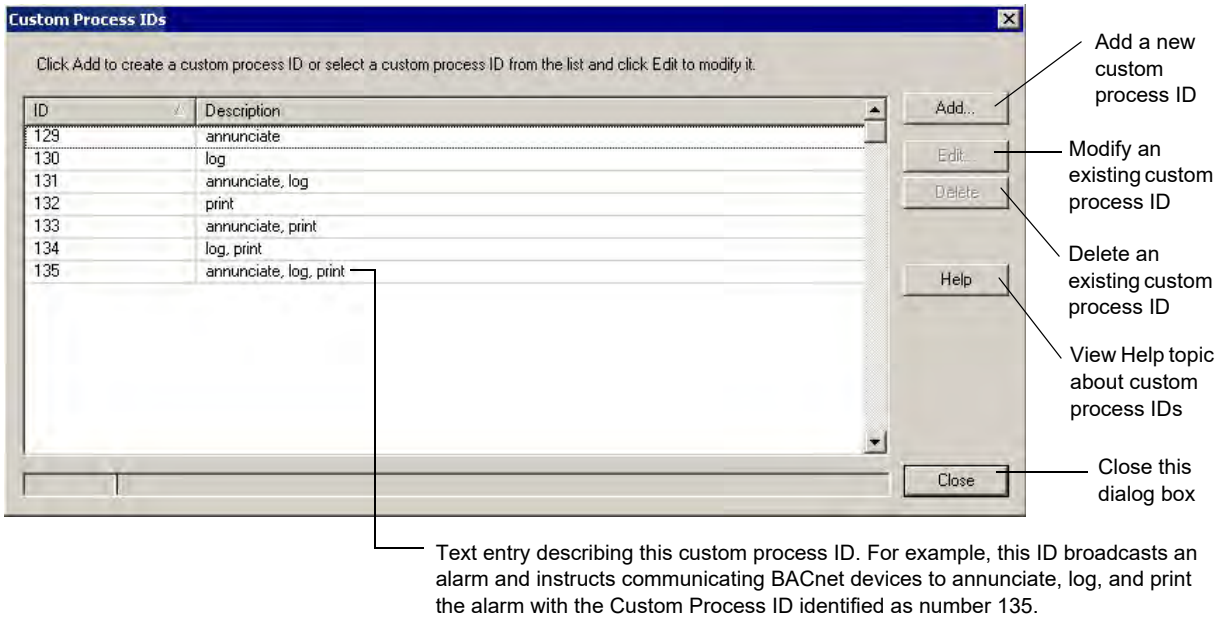
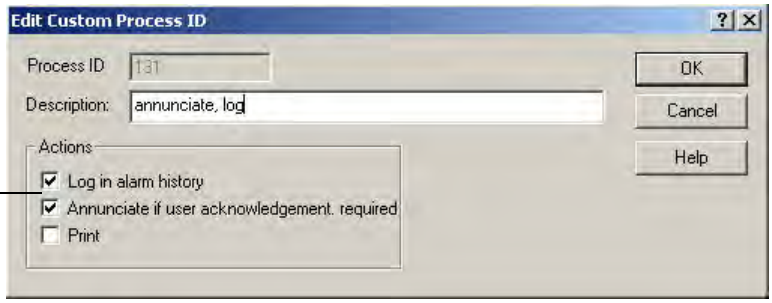


Figure 4.32 The Custom Process ID dialog box where new process IDs can be added and existing ones can be selected and then edited or deleted.

Use the Custom Process ID dialog box to add, edit, and delete process IDs. The Edit Custom Process ID dialog box opens when you click **Add** or **Edit**.



The Process ID is a numerical value assigned to a process ID that identifies it from other process IDs. Default custom process IDs are predefined in the range 129-135. Each predefined ID has a unique combination of annunciation, logging, and printing enabled. These custom process IDs can be user-edited.

Specify how you want the alarm to be handled once this custom process ID is broadcast to all communicating BACnet devices on the network for an alarm. The Log in Alarm History and Annunciate options are selected by default.

You can delete one or multiple custom process IDs at a time. When multiple IDs are selected for deletion, a confirmation message prompts you to verify that you want to delete more than one ID. This is a security measure to prevent the loss of

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wanted data. Only one ID can be modified at a time so the Edit button is disabled when multiple IDs are selected.

Custom process ID versus a non-custom process ID

When Envision for BACtalk processes an event that is configured as an unconfirmed event notification, it processes the ID based on the definition for a matching custom process ID. Otherwise, Envision for BACtalk uses a specific process ID.

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Schedules

5

Envision for BACtalk schedules enable you to plan building operations based on the time of day, holidays, and special events. Schedules can control zones and binary objects (ON or OFF) that support the priority-array property.

A *schedule set,* which you assign to a point or zone, consists of a *standard schedule*, a *holiday schedule*, and an *event schedule*. This scheduling structure allows you to control day-to-day zone operations with the standard schedule. The holiday schedule controls days or times when a facility is typically unoccupied. The events schedule controls time periods outside normal occupied times. The holiday schedule overrides the standard schedule, and the event schedule overrides the holiday and standard schedules within a schedule set.

Benefits

Efficient Scheduling data points and relying on the BACtalk system to turn equipment ON and OFF frees you to focus your attention on other areas of system operation.

Convenient Set up a schedule and then share it to control any number of points. Use the Time Schedule Wizard to view scheduled status at a glance.

Easy Right-click an item on a data display, and then click **Schedules** to edit the schedules or set up a new schedule set if the point is not yet scheduled.

Fast Set up times for one day of the week and then copy the settings to other days.

Practical application

The Administration building at State University is open Monday through Friday from 8:00 AM until 5:00 PM. This building is closed on state and federal holidays. Occasionally, special events in the conference room of the Administration building require a special schedule. For instance, on Monday, January 20, 2003 from noon to 3 PM, the building will be open for a special luncheon honoring Martin Luther King, Jr.

Marc is responsible for scheduling operations in the Administration building. He will use schedules in Envision for BACtalk to do it.

Quick start–schedule setup

Use the following table to help you set up schedules. The key steps for creating schedules are listed in order.

Table 5.1 Tasks for setting up a schedule

Task		See
1	Identify the zone or data point in your system that you want to schedule. Must be a BV in a global controller, a BO in a VLC, or BV-40 in VLC 2.04 and later.	• Site documentation • "Zones" on page 29 • "How schedules work" on page 103
2	If working with a data point, add a new scheduled point to the Point List in the Schedules dialog box (BACtalk>Schedule Points). If working with a zone, select the zone from the Zones list (BACtalk>Zones), and then click **Schedule**. Or, use the Schedule List (BACtalk> Schedules> Schedule List).	• "Zones" on page 29
3	Specify the host device that will store and run the schedules	• Site documentation
4	For each of the three schedules–standard, holiday, and event–that control the point or zone, specify whether you want to create a new schedule, copy an existing schedule, or share an existing schedule.	• "Using the New Schedule Wizard" on page 107 • Refer to this year's holiday and event schedules to help you plan next year's holiday and event schedules.
5	Set up time blocks for ON and OFF commands.	• "Setting the schedule date and hours of operation" on page 110

Note It is good practice to name schedules according to their hours of operation (for example, M-F, 7AM-5PM, ON) rather than by the controlled equipment or zone so that the schedule remains flexible.

See "Zones" on page 29 and "Optimum start" on page 119 or Envision for BACtalk Help for more information about setting up and working with these features.

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How schedules work

When you set up schedules to control a data point or zone, it is important to understand the relationship of the schedules in the schedule set and how to use each one.

- **Standard schedule** Use standard schedules to control equipment with ON and OFF commands during routine hours of operation. This schedule may contain ON commands for operating hours or an all day ON command.
- **Holiday schedule** Use holiday schedules to override standard schedules for an entire day, usually with an all day OFF command. You can then schedule ON times within the holiday. This schedule overrides the standard schedule for the entire day.

  Note Holiday schedules automatically write a 12:00 AM OFF time, which is in effect until the first scheduled ON command of the day occurs.
- **Event schedule** Use event schedules to override standard and holiday schedules with ON and OFF commands for time blocks in a day. Event time blocks are only in effect for the duration of the scheduled event and can not run through midnight.

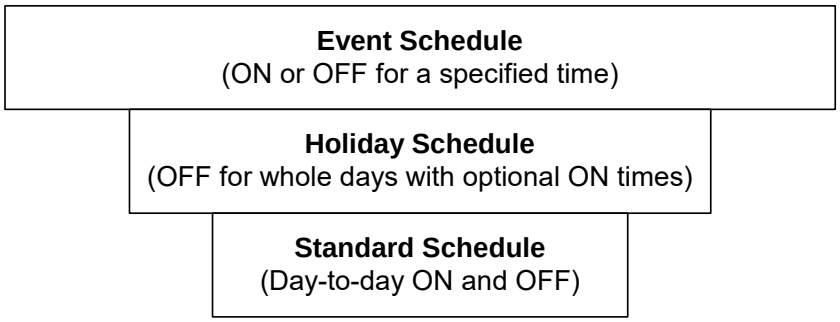

Figure 5.1 The schedule set hierarchy—event schedules override holiday and standard schedules, holiday schedules override standard schedules.

How schedules write to zones and points

If you use zones in your system, you do not need to be as concerned about the technical details of how the system arbitrates for control of the point. The zone object resolves commands from the standard, holiday, and event schedules. The only concern: ensure that the occupied command you specify in the zone setup is not being written to by DDC. The occupied command data point is usually BV-40 in a VLC.

To fully understand how schedules operate with data points, it helps to understand the BACnet priority array. The BACtalk system uses the BACnet priority-array to manage the hierarchy of schedules.

CAUTION A data point must support the priority-array property to be scheduled. BVs in Alerton global and building controllers support the priority array. VLC versions 2.04 and later support the priority array. BOs in VLCs support the priority array.

See "Zones" on page 29 or Envision for BACtalk Help for information about using zones.

See the *BACtalk Systems Programmer's Guide and Reference* (LTBT-TM-PRGRMR) for information about the priority array.

- Standard schedules write to data points at priority-array index 16. If the standard schedule is not writing an ON or OFF command, it is NULL.
- Holiday schedules write to data points at priority-array index 15. For days when a holiday schedule is in effect, an OFF command is written from 12:00 AM to 11:59:99.99 PM. On non-holiday days, the holiday schedule is NULL.
- Event schedules write to data points at priority-array index 13. If the event schedule is not writing an ON or OFF command for a time block, it is NULL.

Usually, the data points that schedules write to are reserved for scheduling. When a schedule set is assigned to a zone, the schedules write to the occupied command referenced for the zone (see "Zones" on page 29). Be careful that nothing else (such as DDC applications) writes to points that are scheduled.

There are essentially three methods for scheduling data points:

- BV-40 method
- Global controller BV method
- Direct BO control method

BV-40 method

Schedules control the occupied command in a VLC directly through BV-40. This enables you to directly schedule the occupied command in the VLC by assigning schedules to BV-40.

CAUTION Use this method only with VLC versions 2.04 because they support a priority-array for BV-40. Do not use this method for earlier VLC versions.

Global controller BV method

With this method, a schedule set controls the present-value of a global controller BV. DDC in the global controller then transfers the present-value to a VLC BV. Each global controller typically has a BV devoted to scheduling. Likewise, each zone controller has a BV in DDC assigned for scheduling (BV-40 in most applications). Most system developers write subroutine DDC in the global controller to transfer the scheduled global controller BV to each respective zone controller BV. Subroutine DDC is usually already present to transfer other data, such as outside air temperature.

This scheduling method has a couple of advantages. Alerton Standard applications do not need to be edited for schedules. Also, VLC and building controller BOs can have the out-of-service property set to true, and schedules will still control the BO using DDC. One disadvantage is that global controller DDC must transfer the scheduled global controller BV to the appropriate VLC or building controller BVs.

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Direct BO control method

You can directly control a BO in a VLC or VLX by assigning a schedule set to it. Right-click a prompted item on a data display that is set up as the present-value of a VLC BO, and then click **Schedules**. The schedule set then commands the priority-array of the BO. When you use this scheduling method, the most important consideration is that internal DDC running in the VLC writes commands at priority-array index 14, and will override the standard and holiday schedules.

One advantage of this approach is that there is no global controller DDC to write or maintain for schedules. Another advantage is the ease of scheduling a BO (right-click an item on a display).

The greatest disadvantage of this approach is that you must edit and monitor VLC DDC so that it does not conflict with schedules. If you do not modify DDC, conflicts may occur, and the data point will appear to not respond to schedule control.

Setting up schedules with the schedule wizards

The New Schedule Wizard and the Time Schedule Wizard enable you to efficiently set up reliable schedules for BACtalk data points and zones.

You can access both schedule wizards from the Schedules dialog box. The Schedules dialog box includes a Point List of all properties that have a schedule set assigned to them. If you click **Add** to create a schedule set for a data point not listed, the New Schedule Wizard appears. If you click **Edit** to modify an existing schedule set for a selected point, the Time Schedule Wizard is displayed.

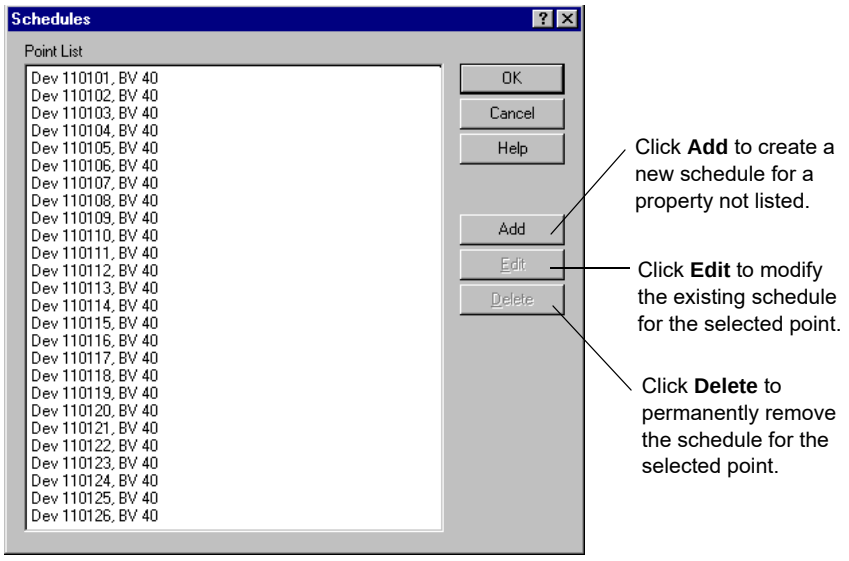

Figure 5.2 Schedules dialog box

You can also access both schedule wizards from the Zones dialog box. If you select a zone with an "S" in the status column, and then click **Schedules**, the New Schedule Wizard appears. (S in the Status column indicates that the zone does not have a complete schedule set.) If you select a zone that does have a schedule set assigned, and then click **Schedules**, the Time Schedule Wizard appears.

See "Zones" on page 29 for more information about using the Zones dialog box.

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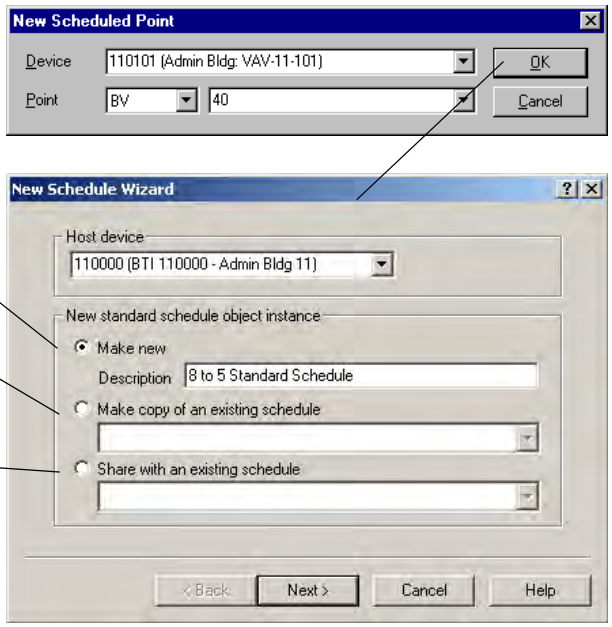
Using the New Schedule Wizard

The New Schedule Wizard enables you to schedule a data point or zone. For the standard, holiday, and event schedules, you can choose to create a new schedule, copy an existing schedule, or share an existing schedule with other zones or points.

Note The New Scheduled Point dialog box only appears when you select **Schedules** from the BACtalk menu.



Make New Create a new schedule set to control this point.

Make a copy... Make a copy of an existing schedule set, give it a unique name, and use it to control this point.

Share... Use an existing schedule to control this point.

Figure 5.3 Use the New Schedule Wizard to set up schedule control for a data point or zone.

Using the Time Schedule Wizard

The Time Schedule Wizard provides a calendar-based tool where you can create, edit, and delete schedules. The majority of BACtalk schedules are edited and configured using the Time Schedule Wizard. The wizard's easy-to-use format graphically displays the standard, holiday, and event schedules—the schedule set—that combine to control a point.

When you work with the wizard, you start with the property you want to schedule. BACtalk assigns a standard schedule, holiday schedule, and event schedule to the data point according to your instructions. You use a calendar and timetable to edit commands, and BACtalk sets up the appropriate schedules for you. The schedules are saved to the global controller and to your workstation hard disk when you save your work.

There are three ways to start the Time Schedule Wizard:

- **Data points** Select **Schedules** from the BACtalk menu, select a data point, and then click **Edit.**
- **Zones** Select **Zones** from the BACtalk menu, select a zone, and then click **Schedule**. (If the Zone has not been scheduled, the New Schedule Wizard appears first, followed by the Time Schedule Wizard.)
- **Data display access** Right-click a data display item and click **Point Schedules**. If the data point belongs to a zone, point to Zones first and then click **Schedule**.

Time blocks on the Time Schedule Wizard timetable represent ON or OFF commands by hour of the day. Blocks are color coded for easy identification. Each column shows time blocks for the corresponding schedule.

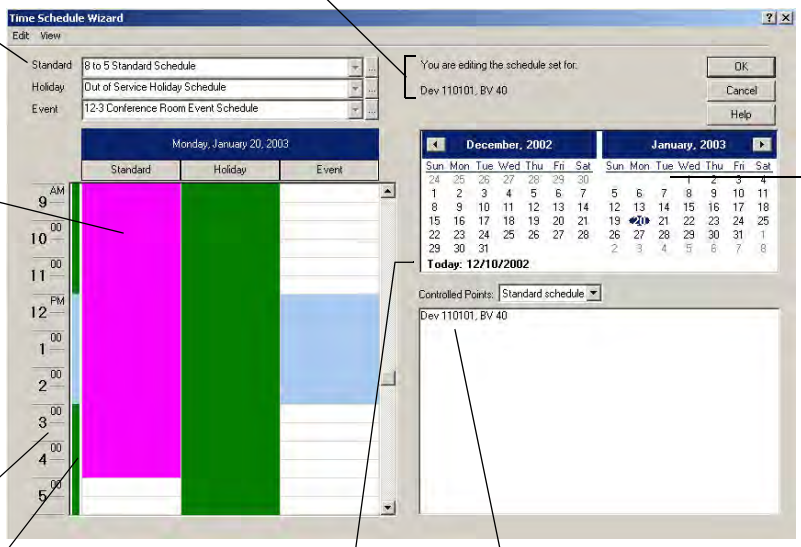
The Time Schedule Wizard's interactive calendar and timetable make it easy to add and remove scheduled commands. Use the timetable to edit a scheduled command, edit schedule properties, or delete a schedule command. Use the calendar to jump to existing holiday and event schedules.

About the example shown This is a common setup for a holiday, Martin Luther King Jr. day, on which a special luncheon will be held from 12-3 PM. The standard schedule is set up for Monday through Friday (using the recurrence feature) 8 AM to 5 PM ON. An OFF command for the entire day is set up in the holiday schedule. From 12 to 3, the event schedule issues an ON command for the luncheon event.

The data point you are working with.

The calendar Shows dates, with holidays and events assigned in bold. Click a day on the calendar to set up scheduled times on that day. The active day appears highlighted. To quickly jump to a different month or year, click the month or year in the header and then select the one you want.

The schedules listing Shows the description of the schedules in this schedule set and enables you to change assignments and descriptions.



The timetable Graphically shows ON and OFF times for each schedule for the selected day. It also lets you easily edit and add scheduled commands. Double-click a time slot in the appropriate column to set up a new scheduled time block. To delete a scheduled event, right-click anywhere on the command block and click **Delete**. To edit a time, click the block and drag its edges until it occupies the appropriate time slots.

The timeline Right-click anywhere along the timeline to change displayed increments (60 min, 30 min, 15 min, or 10 min).

The point status bar Shows the resulting status of the point based on the combination of standard, holiday, and event schedules. (Colors are configurable. Right-click the status bar to change the ON and OFF colors.)

Click to jump to today's schedule.

The Controlled Points list Shows the points and zones the selected schedule controls. Right-click a point or zone to delete it (and remove schedule control) or to add a new point or zone.

Figure 5.4 The Time Schedule Wizard

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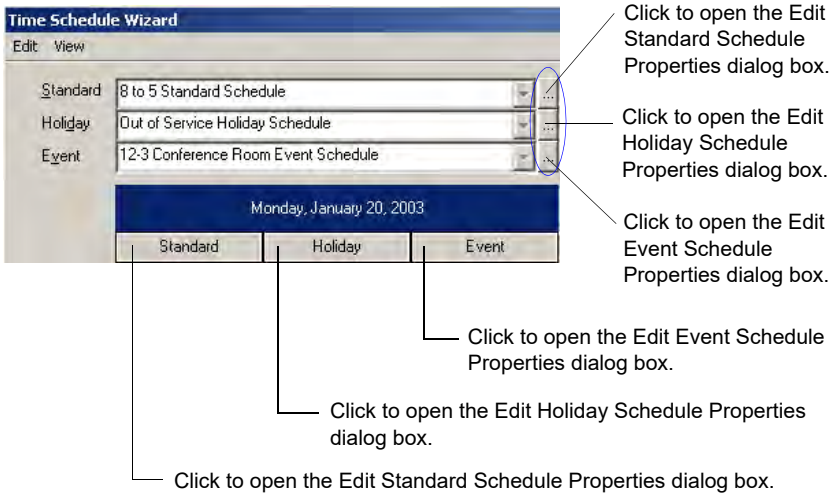
Setting the schedule effective period and properties

In rare cases, you may want to change the description of a schedule in a schedule set. Envision for BACtalk also enables you to change the period of time that a schedule in a schedule set is effective. This feature enables you to have a schedule control the assigned points only during a certain period that you specify. Because of the complexity using this feature introduces, it is rarely used and not recommended.

Click the command button to the right of each schedule type field, click the schedule header, or from the Edit menu, point to Properties and then click the Schedule you want to change to open the Edit Standard (Holiday, Event) Schedule Properties dialog box.



Use the Edit Standard (Holiday, Event) Schedule Properties dialog box to specify the time period that this standard (holiday, event) schedule will be in effect during the year. Specify the month, day, and year or the day of the week that this schedule will start and stop controlling the data point. Leave the date fields blank if you want this schedule to always be enabled.

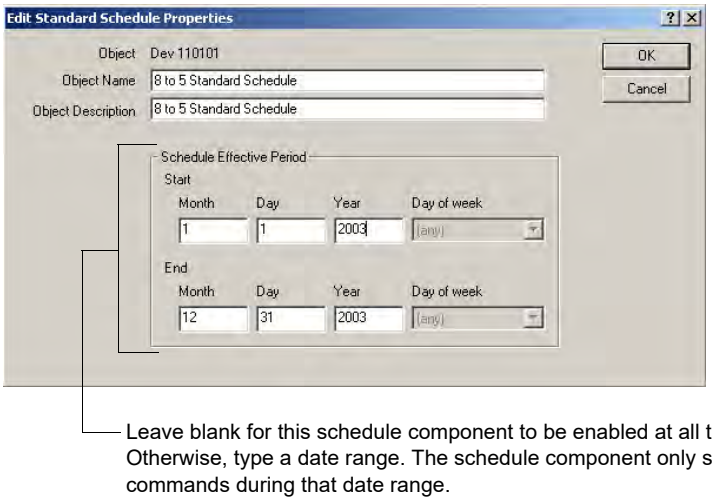


Figure 5.5 This 8 to 5 Standard Schedule will be effective from January 1, 2003 through December 31, 2003.

Setting the schedule date and hours of operation

Standard schedule

Use the Edit Schedule Wizard to set the days of the week and the hours your standard schedule will be enabled.

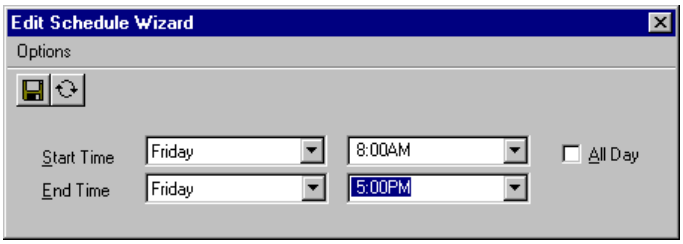


Figure 5.6 This standard schedule will be enabled on Fridays from 8:00 AM to 5:00 PM.

Note Envision for BACtalk recognizes many date formats to suit your preferences. For example, typing 5 = 5:00 AM, 17 = 5:00 PM, 6P = 6:00 PM, and 5:20P = 5:20 PM.

There are two ways to open the Edit Schedule Wizard:

- Select a time slot, right-click the selection, and then click **New**.
- Double-click a time slot.

Note BACtalk applies the schedule command to the next occurrence of the scheduled day. For example, if you select a start time of Monday at 8:00 AM and then subsequently choose a Tuesday start, the command appears on the next occurring Monday.

To make the schedule command recur on a range of dates, click the **Recurrence** button and then select the days you want the command to occur.

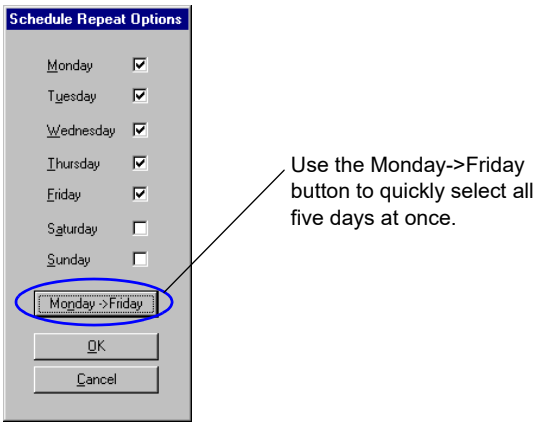


Figure 5.7 This schedule will be in effect Monday through Friday.

There is no “clear all” feature on the Schedule Repeats Options dialog box. Individually clear the check box in front of each day of the week for which you do not want to schedule an event.

Holiday schedule

Use the Edit Holiday Wizard to set a day or time block when the holiday schedule will be in effect.

Figure 5.8 This holiday schedule will command the equipment OFF all day for Martin Luther King, Jr. Day, January 20, 2003.

There are two ways to open the Edit Holiday Wizard:

- Select a time slot, right-click the selection, and then click **New**.
- Double-click a time slot and navigate through the calendar until you locate the date you want to schedule.

IMPORTANT! If you clear the All Day check box, remember that holiday schedules always start with a 12 AM OFF time. So, if you schedule a 2:00 PM to 3:00 PM ON time for a holiday, all other times on that day will be OFF.

Event schedule

Use the Edit Event Wizard to set a day or time block when the event schedule will be in effect.

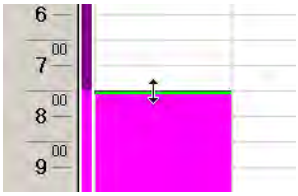
Figure 5.9 This event schedule will command equipment ON from 12:00 PM to 3PM for the luncheon honoring Martin Luther King, Jr. **Note** Event schedules override holiday schedules.

There are two ways to open the Edit Event Wizard:

- Select a time slot, right-click the selection, and then click **New**.
- Double-click a time slot.

Editing a scheduled command

Once you have created a schedule, it is easy to go back and modify its command parameters. Click anywhere on the time block to select the time period for editing. Position the mouse pointer on the edge of the time block you want to change so it appears as a double-headed arrow and drag it to the new starting or ending time.



Note You can also right-click anywhere in the time block and then click **Open** on the shortcut menu to edit a scheduled command.

Deleting a scheduled command

Select a scheduled point from the Schedules dialog box, and then click **Delete** to permanently remove a schedule from the data point. If you are already working with the Time Schedule Wizard, right-click anywhere on the time block and then click **Delete**.

Jumping to an existing holiday or event schedule

Use the View menu in the Time Schedule Wizard to quickly move to an existing holiday or event schedule. Click **Dates** from the View menu, and then click

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Holiday or **Event** schedule. A list of dates for which holidays or events are scheduled is displayed (depending on your selection). Select the date you want to open and click **OK**.

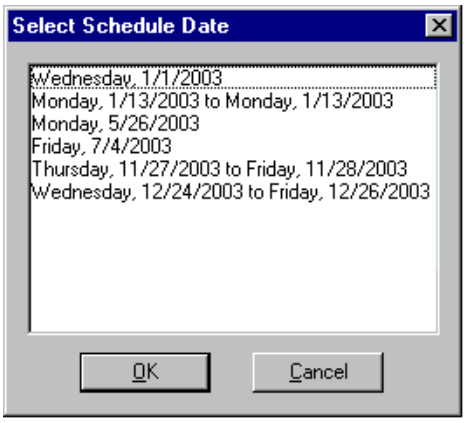


Figure 5.10 This is a list of existing holiday schedules assigned to the selected point.

Practical application

The Administration building at State U has a single global controller, a BTI with device instance 110000. There are numerous zones within the building, such as: university administrative staff offices, the university president's office and conference room, the provost's office, Academic Records, Student Registration, Cashier, Academic Scholarships, faculty payroll, university accounting, Alumni Services, Graduation Services, small conference room, medium conference room, large conference room, and restrooms and lobby.

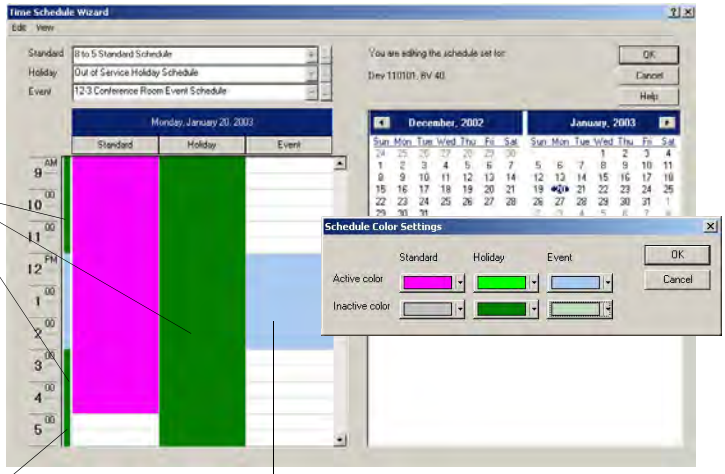
Regularly scheduled operating hours are from 8 AM to 5 PM every weekday. Marc has the Administration building zones set up to share the same standard schedule, which he named "8 to 5 Standard Schedule." When the university administration changed hours from the old 7 AM to 4 PM schedule last year, it was easy for Marc to update the schedule. He simply changed the time block and the schedule object description on a standard schedule for one of the zones and all zones that use this schedule were updated to the new operating hours.

Each year around late November, the provost releases the business holidays for the following year. Because the business holidays are different from the school holidays, the Administration building needs its own holiday schedule, "Business Holiday Schedule." Holidays are set up on this schedule to be OFF all day.

Marc set up each zone in the Administration building with its own event schedule. This way, an event in one of the zones does not cause equipment in the other zones to come ON.

Early tomorrow, a disciplinary hearing is being held in the university president's conference room, from 7:00 AM to 8:00 AM. Marc adds a 7:00 AM ON time block to the event schedule for the following day. Because the zones have different event schedules, it affects only the university president's conference room.

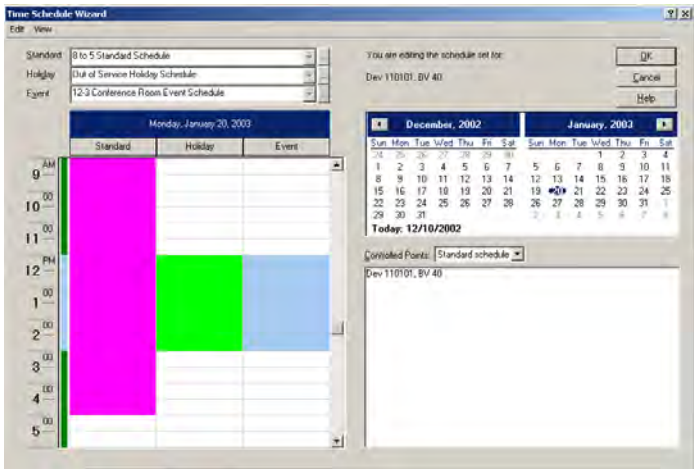
For the luncheon on Martin Luther King Jr. day, Marc modifies the holiday schedule. This way, he can affect all zones in the building. MLK day is already selected as an All Day OFF holiday. Marc navigates to the calendar, right-clicks the Holiday column, and selects Open. He then clears the All Day check box. Marc then adds an event schedule for 12:00 PM to 3:00 PM and clicks the ON option button. The holiday schedule still issues an 12:00 AM off command, but there is now a single ON command for the luncheon.



Shows that the holiday schedule is in effect so Administration building equipment is scheduled OFF. Use the color settings to help you understand which schedules are active or inactive. This image shows the Holiday column and the point status bar are the same color.

Shows that the event schedule is in effect from 12 PM to 3 PM. **Note** Event schedules override holiday schedules.

Right-click the point status bar to view/edit schedule status colors.



Notice how the point status bar in the image above still indicates that the entire day is set to OFF, except 12 PM to 3 PM. When Marc sets up the single time for the ON holiday, the building is set to ON for the specified event and remains set to OFF for the rest of the day. If he wants to add a second ON time for the holiday, Marc can add the ON time to the holiday schedule or use the event schedule.

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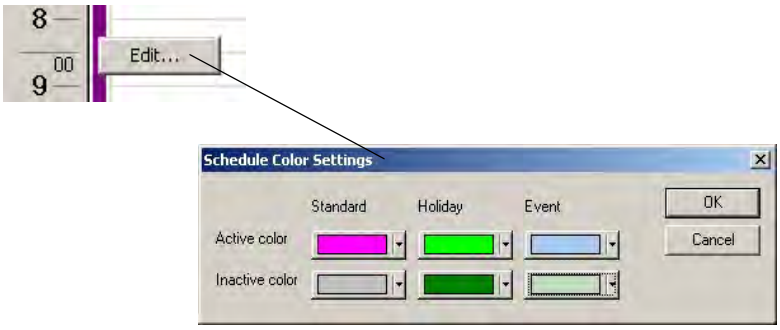
Customizing the appearance of the timetable

You can customize the appearance of the timetable in the Time Schedule Wizard to better meet your needs.

Changing schedule color settings

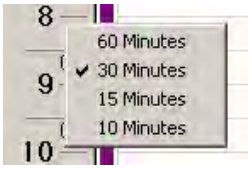
You can change the color associated with each of three types of schedules for easy recognition while setting up and working with schedules. Right-click the point status bar, and then click **Edit**.



A color box appears in the Schedule Color Settings dialog box for each schedule type and command state–Active (ON) or Inactive (OFF). Use the arrow next to the schedule and command state you want to change, and then select a color from the palette.

Changing the time increments displayed on the timeline

By default, the timeline along the left side of the timetable is displayed in 1-hour increments. Right-click anywhere on the timeline and then select the time increment you want. A check mark appears next to the selected increment.



You can change the time increments in the timeline to either 60, 30, 15, or 10 minutes. Default is 30 minutes.

Changing the Time Schedule Wizard dialog box size

You can adjust the size of the Time Schedule Wizard dialog box to suit your needs. Click **Size** on the **View** menu, and then click either **Large** or **Small**. By default, the size of the Time Schedule Wizard dialog box is set to **Small**. Selecting **Large** allows you to view more hours in the timetable and enlarges the Controlled Points list area.

Editing schedule sets and point assignments

You can easily change the operation of a schedule set once it is defined. You can add and remove data points and zones, exchange a standard, holiday, or event schedule for another one, and change the description and effective date of a schedule component.

Changing the points or zones that a schedule set controls

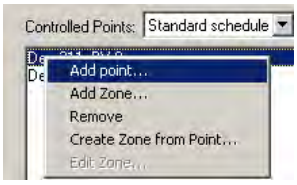
You may need a schedule set to control a different property as time passes. For example, a tenant may expand their operations to another floor and they have a different work schedule than the previous tenant. With the occupied mode for the zone specified, BACtalk makes it easy to remove the properties from the old schedule set and assign them to a new one.

Removing a property from a schedule set

Either through the BACtalk menu or by right-clicking a data display, select the scheduled point that you want to work with from the Point List in the Schedules dialog box. To permanently remove the assigned schedule set from the selected point, click **Delete**.

Assigning additional points to a schedule set

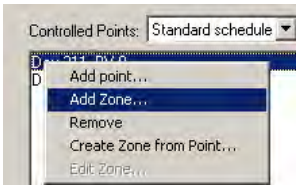
You may also want to assign the same schedule set to additional points. Open the Time Schedule Wizard for the schedule set you want to use, and then right-click anywhere on the Controlled Points list to display the shortcut menu.



Click **Add point** and specify the device instance of the global controller and point information.

Assigning additional zones to a schedule set

You may also want to assign the same schedule set to additional zones. Open the Time Schedule Wizard for the schedule set you want to use, and then right-click anywhere on the Controlled Points list to display the shortcut menu.



Click **Add Zone** and select an existing zone or create a new one to assign to this schedule set.

See "Zones" on page 29 or Envision for BACtalk Help for more information about working with zones.

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Replacing a schedule in a schedule set

Occasionally, you may need to replace a schedule in one schedule set with a schedule from another schedule set. For example, you may find that a holiday or event schedule for one zone may not be appropriate for another zone.

CAUTION When you edit a schedule set in this way, all properties assigned to the schedule set are affected. Check the Controlled Points list in the Time Schedule Wizard for a schedule set to confirm that you want to make the change.

Replace a standard, holiday, or event schedule in a schedule set with another by opening the Time Schedule Wizard for the point whose schedule you want to edit. To avoid changing the wrong schedule set, verify that only the points you want to edit appear in the Controlled Points list. Use the arrow to select the schedule you want to work with.

Note The drop-down arrow is only available when more than one schedule has been created.

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Optimum start

6

How do you decide when to start equipment to prepare a zone for occupancy? Start too late, and occupants might be too hot or too cold for a while when they are first in the zone. Start too early, and you waste energy conditioning unoccupied zones. You may also need to frequently adjust the start schedule for seasonal and building factors. Instead, use *optimum start* to do the work for you. With optimum start, you schedule only the occupied time for the zone. Your BACtalk system reliably calculates how far in advance to start equipment to meet the desired temperature by scheduled occupancy.

Benefits

Efficient Equipment only works when necessary to condition the space and keep occupants comfortable.

Saves labor You schedule occupied times and the system calculates when equipment actually needs to start. No additional programming or manual adjustments are required.

Intelligent Optimum start learns every time it runs, self-adjusting to ensure maximum efficiency and comfort.

Practical application

Joe, a facilities engineer at the State University Health Sciences building, is getting complaints again that the main lecture hall is too cold in the morning. The first class of the day arrives at 8:00 AM, and the lecture hall is scheduled for occupancy at the same time. This schedule is set up every November. Joe suspects that the hall does not actually warm up to the occupied setpoint until about a half hour later now that the weather is colder. So he checks trendlogs to confirm this. After evaluating the trendlogs, he decides to adjust the schedule to start equipment a half-hour earlier for every occupied time. It works, but he knows he may have to adjust again when the weather gets even colder, then again in spring, and again in summer as the weather gets warmer.

The main lecture hall is a good candidate to use optimum start. Optimum start will look at the lecture hall's scheduled occupied time and then calculate how much earlier equipment needs to start. The feature then monitors how well it did and adjusts the next start time, continuously improving and optimizing. The system will find the optimum time to start equipment based on many factors, including the temperature outside and its past performance.

Joe sets up a zone for the main lecture hall (see "Zones" on page 29) and then sets up optimum start for the zone. The BACtalk system now automatically warms up or cools down the space for its occupied times. From time to time, Joe checks trendlogs of key points to ensure the feature is functioning as expected.

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Quick start–optimum start setup and adjustment

Use the table to determine the order of tasks to perform when you set up optimum start. The table also lists references in this document and elsewhere where you can get more information.

CAUTION Adjusting optimum start settings without sufficient knowledge can cause undesirable results and may inadvertently overwrite BACtalk's self-tuning operations. Before adjusting automatic mode settings, it is recommended that you take values and run them through the equations to try to predict their effect.

Table 6.1 Tasks for setting up optimum start

Task		See
1	Identify the zone you need to work with or set up a new zone.	• "Optimum start" on page 119 • Site documentation
2	Confirm that the zone has a schedule set assigned to it and that the occupied times are correct. Edit the schedule set if necessary.	• "Zones" on page 29 • "Schedules" on page 101
3	Confirm that the zone has optimum start references. If necessary, verify that the references are correct.	• "Zones" on page 29 • "Setting or confirming optimum start references for the zone" on page 132
4	For zones with existing optimum start, make sure to update the data.	• "Saving data from the controller to the Envision for BACtalk server" on page 128
5	Select the optimum start mode.	• "Choosing manual or automatic mode" on page 135
6	Set your parameters.	• "Editing optimum start settings" on page 133 • Site documentation

How optimum start works

This section first provides the equations and logic that optimum start uses to calculate equipment *advance time*. Advance time is the amount of time before occupancy that the BACtalk system begins warmup or cooldown to get a zone to target heating and cooling setpoints for occupancy. This chapter then provides information about how an optimum start program is saved, how it runs, and the other BACtalk features it interacts with.

This information may be helpful if you are setting up optimum start for a zone (See "Zones" on page 29) or if you need to determine if optimum start is doing its job as expected. (Also, see "Strategies and tips for checking optimum start operation" on page 139.) Most readers can skip this section.

About automatic and manual modes of operation

Optimum start has two modes of operation: manual mode and automatic mode. The mode is selected when optimum start is set up.

Manual mode

Manual mode offers a simple method to implement optimum start for zones where heating and cooling operations are very predictable, regardless of the time of day, the temperature outside, or other building factors. You simply specify how many degrees per hour you expect equipment to heat up or cool down a zone prior to occupancy. You also specify the maximum advance time for equipment. Use the maximum advance time as a fail-safe of sorts. The maximum advance ensures that the system will not start warmup or cooldown operations too early under error conditions (for example, if a sensor fails or a unit is offline).

The calculations in manual mode are straightforward.

Warmup calculation AdvanceMinutes = (HtgSP–Temp) X 60/HtgRate

Where:

AdvanceMinutes = The amount of warmup time optimum start calculates to be necessary before occupancy

HtgSP = The occupied heating setpoint for the zone

HtgRate = The heating rate set up for optimum start (degrees per hour)

Cooldown calculation AdvanceMinutes = (Temp–ClgSP) X 60/ClgRate

Where:

AdvanceMinutes = The amount of cooldown time optimum start calculates to be necessary before occupancy

ClgSP = The occupied cooling setpoint for the zone

ClgRate = The cooling rate set up for optimum start (degrees per hour)

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Example

A manual optimum start program is set up for a zone with a heating rate of 5 degrees F, a cooling rate of 4 degrees F, and a maximum advance time of 120 minutes. The zone is scheduled for two occupied times during the weekday, one at 8:00 AM and the other at 4:30 PM. The zone has an occupied heating setpoint of 68 degrees F and an occupied cooling setpoint of 74 degrees F.

The BACtalk system monitors the zone space temperature and sees it holding at 63 degrees. Optimum start calculates an advance time of 60 minutes [60 = (68 – 63) * 60/5], and will start warmup at 7:00 AM. At 1:30 PM the space temperature is 84 degrees F. Optimum start calculates an advance time of 150 minutes, but does not start equipment [150 = (84 – 74) X 60/4) until 2:30 because 120 minutes is the maximum advance time allowed.

Practical application

The basement classrooms in the Health Sciences building heat and cool at a very predictable rate. In warmup mode, the HVAC system heats the classrooms at a rate of 5 degrees F per hour and cools at a rate of 10 degrees F per hour. It does not matter if it is August or November, 100 degrees F or 10 degrees F outside, 3:00 AM or 3:00 PM. Also, they have never needed more than 10 degrees heating or cooling.

Because this zone of classrooms is so predictable, Joe, the facilities engineer, has set up manual mode optimum start for it. The heating rate is set to 5 degrees per hour and the cooling rate is set to 4 degrees per hour. Because it never varies from the setpoint by more than about 10 degrees, Joe sets the maximum advance time to 240 minutes. This ensures that the system never starts warmup or cooldown more than 2 hours before scheduled occupancy.

Automatic mode

Automatic mode offers an intelligent and adaptive algorithm to control warmup and cooldown operations for a zone. Setup is more complex for automatic mode responding to environmental and historical conditions dynamically, but its behavior is also much more advanced and adaptive than manual mode.

CAUTION Adjusting automatic mode settings requires a solid understanding of their effect on the optimum start calculations. Adjusting these settings without sufficient knowledge can cause undesirable results and may inadvertently overwrite BACtalk's self-tuning operations. Before adjusting automatic mode settings, it is recommended that you take values and run them through the equations to try to predict their effect.

Use automatic mode when you want warmup and cooling operations to intelligently adapt to changing conditions.

Initial warmup calculation AdvanceMinutes = WrmFctr X (OADelta + BldgMass X (HtgSP–Temp)) X 2

Where:

AdvanceMinutes = The amount of warmup time optimum start calculates to be necessary before occupancy.

WrmFctr = An automatically adjusted warmup factor. Maximum value is 10. Minimum is 0. The greater the warmup factor, the greater the advance time.

OADelta = The difference between the outside air limit—a value that you specify in the optimum start setup—and the actual outside air temperature. If the result is less than zero, optimum start uses zero.

BldgMass = A value that you specify in the optimum start setup that can be equal to 3, 4, or 5. Larger numbers correspond to greater interior building mass (including heavy bookcases, thick walls, glass walls, and lots of oversized office equipment), increasing the effect of zone temperature within the equation. Smaller numbers correspond to less interior building mass, increasing the effect of outside air temperature within the equation.

HtgSP = The occupied heating setpoint for the zone.

Temp = The zone space temperature.

Initial cooldown calculation AdvanceMinutes = ClFctr X (Temp – ClgSP) X BldgMass X 2

Where:

ClFctr = An automatically adjusted cooldown factor. Maximum value is 10. Minimum is 0. The greater the cooling factor, the greater the advance time.

Temp = The zone space temperature.

ClgSP = The occupied cooling setpoint for the zone.

BldgMass = A value that you specify in the optimum start setup that can be equal to 3, 4, or 5. Larger numbers correspond to greater interior building mass, increasing the effect of zone temperature within the equation. Smaller numbers correspond to less interior building mass, increasing the effect of outside air temperature within the equation.

Heating and cooling factor adjustments Optimum start adjusts warmup and cooldown factors based on the performance of optimum start. Adjustments occur at the end of an optimum start operation (that is, after scheduled occupancy).

When adjusting warmup and cooldown factors, optimum start uses a self-tuning factor that you specify. This value ranges from 0.0 to 1.0. Use the self-tuning factor to adjust how aggressively optimum start tunes. When the factor is set to 1, the most recent optimum start performance has the maximum effect on the adjustment. When set to 0.1 it has the minimum effect. When set to 0, automatic adjustment is disabled.

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Note If the previously calculated advance time exceeded the maximum advance time defined in the Optimum Start dialog box, optimum start does not further adjust the heating and cooling factors.

If optimum start fails to reach the setpoint by the scheduled occupied time, optimum start compares the ratio of desired temperature change to actual temperature change to calculate an adjustment to the heating or cooling factor.

FctrAdjustment = (SP - StartTemp) / (ResultTemp - StartTemp)

Where:

SP = The occupied heating or cooling setpoint as appropriate.

StartTemp = The zone space temperature measured at the time optimum start began warmup or cooldown (the scheduled occupied time less the advance time).

ResultTemp = The zone space temperature measured at the scheduled occupied time.

If the zone reached the setpoint too early, optimum start uses the ratio of actual time to achieve desired temperature to planned time to achieve the temperature to calculate an adjustment to the heating or cooling factor.

FctrAdjustment = (ActualMinutesToSP / CalculatedAdvanceMinutes)

After optimum start calculates the adjustment to the heating or cooling factor, it uses the adjustment to calculate a new heating or cooling factor as follows.

NewFctr = OldFctr + OldFctr X (FctrAdjustment - 1.0) X TuningFactor

Where:

NewFctr = The new heating or cooling factor as appropriate.

OldFctr = The previously used heating or cooling factor.

FctrAdjustment = The factor adjustment that optimum start calculated (see earlier equations). The greater the adjustment, the greater the difference between the old factor and the new factor.

TuningFactor = The tuning factor, which you specify in the optimum start setup, varies from 0.1 to 1.0. The greater the tuning factor, the greater the difference between the old factor and the new factor. A tuning factor of 1.0 causes heating and cooling factors to tune the most aggressively. A tuning factor of 0.1 causes them to adjust least aggressively. A tuning factor of 0 disables factor adjustments.

Example

An automatic optimum start program is set up for a zone with the following settings:

Self-tuning factor: 0.5

Outside air limit: 65 degrees F

Building mass: 4.0

Warmup factor: 1

Maximum advance: 120 minutes

The zone is scheduled for occupancy at 9:00 AM and has an occupied heating setpoint of 68 degrees F. When the BACtalk system monitors the zone to calculate optimum start, the space temperature is 58 degrees F. The outside air temperature is 50 degrees F.

Optimum start calculates an advance time of 110 minutes and will start warmup up at 7:10 AM, using the initial warmup equation (see See "Initial warmup calculation" on page 124 for more information):

AdvanceMinutes = WrmFctr X (OADelta + BldgMass X (HtgSP–Temp)) X 2
110 = 1 X (15 + 4 X (68 - 58)) X 2

At 9:00 AM, the zone temperature has reached only 65 degrees F, so optimum start makes the necessary adjustments to reach the heating setpoint earlier next time. First, a factor adjustment of 1.4 is calculated, using the following equation:

FctrAdjustment = (SP - StartTemp) / (ResultTemp - StartTemp)
1.4 = (68 - 58) / (65 - 58)

Next, the factor adjustment is used to determine a new warmup factor of 1.2:

NewFctr = OldFctr + OldFctr X (FctrAdjustment - 1.0) X TuningFactor
1.2 = 1 + 1 X (1.4 - 1.0) x 0.5

Finally, a new advance time of 132 minutes is calculated for the next day:

132 = 1.2 x (15 + 4 X (68 - 58)) X 2

Practical application

The main lecture hall in the Health Sciences building has lots of windows so Joe, a facilities engineer, sets up optimum start for this zone with a light building mass of 3. This zone is located on the third floor where the windows are not shaded by trees or other buildings so it gets lots of sunshine and is very susceptible to time-of-day and seasonal temperature changes. Joe raises the self-tuning factor for this zone to 0.8 to account for its physical location. He also sets up and checks trendlogs to help him verify that optimum start is performing as expected and to help him determine when he needs to tweak optimum start factors as environmental conditions change.

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Automatic mode with humidity

Humidity can play a significant role in cooling a zone because it takes longer to cool a space with higher humidity. If the optimum start mode is set to automatic, and the relative humidity is known, the following algorithm is used to calculate advance minutes when the zone requires cooling:

AdvanceMinutes=Cooling_Factor X (Enthalpy(ZoneTemp, ZoneHumidity)-Enthalpy(CoolingSP,50)) X 12

Where ZoneHumidity has a minimum of 30% and the ZoneTemp is limited between 40°F and 100°F for the Enthalpy calculations. If the humidity is below 30%, then the value 30% is used. If the temperature is outside the range 40°F through 100°F, the nearest value inside the range is used.

Enthalpy can be approximated by the following:

Td= dry bulb temp in degrees F
RH= the relative humidity, 0 through 100, in percent

Partial pressure of water vapor at saturation
Pws= -0.104 + 0.00869 X Td - 0.0001395 X Td^2 + 0.000001581 X Td^3

Partial pressure Pw at humidity RH
Pw=RH X Pws/100

Humidity Ratio
W= 0.622 X Pw/(p-Pw) (p=atmospheric pressure=14.7 at sea level)

Enthalpy
h=0.24 X Td + W X (1061 + 0.444 X Td)

How an optimum start program is saved and runs

Optimum start is a feature associated directly with a zone. When you set up an optimum start program, the information, configuration, and settings are stored and run as part of a zone object. Optimum start then works along with the schedule assigned to the zone.

For this reason, before you set up optimum start, you must set up a zone and assign a schedule to that zone. Data for optimum start is available as properties of the zone object. For a reference of properties related to optimum start, see the *BACtalk Systems Programmer's Guide and Reference* (LTBT-TM-PRGRMR).

See the Zones chapter or Envision for BACtalk Help for more information about setting up and working with zones.

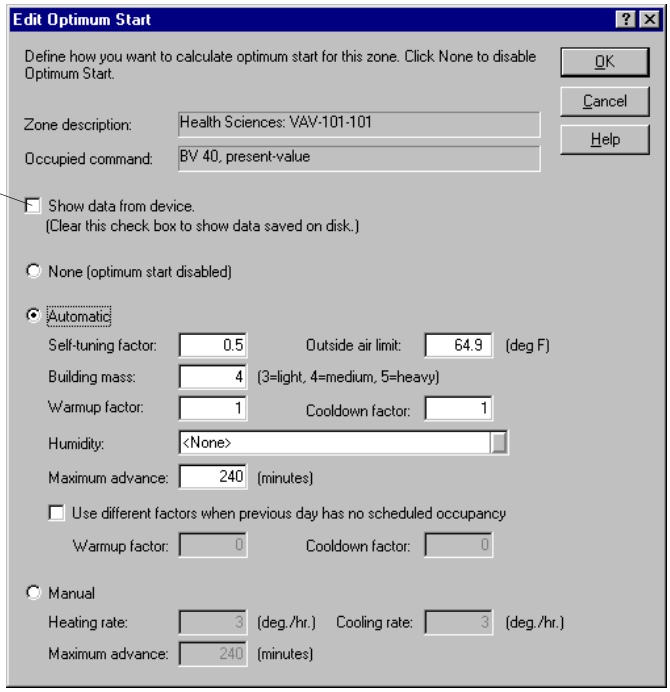
Saving and restoring optimum start settings, and automatically calculated values

Optimum start settings and standard optimum start calculation values are stored in a database on the Envision for BACtalk server. They are also saved in the global controller. When the BACtalk system self-tunes the values used in optimum start calculations, those values are saved in the global controller. Also, if you adjust values from a data display, the values are adjusted in the global controller.

WARNING Although values in the global controller update dynamically, they are not automatically updated in the Envision for BACtalk database. This would have an unacceptable impact on system performance.

Selecting the Show data from device check box in the Edit Optimum Start dialog box causes Envision for BACtalk to get the most recent data stored in the global controller. When working with optimum start, it is highly recommended that you select this check box so that data in Envision is synchronized with data in the controller when you click **OK.**

Select this option to update this dialog box with data from the device. When this option is cleared, the dialog box reflects the data that is saved on the local disk.



CAUTION If you make changes to optimum start settings here without the Show data from device check box selected and then click **OK**, you risk overwriting calculated values in the global controller. This is of particular concern when you use automatic mode and when you use a data display to adjust values.

Saving data from the controller to the Envision for BACtalk server You may want to save optimum start self-tuning data to the Envision for BACtalk server, especially if you have found the settings that enable your system to meet setpoint at scheduled occupancy.

There are two ways to save current settings in the controller to the Envision for BACtalk server:

- Select the device record for the zone's host controller in Device Manager, click **Save**, and then select **Zones and Point Data**. This also allows you to select multiple global controllers to save at once.
- Open the Edit Optimum Start dialog box, select **Show data from device** to update values, and then click **OK** to write the values. This saves one zone at a time.

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Restoring data from Envision for BACtalk to the controller You may need to restore optimum start settings if a user has changed descriptions or values through a data display or conditions have changed such that the values stored in the controller are no longer acceptable.

To restore current settings from Envision for BACtalk to the global controller, you have two options:

- Select the device record for the zone's host controller in Device Manager, click **Send**, and then select **Zones and Point Data**.
- Open the Edit Optimum Start dialog box, clear the **Show data from device** check box to show only values in the Envision for BACtalk database, and then click **OK**. This overwrites the values in the controller.

Setting up and adjusting optimum start values

Optimum start uses both zone and scheduled occupancy during the optimum start calculation to determine the best time to start operating in warmup or cool-down mode. It monitors when a zone is scheduled to be occupied, uses building and environmental factors to estimate how far in advance to start heating or cooling, examines how well optimum start performed the last time, and then adjusts to do better the next time.

Once you have zones and schedules set up and the optimum start feature pointing to the right data, you typically do not have to modify the optimum start setup again.

See the Zones and Schedules chapters in this manual or Envision for BACtalk Help for more information about setting up and using these features.

CAUTION Do not adjust optimum start settings unless you have a thorough understanding of both the feature and the operation of your system. Adjusting optimum start settings without sufficient knowledge can cause undesirable results and may inadvertently overwrite BACtalk's self-tuning operations.

You can access zone and optimum start configuration through a data display. Open a device data display and right-click a field. Point to **Zone**, and then click **Optimum Start** to access data for the selected zone.

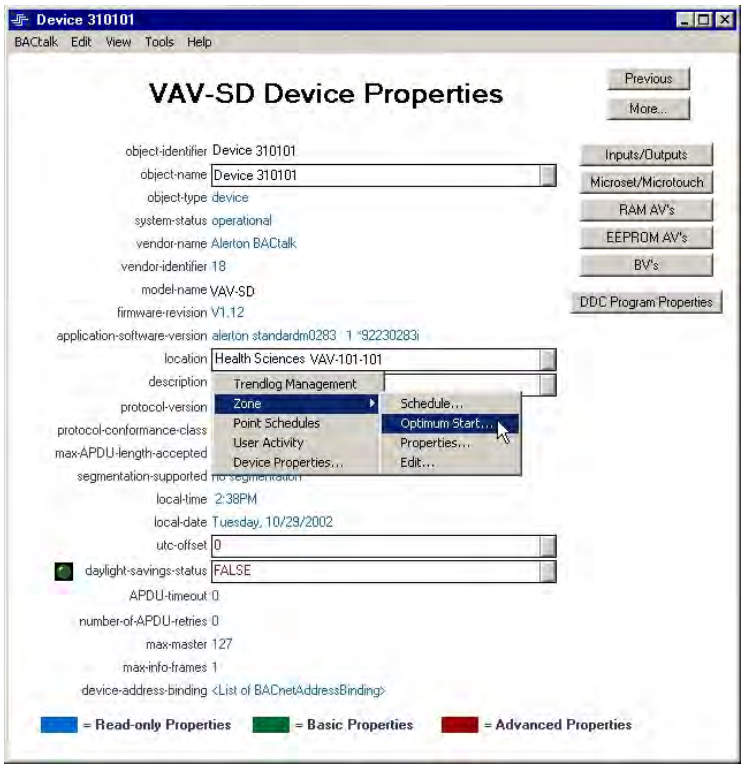

Figure 6.1 Access optimum start for the 1st floor main lecture hall by right-clicking the location field.

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Selecting the zone you want to work with

Optimum start works hand-in-hand with schedules to determine when to start equipment to achieve the setpoint temperature by the time occupants are scheduled to arrive. When setting up optimum start, make sure the zone you are working with has a schedule assigned to it. Do not select a zone with an “S” in the status column because these zones do not have schedules assigned to them. Zones may be set up differently depending on your site’s design and needs.

See the Zones chapter or Envision for BACtalk Help for more information about setting up zones.

It is very important to use a meaningful and unique description for each zone you set up so that users can easily locate the zone. You may want to describe the physical location of the zone in relation to the rest of your job or describe the type of equipment located in the zone. For example, if the job has only one big chiller, you may decide to describe the zone where it is located as “Big Chiller Zone.” The State University job has been set up so that the zone description depicts the building (Health Sciences), device type (VAV) building number (101), floor number (1), and device instance (01).

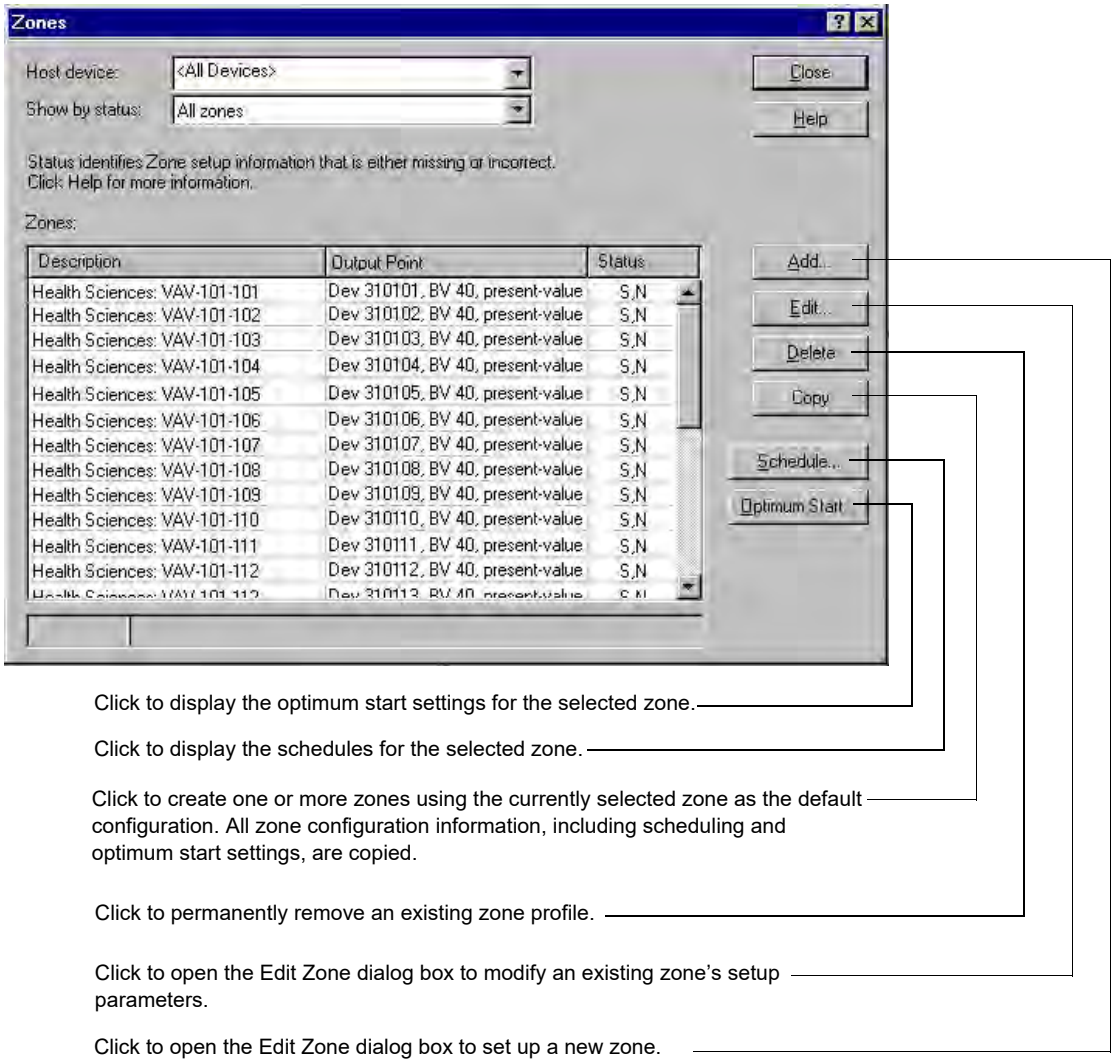

Figure 6.2 Use the Zones dialog box to add, edit, delete, or copy a zone. You can also set up optimum start settings and schedules through the Zones dialog box.

Setting or confirming optimum start references for the zone

Use the Optimum Start References tab on the Edit Zone dialog box to set up how optimum start will be used in the selected zone. The selected zone and the occupied command for the selected zone appear at the top of the tab. Envision for BACtalk automatically fills in this data from the information you provided on the General tab.

There are three areas on the Optimum Start References tab that you must fill in to complete the optimum start setup. Specify the properties you want BACtalk to use for each of the following: outside air and zone temperature, target heating and cooling setpoints, and warmup and cooldown operation initialization.

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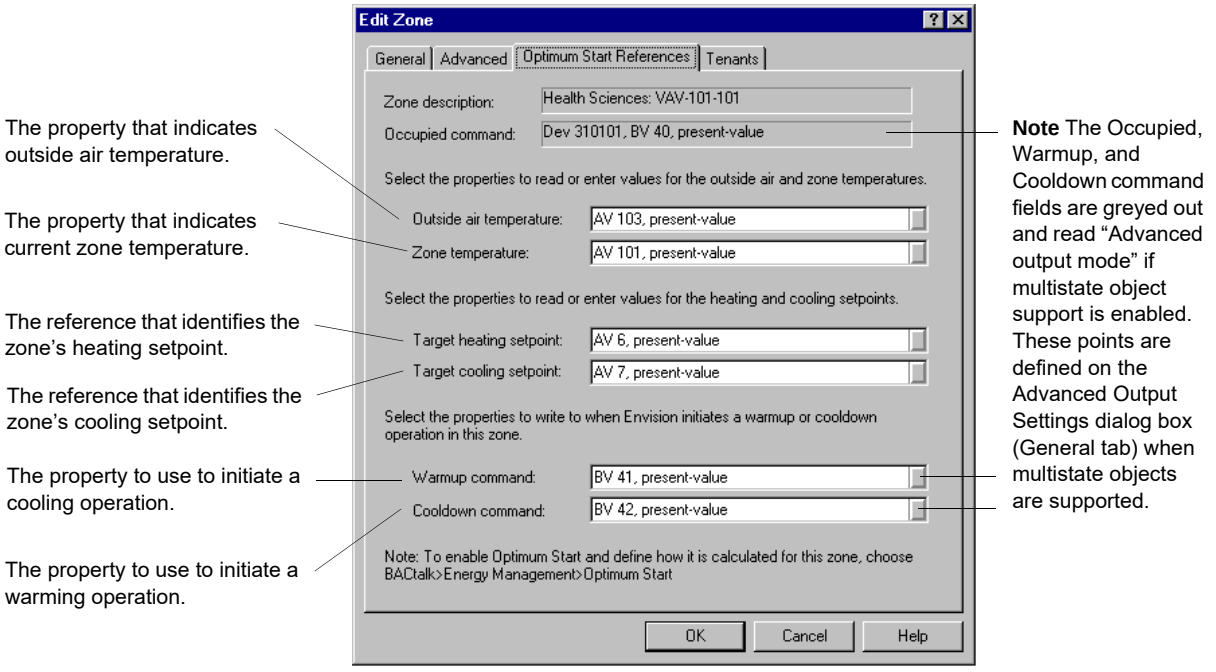

Figure 6.3 Setting optimum start references for Health Sciences

See the Zones chapter or Envision for BACtalk Help for more information about using zones.

Editing optimum start settings

The Edit Optimum Start dialog box gives you access to all the optimum start settings for the selected zone. Use the Edit Optimum Start dialog box to display data from the device or the local hard disk, to enable or disable optimum start, and to specify whether optimum start will run in automatic or manual mode. See "About automatic and manual modes of operation" on page 122 for more information about optimum start modes and how BACtalk calculates optimum start.

Open the Edit Optimum Start dialog box from a data display by right-clicking an item, pointing to **Zones**, and then clicking **Optimum Start**. You can also open the Edit Optimum Start dialog box from the BACtalk menu. Point to **Energy Management** on the BACtalk menu, and then click **Optimum Start**. Double-click the zone to display the Edit Optimum Start dialog box.

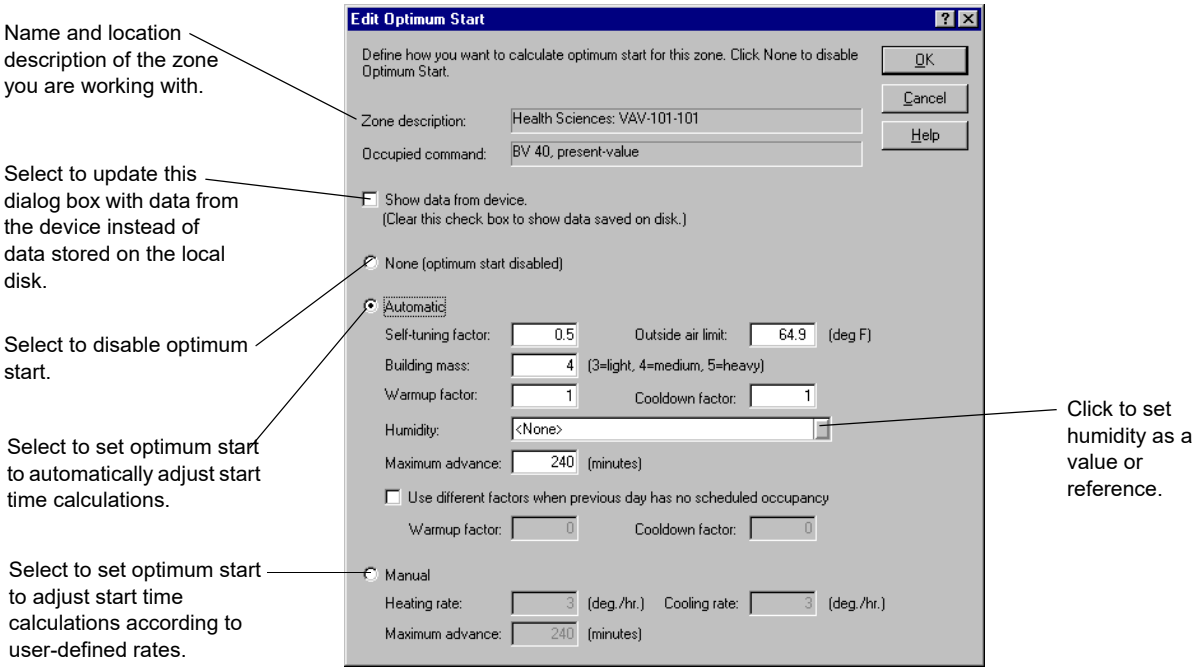

Figure 6.4 Use the Edit Optimum Start dialog box to enable optimum start and to set either automatic or manual operational mode.

CAUTION Be careful not to overwrite warmup and cooldown factors automatically calculated by optimum start. Self-tuning calculations are stored at the local device and the optimum start object is stored in a database at the Envision for BACtalk server. Before clearing the Show data from device check box, it is recommended that you back up self-tuning values to the server database to prevent overwriting them.

See "Temporarily disabling optimum start" on page 138 for more information about saving changes made to optimum start settings and recovering if optimum start settings are lost.

Zone description BACtalk automatically updates the zone description from the user-defined information provided on the General tab of the Edit Zone dialog box (BACtalk>Zones>Edit). Use a meaningful and unique description for this zone so that users know exactly where this zone is located or what type of equipment is controlled in it. For example, "Health Sciences: VAV-101-301." Health Sciences and 101 describe the physical building where this zone is located. VAV is the device type, and 301 is the first device instance on the 3rd floor.

Occupied command BACtalk automatically updates the occupied command for the selected zone from the user-defined information provided on the General tab of the Edit Zone dialog box. The occupied command is the property you want BACtalk to write to when the zone is occupied.

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Show data from device By default, the Edit Optimum Start dialog box displays the data currently saved on the local hard disk. If you select the Show data from device check box, Envision for BACtalk will update the optimum start feature with data saved at the device instead. The data on the device may be different due to the self-tuning capability.

Choosing manual or automatic mode

BACtalk uses optimum start settings to calculate what time of day it has to start equipment to meet a zone's temperature setpoint by the time occupants are scheduled to arrive. If equipment is started too early, money and energy is wasted. If equipment is started too late, occupants arrive to a cold zone. You specify whether you want BACtalk to make this calculation automatically based on previous performance, or manually based on values you calculate and provide.

Use automatic mode when you want warmup and cooling operations to intelligently adapt to changing conditions. Automatic mode is very powerful, but the setup is a bit more complex. Use automatic mode to get the most from the optimum start feature's ability to adapt.

Use manual mode when equipment operation has a very predictable effect on a zone—essentially, when you know the zone heats up or cools down at the same rate regardless of other factors. You can also use manual mode if you do not have access to outside air temperature, you do not want the system to self-tune, or you prefer to keep your system very simple.

See "How optimum start works" on page 122 for more information about using optimum start.

Automatic mode settings

It is important to understand that the BACtalk system automatically adjusts automatic mode settings. In nearly all cases, manually changing these settings will not be necessary. Also, before you change these settings, make sure that they are up-to-date. See "Temporarily disabling optimum start" on page 138.

Table 6.2 Automatic mode settings

Item	Remarks
Self-tuning factor	Use the self-tuning factor to control how aggressively optimum start adjusts based on previous warmup and cooldown efforts. Range is 0.0 to 1.0. 1.0 is most aggressive. 0.1 is least aggressive. 0 disables adjustment. Adjusting the self-tuning factor rather than warmup and cooldown factors directly is recommended.
Outside air limit	Used only in warmup calculations. Set this to approximate the average space temperature of the zone when warmup begins. The greater the difference between this and the outside air temperature, the greater the advance time.
Building mass	A number that corresponds to interior building mass. 3.0 corresponds to the lightest interior mass. 5.0 corresponds to the heaviest interior mass. Larger numbers increase the effect of zone temperature on the advance time. Smaller numbers increase the effect of outside air temperature on advance time.
Warmup factor	Important! Automatically adjusted by optimum start.
Cooldown factor	Important! Automatically adjusted by optimum start.
Humidity	Usually left to <none>. Type a value corresponding to the relative humidity commonly experienced in the space or reference a data point that reports humidity in the zone. If humidity is specified, optimum start uses it in the advance time calculation. Increased humidity will increase the advance time.
Maximum advance	The maximum number of minutes allowed before the next scheduled occupied time to begin an optimum start operation.
Use different factors check box (warmup or cooldown)	Optional. Set different warmup and cooldown factors when the zone was scheduled to be unoccupied the previous day. These factors are independent of the primary warmup and cooldown factors.

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Manual mode setting

Select manual mode when you do not have a way to read outside air temperature or do not want your system to self-tune. You might also select manual mode when you have set fixed warming and cooling rates and want to implement them. Manual mode is easier to set up, but automatic mode is recommended because you will need to tweak manual mode settings yourself as operational and environmental conditions change. Automatic mode implements adjustments to optimum start calculations for you.

Table 6.3 Manual mode settings

Item	Remarks
Heating/cooling rate	Type the rate (in degrees per hour) that you want to change the temperature of the zone. For example, if you set the heating rate to 3.0, the temperature in the zone cannot increase by more than 3.0 degrees per hour. Valid entries are in the range of 0 through 20.0. Default value is 3.0.
Maximum advance	The maximum number of minutes allowed before the next scheduled occupied time to begin an optimum start operation.

Temporarily disabling optimum start

You can temporarily disable the optimum start feature for a zone whenever necessary. When you do this, the most recent optimum start settings for automatic or manual mode are retained. Only optimum start calculations are disabled. Schedules are not affected, so the assigned schedule still controls heating and cooling operations in the zone.

▶ **To disable optimum start for a zone**

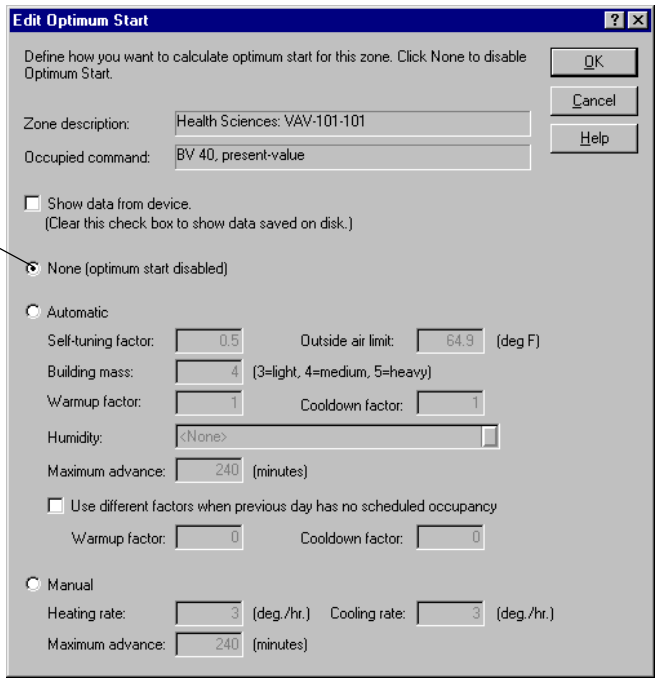
1. From the BACtalk menu, select **Energy Management** and then click **Optimum Start**.

   The Select Zone for Optimum Start dialog box opens.

2. Select the zone you want from the list and then click **Optimum Start**.

3. Select **None** (optimum start disabled) and then click **OK**.

Click to turn off Optimum Start in this zone.



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Strategies and tips for checking optimum start operation

Periodically you may need to check optimum start performance. You may want to verify that the current advance time setting is bringing space temperature to setpoint at the time of occupancy–not too early or too late. Setting up trendlogs for optimum start data points can tell you if a tenant has a valid complaint due to a system operational issue or if they just need to adjust their personal work space or put on a sweater. Trendlogs can also help you decide how to adjust current optimum start settings to accommodate for seasonal changes occurring outside the building.

You can also adjust raw optimum start values and manually calculate how your changes will affect optimum start performance. It is recommended that you manually calculate the outcome of your changes before actually making changes to the optimum start settings in the software to prevent an adverse outcome to your system. See “How optimum start works” on page 122 for more information about calculating optimum start.

For example, set up trendlogs for your system for time periods when optimum start is first enabled, and then disable optimum start and trend system performance the next day. Compare the separate trendlogs to get a clear picture of the operational differences of your system with and without optimum start enabled. If you have set up optimum start correctly, the trendlog for the time period when this feature was enabled should show that your system came within 2 degrees, for example, of the zone setpoint by scheduled occupancy time. See “Trendlogs” on page 163.

See Envision for BACtalk Help for more detailed information about setting up and working with optimum start.

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Tenant activity 7

Envision for BACtalk allows you to monitor when tenants use facilities after hours. *After-hours activity* occurs when a tenant initiates a *tenant override*, causing equipment in the zone to return to occupied mode when the space would otherwise be unoccupied. A tenant override is usually a manual process—for example, the tenant presses a button on the Microset in a room.

Because conditioning a zone for occupancy typically requires more energy resources than conditioning when the space is unoccupied, you may want to track this after-hours activity or bill the tenant for it. The tenant activity feature in Envision for BACtalk enables you to do this.

Envision for BACtalk relies on zone setups for tenant activity. See “Zones” on page 29 for more information.

Benefits

Automated Automatically detect and log after-hours override activity in a zone. Use these logged events to generate tenant bills.

Flexible Review events and billing amounts before bills are generated. Modify or delete events. Change the billing rate. Add surcharges or seasonal billing factors.

Convenient Define how you want to send bills to each tenant. You can print and mail bills. You can generate files and print bills from another program, such as Excel or Word. You can generate files and email them to tenants.

Powerful For large sites, this feature makes it easy to set up multiple tenants and multiple zones and quickly generate bills. You can create one tenant profile and copy it to define multiple tenants. Once you have set up billing rates and other parameters, Envision for BACtalk automatically calculates billing amounts, making it easy to generate bills each month.

Tighter facility management You can control who is billed for what type of after-hours activity. Tenant activity shows you where after-hours usage is occurring—whether you bill for it or not. You can also modify bills before they are generated to ensure that tenants are not billed inappropriately.

Practical application

The State University administration wants to charge individual department budgets for after-hours use of classrooms and labs. Before instituting this practice campus-wide, they have decided to conduct a trial run in the Health Sciences building, using Envision for BACtalk's tenant activity feature.

George, the Facilities Manager, has already defined zones in the Health Sciences building. So to begin tracking after-hours activities in this building, he needs to set up a tenant profile for the Health Sciences department and assign zones to that tenant.

Once tenant activity is set up and running, George can use the tenant activity log to see which classrooms and labs are used after-hours, when they are used, and for how long. He can also generate monthly bills that go to the Accounting office to charge against the department budget and to the head of Health Sciences for information.

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Quick start–tenant activity setup

Use the following table to help you set up tenant activity in Envision for BACtalk. The key steps for defining tenant activity are listed in order.

Table 7.1 Tasks for setting up tenant activity

Task		See
1	Set up zones for the areas where you want to track after-hours tenant activity. In doing so, identify (on the Tenants tab) the data point that reliably indicates a tenant override in the zone.	• "Setting up zones" on page 148 • Site documentation • "Zones" on page 29
2	Define the property manager contact information.	• "Setting up property manager profiles" on page 149
3	Create a new tenant and define the tenant contact information.	• "Setting up tenant contact information" on page 152
4	Define tenant billing information.	• "Setting up billing parameters" on page 153
5	Assign zones to tenants.	• "Linking zones to a tenant" on page 155

How tenant activity works

To set up and use tenant activity in Envision for BACtalk, you create a *tenant profile*, which includes contact and billing information for the tenant, and identifies the *zones* the tenant occupies. You also define the billing party, or *property manager,* whose name will appear on all bills you generate. Envision uses the *tenant-override property* associated with a particular zone to determine if the zone is operating in after-hours mode.

For more information about zones, see "Zones" on page 29.

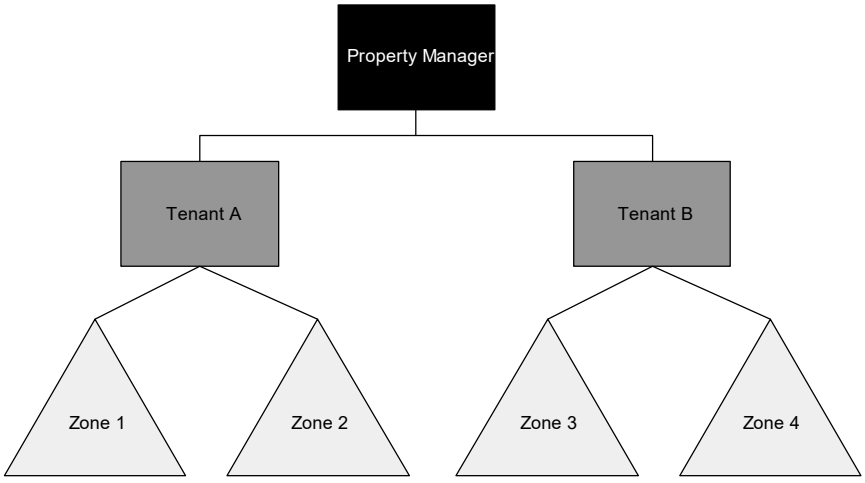
All after-hours activity for a tenant is recorded in the *tenant activity log.* You can use this log to view which zones are used after-hours, when they are used, and for how long. You can also generate bills using the information in the tenant activity log. You can edit events listed in the tenant activity log before generating the bill. You can also use seasonal multipliers or surcharges to make adjustments to calculated billing amounts.

Tenants and property managers

A tenant is any occupant whose after-hours activity in a zone you may want to monitor. You can log tenant activity in any zone with one or more tenants assigned to it. You can log this activity without billing for it. For example, you may simply want to track how much an area or its equipment is used outside of its scheduled occupied hours.

The tenant profile identifies all the relevant information about a tenant, including contact information, billing information, and the zones that the tenant occupies. See "Setting up tenant profiles" on page 150 for more information.

A key component of the tenant profile is the property manager. This is the person or company who appears as the entity sending the bill to the tenant. Most buildings typically have only one property manager. Each tenant must be assigned a property manager to generate a bill.



Note It is possible for multiple tenants to share the same zone. For example, tenants A and B share the medium conference room in the Health Sciences building. Tenant A uses it from 8 AM to 12 PM and tenant B uses it from 1 PM to 5 PM.

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Tenant override in a zone

A manual action by the tenant, such as pressing a Microset override button, usually triggers a tenant override. it is also possible to have an automatic action initiate a tenant override, such as a motion detector or feedback from an access control system.

To use tenant activity in a zone, there must be a system data point that is ACTIVE (ON) for as long as the tenant zone is in override and that is INACTIVE (OFF) when the zone is no longer in override. Envision for BACtalk references this data point to calculate override time. As long as the point is ACTIVE, override time accrues.

The data point that indicates an after-hours tenant override is assigned on the Tenants tab of the Edit Zone dialog box (BACtalk>Zones>Edit). For Alerton field controllers, this data point is usually the present-value of BV-66.

Tenant override operation depends on the operating mode set up for the controller and the requirements of the space. See your site documentation to determine if a data point such as BV-66 is available to indicate override status.

What causes a tenant override to end?

Again, the programming of the field controller for the zone is critical. The following events are likely to cause the tenant override reference to turn OFF.

- The tenant cancels the override
- The override timer expires
- The space reaches a scheduled occupied time
- Optimum start begins conditioning the space

Example

A room is scheduled for occupancy from 8:00 AM to 5:00 PM. Based on this schedule, heating and cooling equipment operate to maintain a temperature between 69 and 73 degrees F. During unoccupied hours (5:00 PM to 8:00 AM), the setpoint is maintained between 55 and 80 degrees F.

The field controller for the zone has device instance 310101. Programming in the field controller uses the present-value of BV-66 as an override status. This data point is ACTIVE whenever a tenant override is in effect.

The room is set up as a zone in Envision for BACtalk. The zone device reference is set up as device instance 310101. In the zone setup, BV-66, present-value is referenced as the tenant override property on the Tenants tab. BV-40, present-value is referenced as the occupied command. A schedule set is assigned to the zone so that during the week it is scheduled for 8:00 AM to 5:00 PM occupancy.

Practical application

Professor Wang has a lecture in his classroom on Tuesday morning at 9:00 AM. He arrives around 7:00 AM to prepare. Since the lecture hall is not scheduled to be occupied at that time, it is a little bit too warm and stuffy when he arrives—78 degrees F, in fact. He pushes the right up button on the Microset II in the classroom until 2:00 appears to get 2 hours of override. He then presses the left down button to drive the setpoint down as low as it will go, to 69 degrees F.

The HVAC equipment in the classroom starts cooling and ventilating the space almost right away to achieve the 69 degree F setpoint.

As soon as Professor Wang pressed the override button on the Microset, programming in the field controller turned the present-value of BV-66 ON. Because BV-66 is referenced as the tenant override data point, this started an override event. The override event ended at 9:00 AM when the zone was scheduled for occupancy. The override event was entered into the tenant activity log at 9 AM when it ended.

The tenant activity log versus the tenant bill

The tenant activity log displays each override event. This display lets you monitor when tenants are using zones after hours. You can view events and manually change override times. You can also choose to include or exclude events from the bill. This gives you control over what the tenant is billed for.

From the tenant activity log, you can access the tenant bill. The tenant bill lists the billing amounts for each override event. You cannot edit events from the tenant bill, but you can change the seasonal multiplier or surcharge amounts (if selected on the Billing tab in the Edit Tenant Profile dialog box), and then recalculate the total. You generate bills from this display.

Override time versus billed time

Depending on how tenant activity *billing rules* are set up, the actual override time may not be the same as the billed time. Based on these rules, you may see an override event in the log that is greater or less than the billed time in the tenant bill.

In the tenant profile, you define the minimum amount of time that a zone must be in override mode before the tenant is billed for override activity. For example, you may not want to track or bill for override events of only a few minutes. In addition, the tenant profile defines the minimum amount of time the tenant is billed for when an after-hours activity "qualifies" as an override event. And finally, you define the maximum amount of time a tenant will be charged for a single override event.

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Example

On the Billing tab in the Tenant Profile dialog box, billing rules are set up as follows. The resulting billed time is shown in Table 7.2.

- Minimum billable override event = 10 minutes. This means that override events of less than 10 minutes are ignored.
- Charge tenant for a minimum of = 30 minutes. This means that any override events longer than 10 minutes and less than 30 minutes are billed as though they were 30 minutes in length.
- Charge tenant for a maximum of = 10 hours. Any override events longer than 10 hours are billed as though they ended at 10 hours.

With these settings, the following table shows examples of what the tenant would be billed for in various scenarios.

Table 7.2 Sample override events and billing amounts

Override event	Billed time
5 minutes	0 minutes
18 minutes	30 minutes
52 minutes	52 minutes
3 hours	3 hours
11 hours	10 hours

Where tenant activity information is stored and how tenant activity runs

Tenant activity information is stored in databases on the Envision for BACtalk server. For example, all the tenant profile setup information is saved on the Envision for BACtalk server. The zone setup information resides in both the server and the global controller. The global controller uses that information to reference the tenant override property in the field controller.

Tenant activity is monitored only in zones with one or more tenants assigned. When override events occur, the global controller sends each event to the Envision for BACtalk server where it is actually logged.

CAUTION The tenant activity feature requires that the Envision for BACtalk server is running to monitor and log override events.

Setting up tenant activity

The first step when you set up tenant activity in Envision for BACtalk is to set up the zones that represent the areas in a facility where you want to track after-hours override activity. Then set up a tenant profile for each tenant occupying those zones. Finally, link zones to tenants and set up Envision for BACtalk to monitor zones for after-hours use.

Setting up zones

Use your site documentation to determine which device controls equipment in each zone, and then use this information to define each zone.

Use the Zones dialog box (BACtalk>Zones) to view the zones set up for your system, edit zones, or set up new zones. The Zones dialog box also provides information about the status of tenant activity for the zone.

See "Zones" on page 29 or Envision for BACtalk Help for more information about setting up zones.

Note You can also set up zones when you create the tenant profile, using the Zones tab on the Tenant Profile dialog box. See "Linking zones to a tenant" on page 155 for more information.

The "S" in the Status column indicates the zone does not have a complete schedule set.

The "N" in the Status column indicates the zone is not linked to a tenant profile.

An "O" in the Status column indicates that the zone is linked to a tenant profile, but a tenant override property has not been defined.

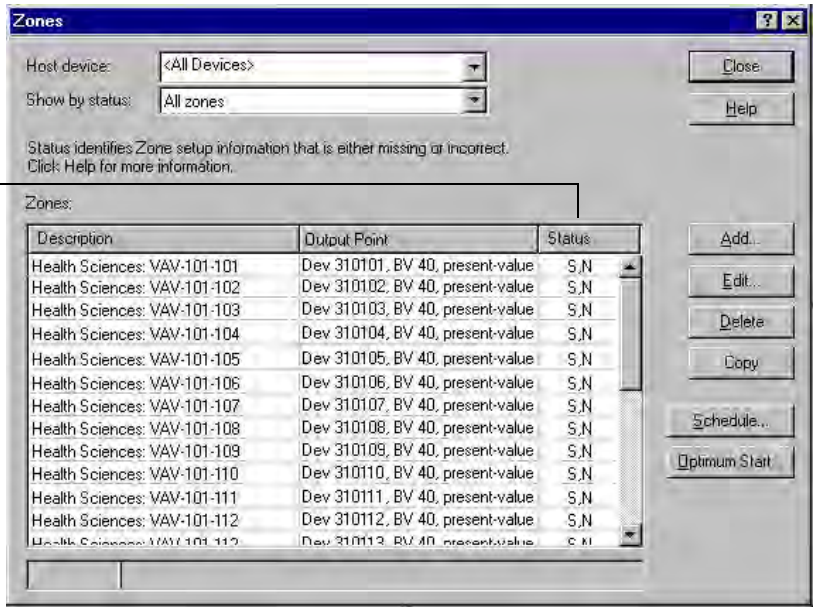

Figure 7.1 Use the Zones dialog box to set up new or edit existing zones, and to view the status of the zone setup.

CAUTION If the host device you select does not have UTC set up correctly, tenant activity start and stop times may be off; however, durations will still be correct. Ensure that the host device has Send UTC offset properties selected on the Capabilities tab in Device Manager. Then ensure that the UTC offset for the device is correct on the Preferences tab in Device Manager. Click **Help** in the Preferences tab of Device Manager for more information about determining the correct UTC for the device location.

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Tenant information is set up on the Tenants tab in the Edit Zone dialog box. Use the Tenants tab to see the tenants assigned to this zone and to view and assign the tenant override data point.

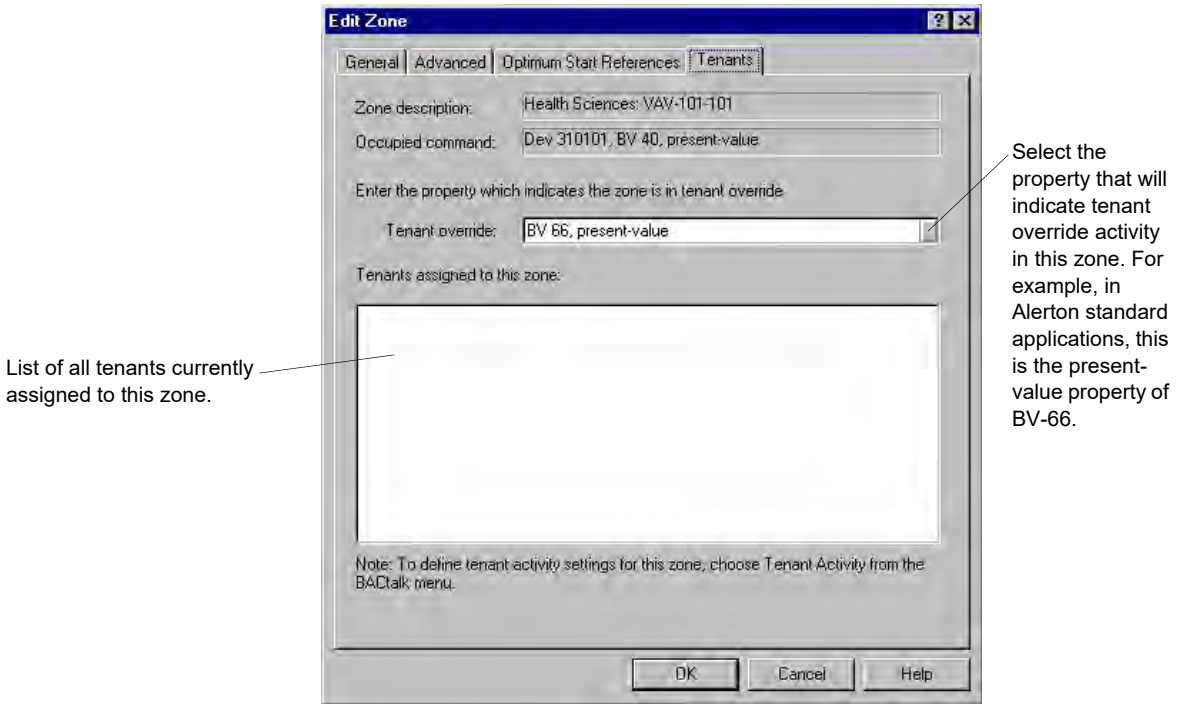

Figure 7.2 Use the Tenant tab on the Edit zone dialog box to assign a tenant override and view tenant assignments for a zone.

Setting up property manager profiles

The property manager is identified on each tenant's bill as the originator of the bill. Property managers are essential to tenants. Before you save a tenant profile, you must first link it to a property manager. You must assign a property manager to a tenant to generate the tenant's bill.

A property manager can, and usually does, have more than one tenant assigned to it, but a tenant can have only one property manager.

Note Emailed bills originate from only one billing email address. Therefore, if you will email a tenant their bill, it is recommended that you set up only one property manager profile on each Envision for BACtalk server and use that property manager's email address in the tenant activity email setup. For more information, see "Setting up email billing" on page 161.

Use the Property Managers dialog box (BACtalk>Tenant Activity>Property Managers) to define new property manager profiles or edit an existing profile.

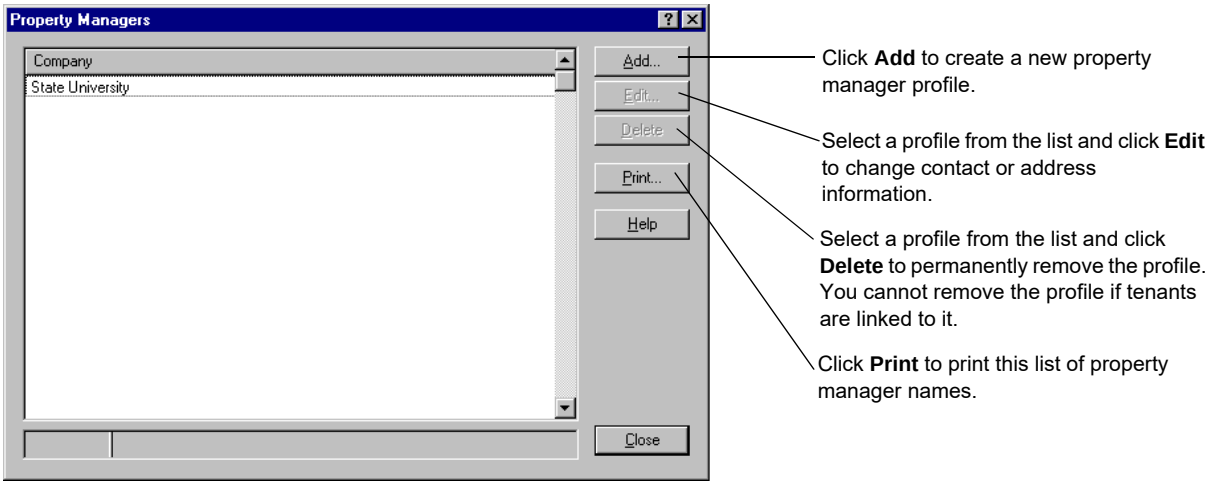

Figure 7.3 Use the Property Managers dialog box to set up new and work with existing property manager profiles.

Deleting and editing property manager profiles

You can edit any information in a property manager profile at any time. However, Envision for BACtalk does not allow you to delete a property manager profile if that property manager has assigned tenants. This is to avoid "orphaned" tenants in your system.

If a property management change occurs, and a new property manager takes over for another, you have a couple of options.

- The simplest way is to update the old property manager profile with the new property manager's information. Existing zones will remain linked to the updated information. Use this method if a new property management company takes over for another entirely.
- Create a new property manager profile. Edit the contact information for the affected zones to reference the new property manager. See "Setting up tenant contact information" on page 152. Use this method if the number of affected zones is relatively small.

Setting up tenant profiles

Tenant profiles store contact, billing, and zone assignments. When you set up a tenant profile, you provide:

- Contact information for the tenant, including the property manager
- Billing details about the tenant, including rules about the events you want to record and how much you want to charge for those events
- Links to the zones the tenant occupies

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Use the Tenants dialog box (BACtalk>Tenant Activity>Tenants) to add or edit tenant profiles.

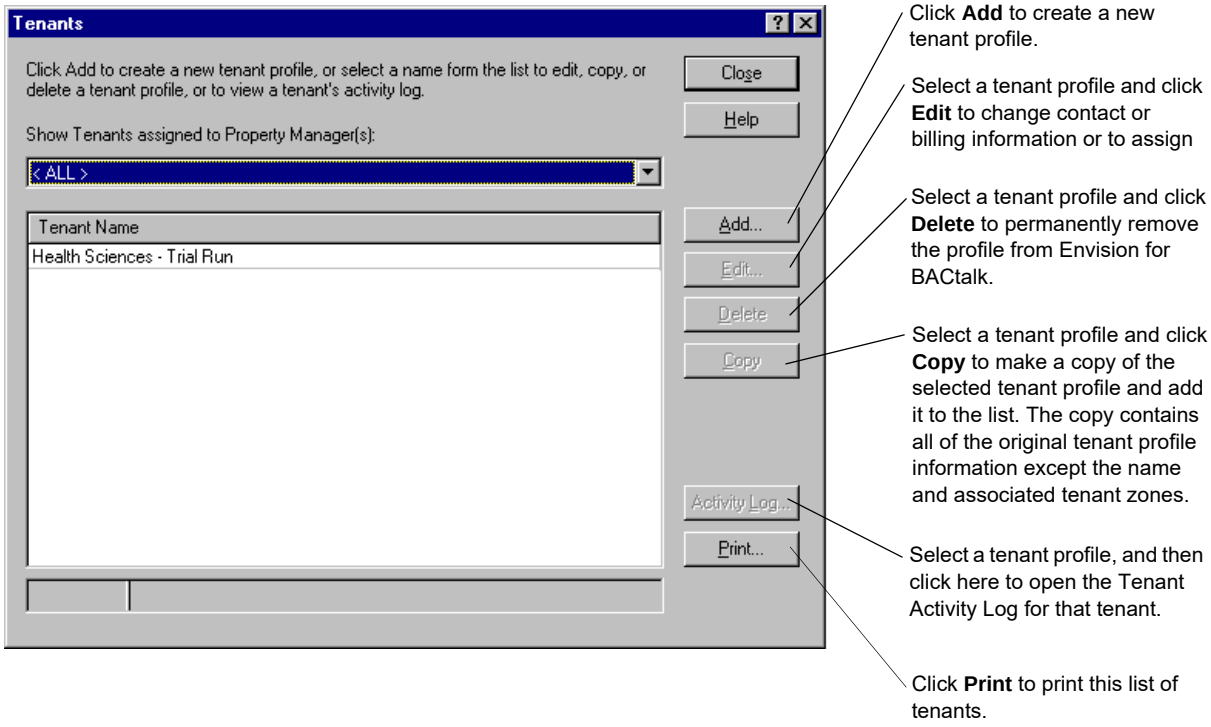

Figure 7.4 Use the Tenants dialog box to add, edit, delete, or copy tenant profiles and to view the activity log for a selected tenant.

Setting up tenant contact information

The tenant contact information enables you to effectively communicate with the tenant, handle billing inquiries in a timely fashion, and ensure that tenant bills are sent to the correct location. Both the company name and address appear on all bills, as does the property manager from whom the bill originates.

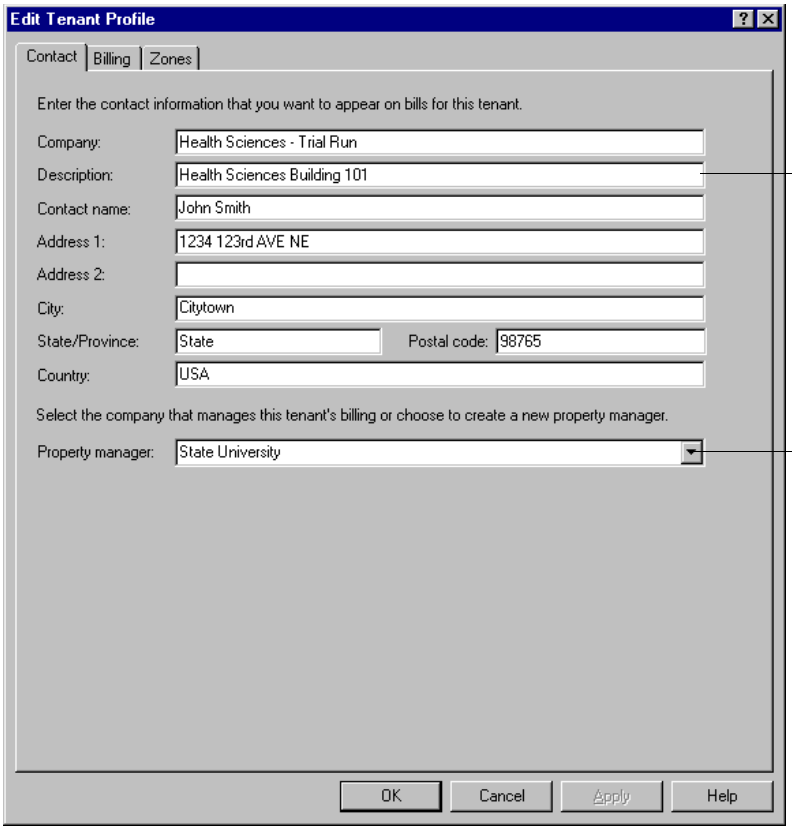

Figure 7.5 Set up tenant contact information in the Edit Tenant Profile dialog box.

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Setting up billing parameters

Tenant bills are generated according to the method of delivery and billing parameters you set up on the Billing tab of the tenant profile.

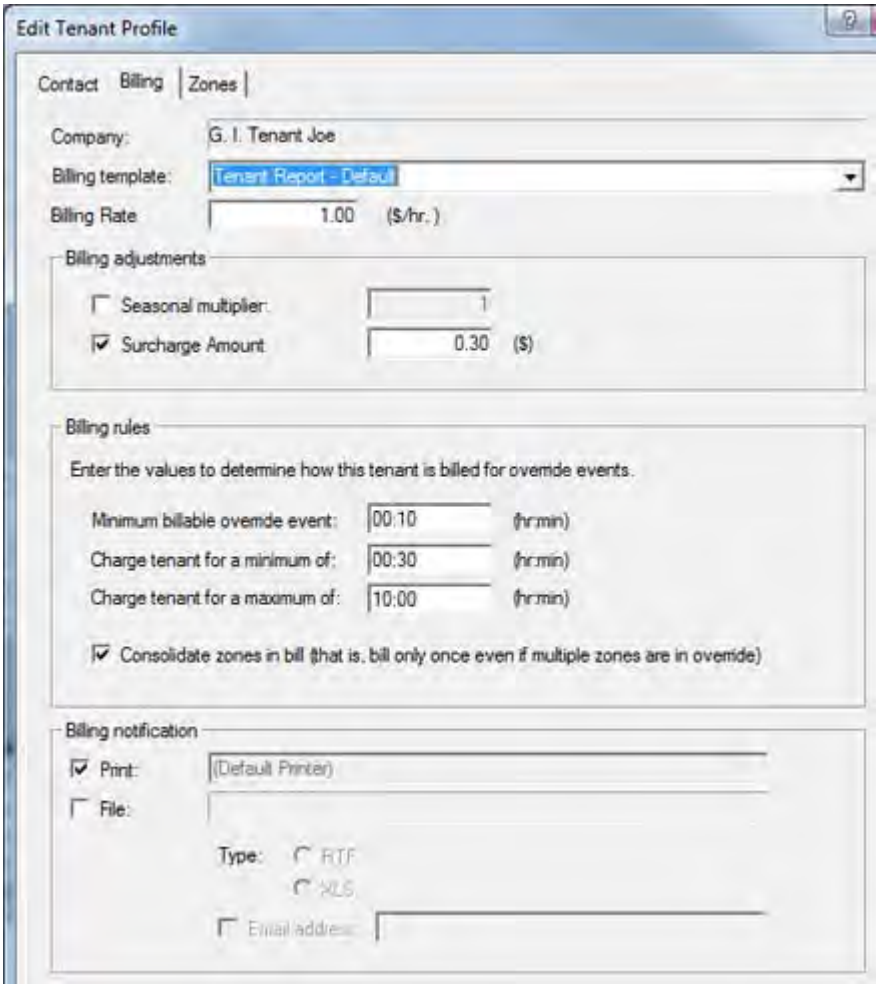

Figure 7.6 The Billing tab of the Edit Tenant Profile dialog box

Billing template This specifies the report template that Envision uses to create the tenant bill. Unless you create additional custom templates, only the default template appears in this list. The template file (Bttenactdef.rpt) is located in <BACtalk root>\<rep>\<job>\Reports\. In most circumstances, the default template will fulfill your billing needs. If you need to customize the default template or create different ones, you can use Crystal Reports 8. If you create additional *.rpt files and place them in the Reports folder, you may need to type the custom template name the first time you reference it in a tenant profile.

Billing rate The *billing rate* is the amount per hour the tenant is charged for after-hours activity. You can charge a different rate for different tenants, if appropriate. Typically, the billing rate is based on utility rates, size of the space, amount of equipment, and any special fees the property manager wants to include for after-hours usage.

Billing adjustments The Billing Adjustments area enables you to add a seasonal multiplier and a surcharge amount to the tenant bill if necessary.

- **Seasonal multiplier** This allows a property manager to adjust tenant billing for seasonally-variant costs, such as the cost of a kilowatt hour of electrical energy, which may be more expensive during peak seasons. The seasonal multiplier is only applied when computing the billing amount and is listed on the bill itself. The subtotal is multiplied by the seasonal multiplier.
- **Surcharge** This enables you to add a fixed cost to a bill that is not dependent on a tenant's energy usage. For example, a tenant might pay a surcharge to cover the monthly rental fee for the vending machines in the break room or the equipment in the exercise room. A surcharge may also be a monthly processing fee, a late payment penalty, or a credit to the customer. Use a negative number to apply a credit to the customer's bill. The surcharge is applied after the seasonal multiplier.

Example

Because October through May is not a peak electrical use season, after-hours usage is billed from the electrical provider at $8. The bill is set up with a billing rate of $8. A tenant has 50 hours of after-hours usage during May and the tenant bill shows $8 x 50. During the peak electrical use season, June through September, kWh rates increase by 20%. The seasonal multiplier in the tenant profile is modified to 1.2 in June. The tenant also uses 50 hours in August, peak cooling, and thus electrical use, season. In August, after-hours usage is billed at $8 x 1.2, or $9.60 per hour.

Billing rules Use the options in the Billing Rules area to specify event billing parameters.

- **Minimum billable override event** Set this to the amount of time that must accrue before the tenant is billed. For example, a setting of 00:10 prevents tenant activity from billing for events less than 10 minutes. Though not billed for these events, the event still appears in the tenant activity log.
- **Charge tenant for a minimum of** Set this to a value that indicates the least amount of time the tenant is billed for. For example, setting this to 00:15 means that the tenant is billed for no less than 15 minutes for any valid override event.
- **Charge tenant for a maximum of** Set this value to the maximum time that a tenant can be billed for an override event. You can use this value as a system overflow check of sorts to prevent billing a tenant for more after-hours use than is possible. For example, if you know that occupied hours are 6 am to 6 pm seven days a week, you know that more than 12 hours of override billing will never occur, so you could set this value to 12:00.
- **Consolidate zones in bill** If a tenant has more than one zone in override, the billing rate will be the highest of the zone billing rates.

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When this option is not selected, the rate will be the sum of the zone billing rates for the zones in override.

Billing notification Select how you want to generate a tenant bill. These settings determine what happens when you click **Bill Tenant** in the Tenant Billing dialog box. You can select any or all of the three billing options: print, file, or email.

- **Print** Select this option if you want to print this tenant bill on the default printer. The bill will print at the default printer for the operator workstation where the billing operation was initiated. To change printers, change the default printer in the Windows control panel. See your Windows operating system documentation for more information.
- **File** Select this option if you want to always save the tenant bill to a file in either RTF (rich text format, for word processors) or XLS (Excel spreadsheet format, for spreadsheets). Send the saved RTF or XLS file as an email attachment or print the saved file and mail the bill to the tenant for payment. Selecting this option is required if you will email the bill.
- **Email address** This option is available only after you select File and the format type (RTF or XLS) you want. You then type an email address for the tenant. With this option selected, when you bill, the file is included as an attachment to an email sent to the tenant. You must first provide a valid email address, define the SMTP server, and specify an email template. For more information, see “Setting up email billing” on page 161.

  Note Starting with v2.5, Envision for BACtalk supports SMTP authentication for increased security and compatibility with SMTP servers such as Gmail and other email providers.

Linking zones to a tenant

To log tenant activity in a particular area, Envision for BACtalk requires a defined zone with a tenant override property assigned. The zone must be linked to a tenant profile.

You can define all your zones, starting at the Zones dialog box (BACtalk>Zones>Add). Then assign zones to tenants using the Edit Tenant Profile dialog box (BACtalk>Tenant Activity>Tenants>Add or Edit). Alternatively, you can create the tenant profile, and then define the zones from the Zones tab on the Edit Tenant Profile dialog box.

Use the Zones tab on the Edit Tenant Profile dialog box to view all the zones currently linked to the tenant. Each zone in the list includes a description (typically the zone location defined when the zone was set up), the device instance of the host controller for the zone, and this tenant’s billing rate for each zone (defined on the Billing tab in the tenant profile).

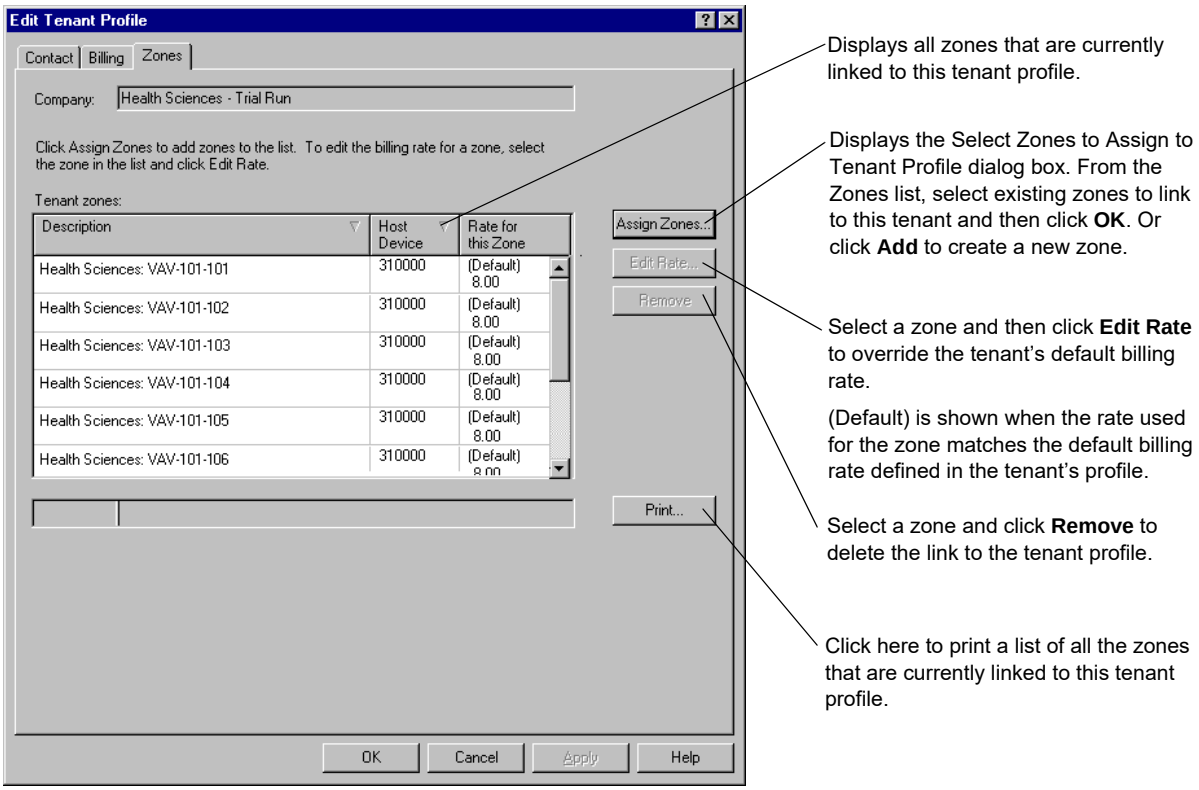

Figure 7.7 Use the Zones tab on the Edit Tenant Profile dialog box to link the tenant to the zones they occupy.

Practical application

The Health Sciences building is being used for the trial run of tenant activity at State U. So, in this case, there is only one tenant for all zones of the building. However, the Facilities Manager wants to monitor after-hours activity only in classrooms and labs, not in the offices or other areas. George has already defined the zones for all the spaces in the Health Sciences building. Now he sets up the tenant profile for the Health Sciences department. On the Zones tab, he clicks **Assign Zones** to display a list of all defined zones. He can select all the zones associated with classrooms and labs in the Health Sciences building and link them to the tenant profile in one operation.

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Viewing tenant activity and billing tenants

Use the Tenant Activity Log and the Tenant Billing dialog boxes to review billing information, make adjustments if necessary, and generate tenant bills.

You can review override events by tenant to determine whether or not you want to change or delete them.

Using the Tenant Activity Log

The Tenant Activity Log is a detailed list of all recorded override events that took place in the selected zone for the specified billing period. You can use it to view events before you generate a bill and to edit events, if necessary.

The log includes the start time of the event, the zone where the event occurred, the duration of the event, and the billed time. The duration and billed time may be different depending on how the billing rules were set up. See “Override time versus billed time” on page 146 for more information.

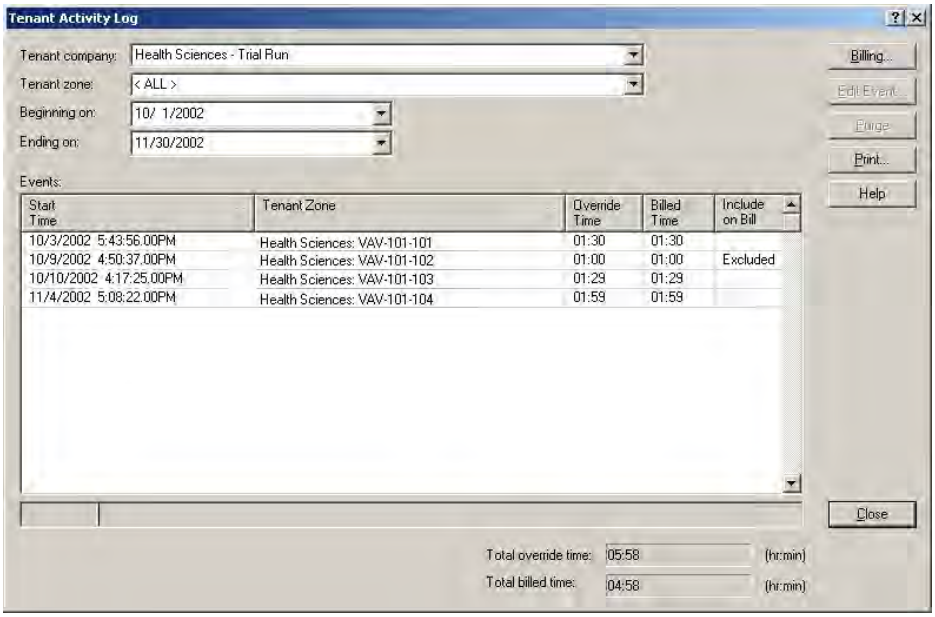

Figure 7.8 Use the Tenant Activity Log to view, edit, delete, or print tenant events.

Manually editing an event or excluding it from the bill

When you select an event from the Tenant Activity Log and click **Edit Event**, you have the option to change the override time or exclude the override from the bill. If you select **Exclude amount on bill**, the word “Excluded” appears in the Status column of the Tenant Activity Log. See Figure 7.9 on page 158 for more information.

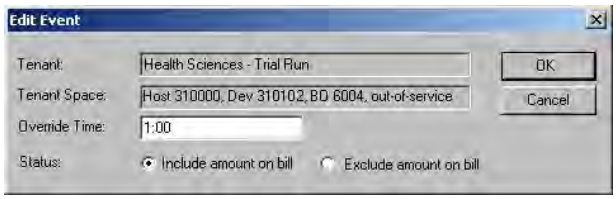

Figure 7.9 Edit an event in the Tenant Activity Log to manually change the override time of an event or to exclude it from the bill.

Example

After-hours maintenance occurred during the billing period and you want to adjust the corresponding event in the tenant activity log. You can view the log for the appropriate tenant, locate the event, and modify or delete it. After you make all necessary adjustments in the tenant activity log, you can generate and send the tenant bill.

Practical application

The Health Sciences department logged 9 hours and 10 minutes of override time in all zones. However, their bill is for only 4 hours.

George manually excluded a 5 hour, 30 minute event from the bill because he knows this event was the night that a maintenance crew was in the referenced zone, and the override event can be attributed to them, not the Health Sciences department. He opened the tenant activity log, edited the event, and then chose Exclude amount on bill. In addition, a 10-minute override event was logged as 30 minutes of billed time based on the billing rules in the tenant profile.

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Generating tenant bills

After you have reviewed the Tenant Activity Log and made any necessary adjustments to tenant events, you can use the Tenant Billing dialog box to generate bills for single tenants. Or, use the Multiple Tenant Billing dialog box to set up billing for multiple tenants at once (BACtalk> Tenant Activity> Multiple Tenant Billing). Use the Beginning On and Ending On dates to set the billing period if necessary.

Note Starting with Envision for BACtalk v2.5, the Tenant Billing dialog box opens in the current month for convenience.

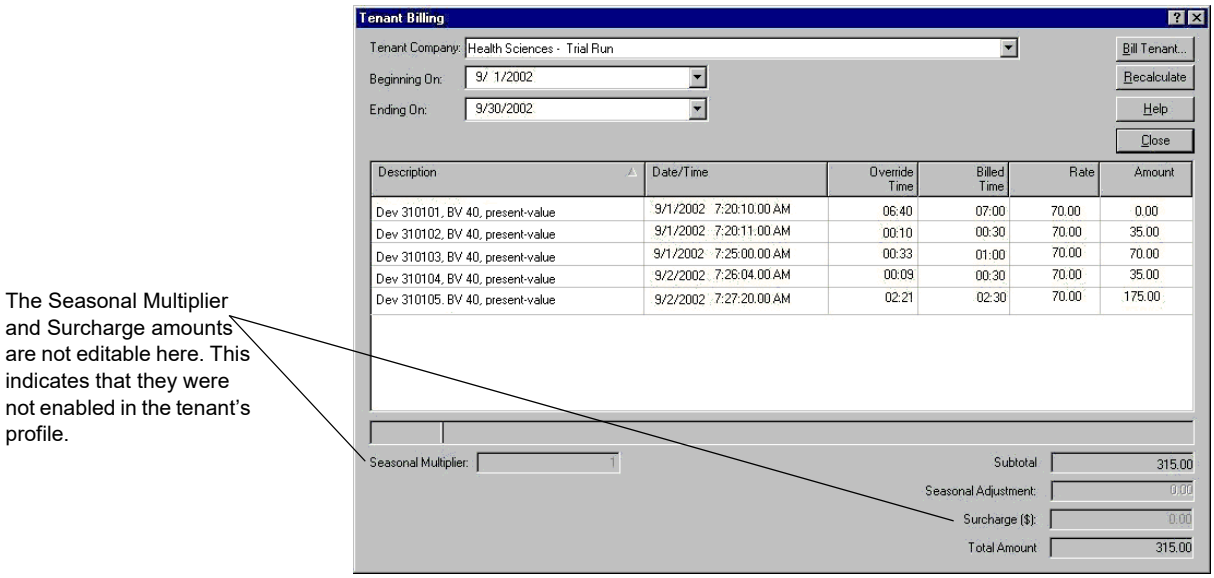

Figure 7.10 Use the Tenant Billing dialog box to view and adjust tenant activity event records and billing information.

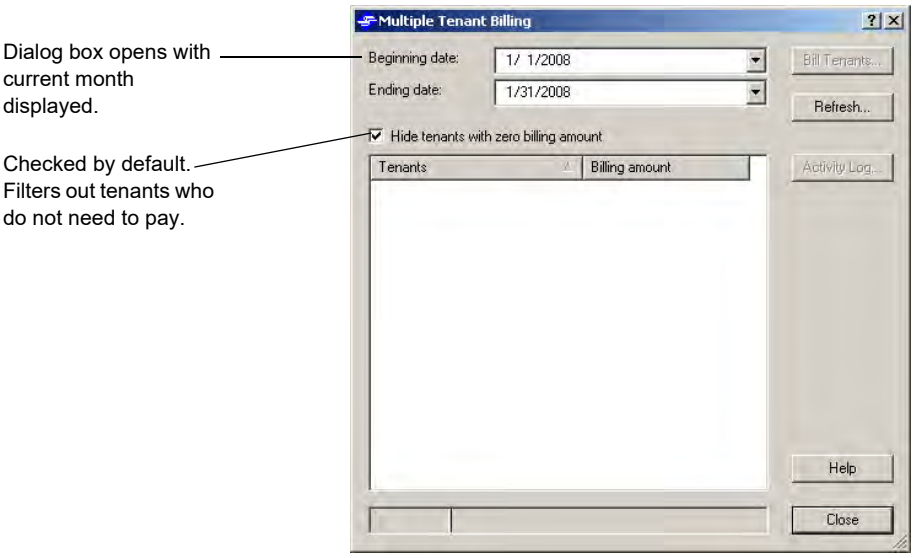

Figure 7.11 Use the Multiple Tenant Billing dialog box to set up bills for multiple tenants at once

Practical application

The head of the Health Sciences department contacted the Accounting office three months ago and arranged for a special billing rate for a charity event that just took place in the current billing period. Accounting agreed to charge only half for any override time for this event.

Accounting did not contact Facilities about this arrangement, and the Health Sciences department complained about the 4-hour charge on their bill at full cost.

George opens the tenant activity log, locates the event, and edits the event, adjusting the override time to 2:00. When he displays the Tenant Billing dialog box, next month's bill already appears. He changes the Beginning on and Ending on dates for last month's bill. The corrected amount appears on the bill, so he re-bills the Health Sciences department for the correct amount.

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Setting up email billing

Tenant bills are emailed to tenants if you specify the email billing method in the Tenant Profile dialog box (for more information, see “Setting up tenant profiles” on page 150). You must set up the email notification to enable Envision for BACtalk to email bills to your tenants. Use the Tenant Activity Email Setup dialog box to set up email delivery for tenant bills.

The information you provide on the Email Setup dialog box applies to all emailed tenant bills. This means that each tenant that is set up to receive bills through email sees the same subject and message text. See “Setting up billing parameters” on page 153 for more information about billing tenants.

You also need to have the Email tab in the General System Setup dialog box (Tools>General System Setup) set correctly for your network environment.

Note The SMTP server must be addressed and set up correctly in General System Setup to send bills by email. Envision for BACtalk v2.5 and later supports SMTP authentication for increased security and compatibility with SMTP servers like Gmail and other email providers. Contact your IT department if you need assistance.

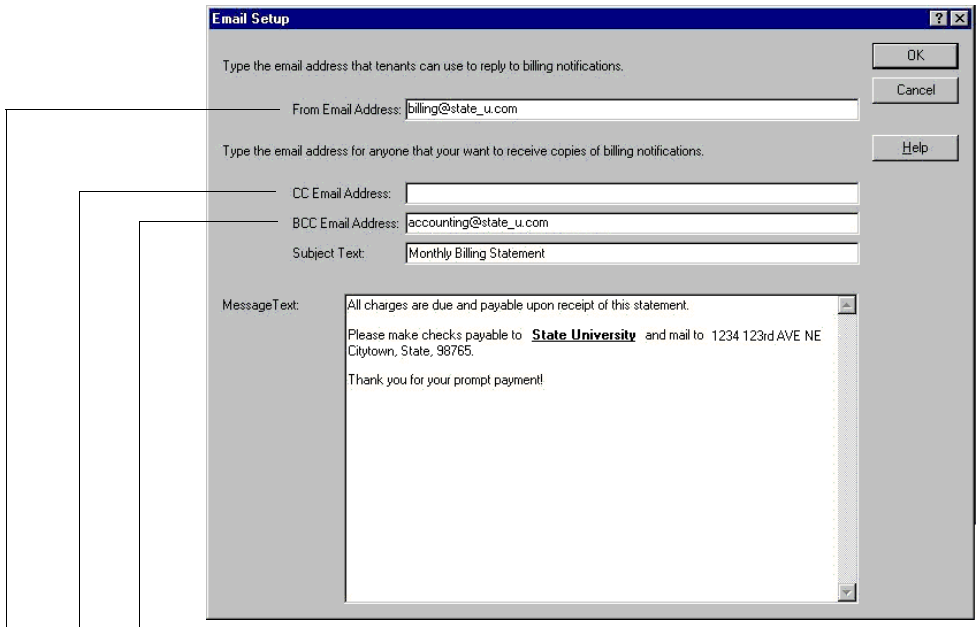

Figure 7.12 You must complete the tenant activity Email Setup before you can email bills to tenants.

Viewing the Tenant Activity Diagnostic Log

The Tenant Activity Diagnostic Log (BACtalk>Tenant Activity>Diagnostic Log) displays an historical record that shows how tenant activity itself is functioning. This log includes any errors that occur while generating bills at the server.

If the tenant activity log lists override events that do not seem to make sense, you can use the information in the diagnostic log to help troubleshoot the problem.

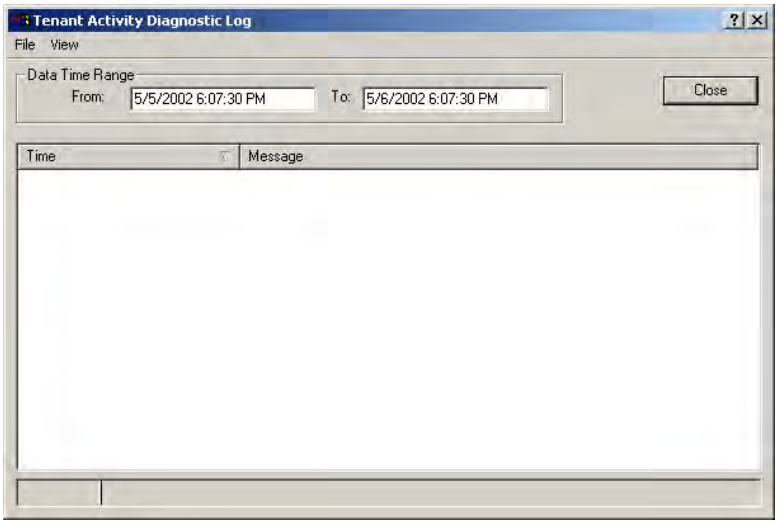

Figure 7.13 Use the Tenant Activity diagnostic log if the tenant activity feature is not working as expected.

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8 Trendlogs

Trendlogs help you troubleshoot problem areas and identify critical operating trends in your system. BACtalk *trendlogs* sample data values from any data point at a regular interval. The Envision for BACtalk server saves sampled values in records that you can view, print, and export. You can view historical data as a list or graph, and choose to view one trendlog side-by-side with another. Global and building controllers buffer samples in memory so that if the server is offline, samples are still gathered.

Trendlog data can also be analyzed using the Enhanced Trendlog Viewer application. Enhanced Trendlog Viewer provides a dynamic graphic display of trendlog data. See “Using the Enhanced Trendlog Viewer” on page 190.

Trendlogs are an essential component of *energy logs*, which provide historical energy demand and consumption data. See “Energy Logs” on page 201 or Envision for BACtalk online Help for more information about using energy logs.

Note If an Envision for BACtalk v1.2 or later client attempts to access trendlog data from a server running Envision for BACtalk v1.1 or earlier, a communications error will occur. If an Envision for BACtalk v1.1 or earlier client attempts to access trendlog data from an Envision for BACtalk v1.2 or later server, unsupported data types (bitstring and null) are filtered out of the display data. As a general rule, when the server and client are running different versions of Envision for BACtalk, avoid operations that impact databases (creating or editing schedules, trendlogs, or alarms, for example).

Benefits

Easy to use View trendlogs in table or graph format to easily spot trends and analyze information. Display trendlog data in order by time stamp or in the order recorded.

Powerful You can set up trendlogs for virtually any data point in your system, and use this information to troubleshoot problems or find opportunities to improve system performance.

Flexible Define trendlogs based on what you need to know. Specify start and end times for collecting trendlog samples. Compare trendlogs side-by-side. Modify existing trendlog setups to get a different view of system performance or problem areas. Work with archived trendlogs.

Practical application

As part of a statewide initiative to reduce energy expenditures by 30%, State University needs to cut its energy bill. To do this, the Facilities Department is considering a demand limiting program. they have decided a good candidate for a pilot program is the Student Union Building (SUB).

Before they implement demand limiting, they need to understand their energy demand and consumption profile in the SUB. Jacob, the SUB's lead engineer, will use energy logs to compile the historical data he needs to inform the demand limiting effort.

Jacob needs to set up a trendlog for the kWh meter in the SUB, which is Device 111101, AI-1, present-value. This trendlog will then be used as the meter reference in the energy log setup.

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Quick start–trendlog setup

Use the following table as a guide when setting up trendlogs. The key steps for defining trendlogs are listed in order.

Table 8.1 Tasks for setting up trendlogs

Task		See
1	Identify the devices and data points that you want to track with a trendlog.	• Site documentation
2	Set up a trendlog handler, if necessary.	• page 170
3	Select a host device for the trendlog.	• page 170
4	Customize trendlog setup, if necessary.	• page 178

IMPORTANT! You must correctly set UTC offset for your BACtalk system in order to time sync trendlogs and graph trendlog data accurately for your time zone. See the *Envision for BACtalk Installation and Startup Guide* (LTBT-TM-ADMIN) for more information about setting the UTC offset.

How trendlog samples are gathered and saved

When you set up a trendlog, you create an Alerton-log object in a global controller or building controller. Trendlogs in global controllers can track values from any manufacturer's BACnet-compliant device. However, the Alerton-log object is a proprietary object that can only be created or modified by Alerton software. For global controllers, the monitored property can be local to the global controller or can be a property from other controllers. For building controllers, only local properties can be trendlogged. For example, you cannot use a trendlog in a VLX to monitor a property in a VLC.

The host device stores information about the log—the device instance, object type and instance, and the property of the *trended point*; the name of the trendlog; and the description of the trendlog.

In addition, each trendlog sample record contains:

- The time the sample was gathered (time stamp)
- Data value of the sample, if available
- An event state returned in lieu of datum (for example, NR—no response from unit or device error code.)

When you set up a trendlog, you select a *trend interval*. This determines how frequently the host device gathers information from, or "polls," the device where the trended data point is.

After the host device gathers trend samples, it stores them in a memory buffer until the trend samples can be sent to an Envision for BACtalk server. You can specify this *buffer size* when you set up the trendlog. See "Advanced trendlog options" on page 178 for more information about setting the buffer size.

Two things cause the Envision for BACtalk server to gather samples from the controller:

- An operator chooses to view a trendlog or updates a trendlog while viewing it.
- The Envision for BACtalk server is running and receives a notification from a log handler that it should gather data.

Whenever the server gets samples to update its database, it looks in its records for the most recent sample in the trendlog. It then retrieves recent records from the controller, adding the samples to its database.

The host device uses a log handler (technically, a notification-class object in BACnet) to tell selected operator workstations when to gather a trendlog's records. When the host device has gathered the number of samples that you define in the trendlog setup as the *notification threshold*, it sends a notification to the operator workstation to get samples.

CAUTION In most cases, the default settings for buffer size and notification threshold are appropriate. Setting the size of the notification threshold relative to the buffer size is a critical consideration when you set up a trendlog. Correct settings will help ensure that samples are not lost. For more information, see "Advanced trendlog options" on page 178.

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Figure 8.1 Trendlog data flow

Trendlog database files

The database files for a trendlog are saved in the job folder on the Envision for BACtalk server, this is usually a folder on the operator workstation hard disk (<bactalk root>*Alerton*\ *BACtalk*\<*version*>\ <repname>\<jobname>).

Table 8.2 Trendlog database files

File Name	Description
Bactalk.mdb	Contains a single table that stores general information about each trendlog. This is the master list of trendlogs. This file stores no sample records.
Trendlog_<*device instance*>_<*trendlog instance*>.mdb	These files store the sample records for trendlogs. Each trendlog has an associated database file. Device Instance is 7 characters long and Trendlog Instance is 10 characters long. Both are 0 padded. For example, the filename for Device 9999's trendlog 37 would be *Trendlog_0009999_0000000037.mdb*.

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Setting up a trendlog

If an item on a data display is set up with the right-click trendlog option, you can right-click the item to work with trendlogs. If no trendlog is set up for the referenced property, Envision for BACtalk displays the Edit Trendlog dialog box. If a trendlog is already set up, you immediately view log data for that property.

If you know the object and property ID of the data value you want to trend, you can select **Trendlog Management>Trendlogs** from the BACtalk menu. This displays the Trendlogs dialog box, which lists any trendlogs that have been defined. From here, you can add new trendlogs and edit, print, or view existing trendlogs. To create one trendlog, click Add, and then click **Single Trendlog**. To create several similar trendlogs, click **Multiple Trendlogs** to display the Multiple Trendlog Builder. See “Using the multiple trendlog builder” on page 173 for more information.

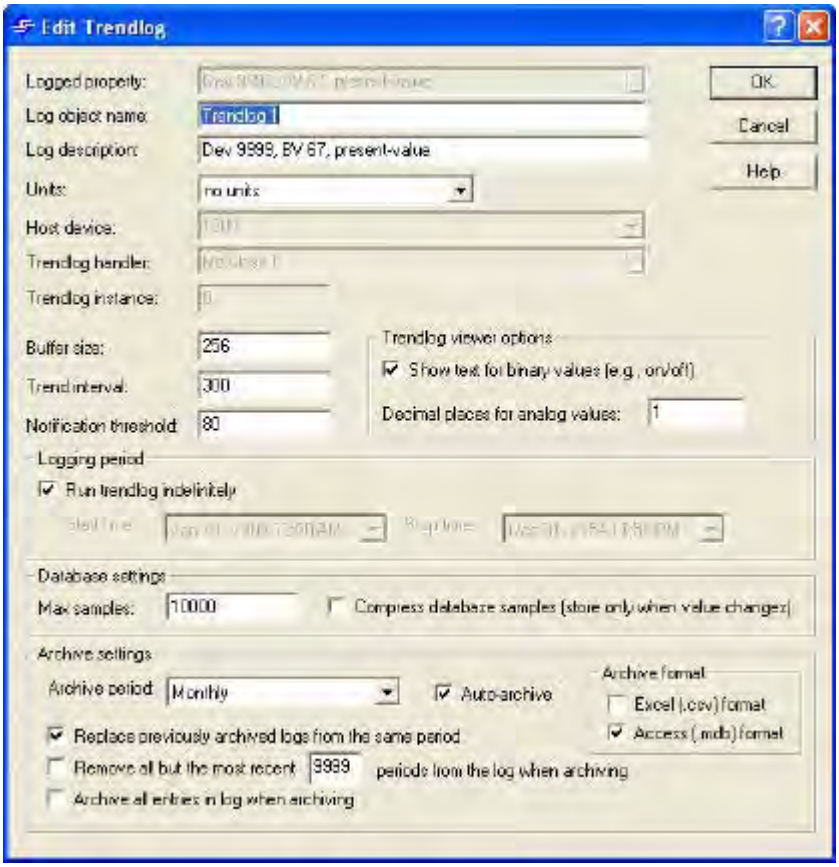

Figure 8.2 Use the Edit Trendlog dialog box to set up a single trendlog.

Use the guidelines in the following table to set up a single trendlog.

Table 8.3 Trendlog properties

Item	Description
Logged property	The property whose value you want to log. After initial setup, the selection is fixed and cannot be changed. This is usually the present-value of an AV, BV, AO, BO, AI, or BI.
Log object name	Envision for BACtalk assigns a default log object name based on the logged property. We recommended that you do not change this object name. Valid names are 1–40 characters.
Log description	Type text that further identifies the trendlog. This text appears as the sample data heading in the trendlog view window. An example is "VAV-5 Room Temp." Valid descriptions are 1–40 characters. You can save time by using variables in the Log Description field. See "Using variables for trendlog descriptions" on page 177.
Units	If desired, select a unit of measure to display when viewing trendlog data and to use if an energy log uses this trendlog (see "Setting up meters" on page 207).
Host device	On initial setup, select a global or building controller where the trendlog setup is stored. After you select a host device on initial setup, the selection cannot be changed. Building controllers can host trendlogs only for their local properties. The host device defaults to the host defined in Device Manager for the device where the logged property originates.
Trendlog handler	On initial setup, select a trendlog handler, which determines the operator workstation that gathers trendlog data from the controller. After initial setup, this selection cannot be changed. Typically, one trendlog handler is set up for each controller. The recipient is the Envision for BACtalk server, and it is assigned by default. If a trendlog handler does not exist in the host device, Envision for BACtalk automatically creates one during the trendlog setup. If the system includes a BCM-WEB, the trendlog handler object name must begin with "Log Handler".
Trendlog instance	The trendlog instance is a unique number that identifies the trendlog in the BACtalk system. By default, Envision for BACtalk auto-generates the trendlog instance using the next available trendlog instance for the selected host device. If you need to enter a custom trendlog instance, clear the Auto-generate trendlog instance check box and type a number between 0 and 4,194,302. Note: You cannot change an existing trendlog instance.
Auto-generate trendlog instance	Selected by default so that Envision for BACtalk automatically creates the trendlog instance using the next available trendlog instance for the selected host device. Clear this check box to activate the Trendlog Instance field and customize the trendlog instance.
Change of value (COV) options (VLCA-1688 only)	
Use COV sampling	Logs samples when the value of the monitored property changes. NOTE: If the selected device or property do not support COV trendlogs, the **Change of value (COV) options** area does not appear.

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Table 8.3 Trendlog properties

Item	Description
COV increment (deadband)	The degree of change required to cause a sample to be logged. For example, if you are monitoring a temperature in degrees Fahrenheit and want to log only changes of one degree or more, you would set this to 1. Type a positive number. Use caution when setting the increment. Small increments can dramatically increase the amount of data gathered and slow system performance.
Log on COV and every *n* seconds	In addition to logging samples when the value has changed, samples are also logged at regular intervals. Select the check box and type a number between 1 and 86,400 (inclusive). This sets the trendlog resubscription interval. Each time the log resubscribes, it logs a sample, so the value entered here in effect becomes the Trend interval.
Buffer size	Determines the total number of samples that the host device can retain before samples are lost. See “Advanced trendlog options” on page 178.
Trend interval	The frequency, in seconds, with which the logged property is sampled. The trendlog records a sample for the logged property at each interval. Default is 60 seconds. Use a 60-second trend interval when trending an energy log. Use the maximum interval that meets your trendlog objectives. Stated minimum is 10 seconds, but this assumes best-case network conditions, which rarely exist. The practical minimum depends on network and site-specific conditions. A greater number of logged points, more network traffic, a slower network connection, or a greater physical distance between the property and the host device require less-frequent trend intervals. Begin with the least frequent trend interval that is reasonable for your application, and then check your trendlogs for gaps and “Sample Interval Too Frequent” messages. Adjust your trend interval upwards if gaps or errors appear. There is no applicable maximum for trend interval.
Notification threshold	Type a notification threshold value in number of samples. When the host device gathers this many samples, it sends notification to the Envision for BACtalk server to gather the sampled data. This value should be significantly less than the buffer size to minimize the possibility of data loss. See “Advanced trendlog options” on page 178.
Trendlog view options	
Show text for binary values	Select this check box if you want the trendlog view window to display text, such as ACTIVE and INACTIVE, for binary values. Clear the check box to display 1s and 0s.
Decimal Places for analog values	Enter the number of digits you want to appear to the right of the decimal point for analog values in the trendlog view window.
Max samples	The number of samples the database at the Envision for BACtalk server saves before it deletes the oldest data. Allowable range is 5,000 to 50,000 samples. The default is 10,000 samples. Smaller values help performance—Envision for BACtalk will read the database more quickly, but you must archive data more frequently.
Sample times	

Table 8.3 Trendlog properties

Item	Description
Run trendlog indefinitely	Clear this check box to enter the date and time that trendlog sampling should begin and end. These fields are disabled if the "Supports BACnet Trendlog" capability is not selected in the Device Profile for the host device. Default is to run trendlogs indefinitely.
Database settings	
Max samples	The maximum number of samples to be stored in the database. A large number here may impact system performance.
Compress database samples	Logs samples only when the sample is different from the previous sample. This differs from COV logging because it samples at regular intervals and only records variations. COV logging logs a sample each time the value changes. Samples gathered before this feature is activated will be unaffected.
Archive Settings	
Archive period	Daily, weekly, twice a month, monthly, quarterly, twice a year, yearly.
Auto archive	Select the check box to enable auto-archive. Otherwise, a user must manually click **Archive Now** to archive trendlog data. Archived files are saved to the server. **Note**: Do not attempt to open an MDB file that is already in use by BACtalk. For example, do not click **Archive Now** for a selected file when BACtalk is already using that file.
Archive format	Save archived data as an Excel (.csv) file or an Access (.mdb) file.
Replace previously archived logs from the same period	Overwrites Excel (.csv) trendlog data files for the same period to save database space. Or, appends Access (.mdb) files for the same period.
Remove all but the most recent periods from the log when archiving	Purge old data from the database and specify the maximum periods of data that should be stored in the database.
Archive all entries in log when archiving	To avoid any data loss, archive all trendlog data in the database.

Practical application

Jacob can not remember the device instance of the controller for the SUB kWh meter (it has a bunch of 1s in it) but he knows how to get to it on his site data displays. He navigates to the consumption meter value on a display, and then right-clicks to bring up the shortcut menu. He selects Trendlog Management. Because no trendlog already exists for this point, the Edit Trendlog dialog box appears.

Jacob confirms that it is the correct data point, Device 111101, AI-1. A trendlog host has been assigned to Device 111101, a VLC-550, in Device Manager. So the correct BTI, device instance 111000, appears as the host device in the trendlog setup. Also, the trendlog handler selection defaults to "NotClass 1," which was

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already set up for another trendlog. Jacob clicks **Trendlog Handler** and verifies that the server is designated as the trendlog recipient.

He knows this trendlog will eventually be used as a meter input to an energy log, so he makes sure he selects the right units: kW or kWh? it is a consumption meter so he selects kWh. (See “Setting up meters” on page 207.)

He leaves the log object name the same, but types in a description, “SUB kWh meter,” so that he will know what the trendlog is when he sees it in listings.

He does not adjust the buffer size or the notification threshold. He also decides to leave the trend interval at the default 60 seconds because he will be using it later with energy logs.

Jacob thinks about the maximum samples setting. He knows there are 1440 minutes in a day. So to keep a month’s worth of samples in the database, he needs to set Max Samples to at least 44,640 (31 days X 1440). He sets it to the maximum, 50,000, knowing that there is plenty of hard disk space on the server. He knows that such a big database will slow the performance in BACtalk, but since he will mostly be using the data in Excel anyway, it does not matter.

He leaves the decimal places displayed to 1, and he ignores the setting for showing text for binary values.

Using the multiple trendlog builder

Envision for BACtalk enables you to quickly set up a number of similar trendlogs for a range of controllers at one time. This is useful for sites with a large number of VLCs or other unitary devices performing essentially the same application task with the same I/O configuration—VAV controllers, for example.

You can set up trendlogs for space temperature and supply air temperature all at the same time for all the controllers. The device instance of controllers must be sequential (110101, 110102, 110103...for example), and it is best that the controllers have the same I/O configuration—for example, AI-0 is space temperature in all controllers.

The Multiple Trendlog Builder is also useful if you have more than one trendlog to set up in a single device.

In the global controller defined as the host device, Envision for BACtalk creates a trendlog for each of the properties in each device. For example, you can build identical logs for the present-value of AI-0 and AI-2 in controllers 110101 through 110130.

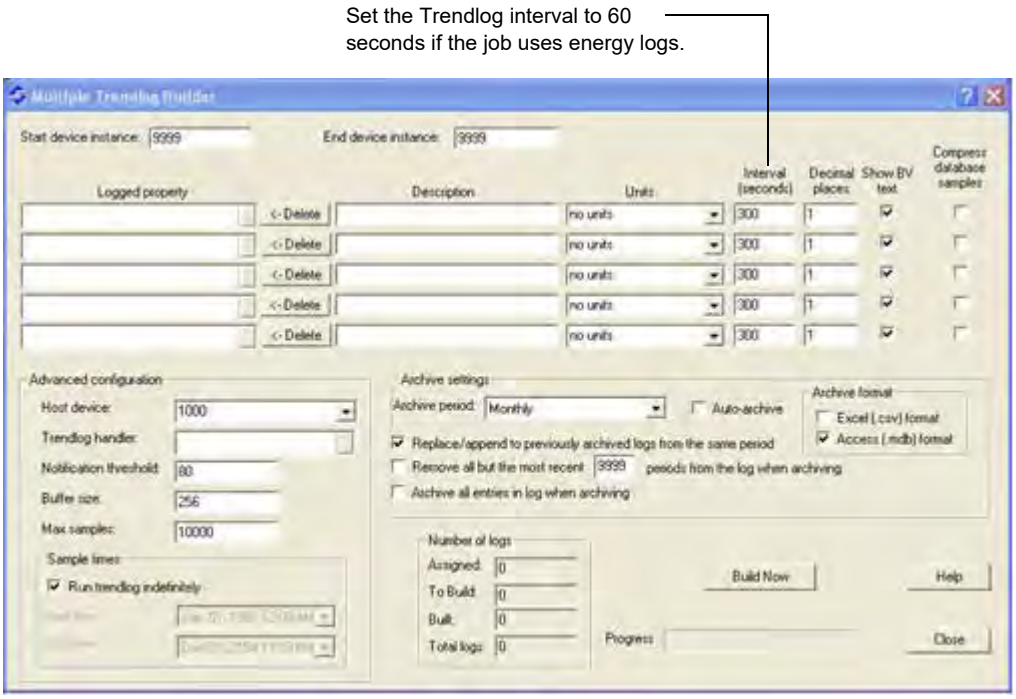

Figure 8.3 Multiple Trendlog Builder dialog box

Use the following guidelines to set up multiple trendlogs.

Table 8.4 Parameters for setting up multiple trendlogs

Item	Description
Start/End Device Instance	Type the device instance of the first and last device in which you want to log data. Trendlogs are built for properties in devices from the Start Device Instance to the End Device Instance.
Logged Property	The property whose value you want to log. After initial setup, the selection cannot be changed. This is usually the present-value of an AV, BV, AO, BO, AI, or BI.
Description	Type text that further identifies the trendlog and appears as the sample data heading in the trendlog view window. An example is "Room Temp." Valid descriptions are 1–40 characters. You can save time by using variables in the Description field. See "Using variables for trendlog descriptions" on page 177.
Units	If desired, select a unit of measure to display when viewing trendlog data and to use if an energy log uses this trendlog (see "Setting up meters" on page 207).

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Table 8.4 Parameters for setting up multiple trendlogs

Item	Description
Interval (seconds)	The frequency, in seconds, that the logged property is sampled. The trendlog records a sample for the logged property at each interval. Default is 60 seconds. Always use the maximum interval that meets your trendlog objectives. Stated minimum is 10 seconds, but this assumes best-case network conditions, which rarely exist. The practical minimum depends on network and site-specific conditions. A greater number of logged points, more network traffic, a slower network connection, or a greater physical distance between the property and the host device requires a less frequent trend interval. Begin with the least frequent trend interval that is reasonable for your application, and then check your trendlogs for gaps and “Sample Interval Too Frequent” messages. Adjust your trend interval upwards if gaps or errors appear. There is no applicable maximum for trend interval.
Decimal Places	Enter the number of digits you want to appear to the right of the decimal point for analog values in the trendlog view window.
Show BV Text	Select this check box if you want the trendlog viewer to display text, such as ACTIVE and INACTIVE, for binary values. Clear the check box to display 1s and 0s.
Compress database samples	Select this check box to filter out trendlog samples so that only samples that are different from the previous sample get logged. Database records that exist before Log on COV is activated remain in the database and do not get altered. All logged records in the database are displayed.
Host Device	On initial setup, select a global or building controller where the trendlog setup is stored. After you select a host device on initial setup, the selection cannot be changed. Building controllers can host trendlogs only for their local properties. The host device defaults to the host established in Device Manager for the device where the logged property originates.
Trendlog Handler	On initial setup, click the command button, and then select a trendlog handler, which determines the operator workstation that gathers trendlog data from the controller. After initial setup, this selection cannot be changed. Typically, one trendlog handler is set up for each controller and the recipient is the Envision for BACtalk server. If a trendlog handler does not exist in the host device, Envision for BACtalk prompts you to create one.
Notification Threshold	Type a value in number of samples. When the host device gathers this many samples, it sends notification to the operator workstation to gather the sampled data. This value should be significantly less than the buffer size to minimize the possibility of data loss. See “Advanced trendlog options” on page 178 for more information.
Buffer Size	Determines the total number of samples that the host device can retain before samples are lost. See “How trendlog samples are gathered and saved” on page 166 for more information.

Table 8.4 Parameters for setting up multiple trendlogs

Item	Description
Max Samples	The number of samples the database at the operator workstation saves before it deletes the oldest data. Allowable range is 5,000 to 50,000 samples. The default is 10,000 samples. Smaller values help performance—Envision for BACtalk will read the database more quickly, but you must archive data more frequently.
Run trendlog indefinitely	Select to enter the date and time that trendlog sampling should begin and end. These fields are disabled if the "Supports BACnet Trendlog" capability is not selected in the Device Profile for the host device.
Archive period	Daily, weekly, twice a month, monthly, quarterly, twice a year, yearly.
Auto archive	Select the check box to enable auto-archive. Otherwise, a user must manually click **Archive Now** to archive trendlog data.
Archive format	Save archived data as an Excel (.csv) file or an Access (.mdb) file.
Replace previously archived logs from the same period	Overwrites Excel (.csv) trendlog data files for the same period to save database space. Or, appends Access (.mdb) files for the same period.
Remove all but the most recent periods from the log when archiving	Purge old data from the database and specify the maximum periods of data that should be stored in the database.
Number of logs	Assigned = number of logs already in the host device To Build = number of additional logs this build will create Built = number of logs built so far for the current build request Total logs = sum of existing and new trendlogs in host device

Practical application

Mario, the lead engineer in the Health Sciences building, wants a weekly report showing space temperature trends, in graph format for every 24 hours in 15-minute increments, for every zone in the Health Sciences building as part of an evaluation of the optimum start program there. Joe, a facilities engineer, is responsible for setting up the trendlogs. Mario wants the graphs shown alongside the cooldown command status for the zone.

After looking at the site documentation, Joe sees that all the VAV boxes in the Health Sciences building are set up with sequential device instances, 310101-310130 (floor 1), 310201-310230 (floor 2), 310301-310330 (floor 3), and all have the same references for space temperature, AI-0. Fortunately, all of these VAV controllers also have the same cooldown command, BV-42.

Joe decides this is a great application for the multiple trendlog builder. He opens up the Trendlogs dialog box from the BACtalk menu and clicks **Add** to create multiple trendlogs for the Health Sciences building. He specifies the starting device instance for the Health Sciences VAV on the first floor that he wants to set up a trendlog for; it is a VLC with device instance 310101. The ending device instance is VLC 310130. Then Joe sets the logged properties that he wants to trend, AI-0, present-value. He types in a description that can be used for all these trendlogs. Joe uses "Heath Sci: VAV Space Temp." He sets up the cooldown command for BV-42 and labels it "Health Sci: Cooldown Command." Joe also

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changes the Interval setting to 900 seconds. Like Jacob over in the SUB, Joe sets the Max Samples value to the maximum limit of 50,000.

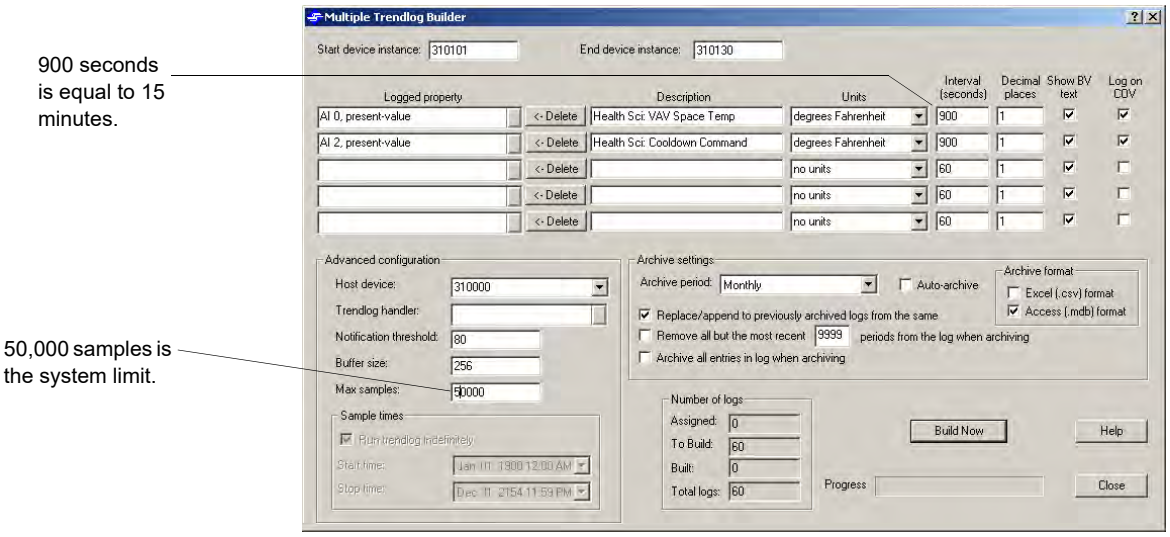

Figure 8.4 Multiple Trendlog Builder dialog box setup for the first floor of the Health Sciences building

When Joe finishes setting up both series of trendlogs, he views each of the space temperature logs, right-clicks the column heading for each one, selects **Add companion log**, selects the corresponding BV from the list, and then clicks **Select**. Joe can now see the two trendlogs side by side in the Trendlog View dialog box.

Using variables for trendlog descriptions

When setting up trendlogs, typing descriptions can be time consuming - especially when creating multiple trendlogs. Variables streamline this task by retrieving information from the Envision for BACtalk server and placing it in the description field of the trendlog(s).

To use variables, type the variable in the description field. When you build the trendlog(s), the returned values will be shown in the description field. In Multiple Trendlog Builder, two variables (%3 and %4)are placed in the description field by default. Table 8.5 lists all of the variables.

Table 8.5 Trendlog description variables

Variable	Description	Example
%1	The device instance of the device that hosts the monitored property.	“702”
%2	The monitored object, property, and the description of the property in parentheses.	“AI 3, present-value (return air temp)”

Table 8.5 Trendlog description variables

Variable	Description	Example
%3	The device instance of the monitored property, preceded by the word "Device" and followed by the device's description in parentheses. Included in the default description.	"Device 110006 (Fan-Coil 6 Controller)"
%4	The monitored property without the property's description. Included in the default description.	"AI 4, present-value"
%5	The device description of the monitored property. Fan-Coil 6 Controller. If the description is empty, returns "Device <device instance>".	"Fan-Coil 6 Controller" or "Device 702"
%6	The description of the object containing the monitored property. If the description is empty, returns the monitored object and property.	"return air temp" or "AI 5, present-value"

Advanced trendlog options

For most trendlogs, the defaults in the trendlog setup dialog boxes (Edit Trendlog and Multiple Trendlog Builder) are adequate. This topic is intended for advanced users. This information is useful if you experience gaps in trendlog data or if you have unusual trendlog or site circumstances.

Calculating the buffer size

When you set a buffer size for a trendlog, consider how many trendlogs the controller hosts, or is planned to host, and the number of other objects (such as schedules and calendars) the controller hosts. The amount of memory a trendlog occupies depends on the buffer size, expressed in samples, that you select for a trendlog. For example, each BTI has approximately 6.2 MB reserved for object memory, and the BCM-ETH has about 2.5 MB reserved for object memory. Leaving ten percent of available memory free is a good rule of thumb for all controllers.

When you set a large buffer size for a trendlog and combine it with a relatively small notification threshold, you are less likely to lose data if the operator workstation can not gather samples for some reason (for example, it is shut off or Envision for BACtalk is not running). However, your global controller will not be able to support as many trendlogs.

Use the following equation to calculate how much host controller memory a trendlog will occupy based on buffer size:

$n + 194 + ([1 + \text{int}(s/128)] \times 1160) = \text{Bytes for Trendlog}$

s = value of buffer size in samples
n = number of characters in object name and object description

Note int(s/128) indicates to use the integer portion of s/128. For example, if s/128 = 8.59, int(8.59) = 8. If s/128 = 0.78, int(0.78) = 0. This portion of the equation accounts for the controller's assigning of trendlog memory in 128-byte blocks.

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Example

Buffer Size (s) = 288
Object Name = *Alerton Log Object 54* (21 characters)
Object Description = *Outside Air Temp.* (17 characters)
(n) = 21 + 17 = 38.

38 + 194 + ([1 + int(288/128)] × 1160) = 3712 bytes

Choosing a notification threshold

The notification threshold determines when the notification-class object alerts an operator workstation to gather trendlog data. The smaller your notification threshold relative to your buffer size, the more secure your data is—there is more room to store data in the buffer if a notification is not effective. The buffer size minus the notification threshold is called *slack*.

An excessively small notification threshold (especially for a number of trendlogs) might burden your network with rapidly repeating notifications. A good notification threshold value for critical trendlogs is approximately 30% of the buffer size, which allows for three notifications before data begins to drop out of the buffer. Also consider the trend interval when you set the buffer size and notification threshold. A smaller trend interval might warrant a larger buffer size and a smaller notification threshold, and a larger interval just the opposite.

Calculating slack time

An important calculation is *slack time*. This is the amount of time that the recipient operator workstation can be offline before the oldest samples in the trendlog are deleted. If slack time is exceeded, gaps in trendlog data appear.

Equation for determining slack time in minutes
(Buffer Size – Notification Threshold) X (Trend Interval/60) = Slack Time

This equation can be useful for:

- Stand-alone applications, when determining how often to connect to gather log data.
- For applications where the recipient operator workstation may be offline for some time.

Example

Trend Interval = 30 sec.
Buffer Size =256
Notification Threshold = 80

(256 - 80) x (30/60) ≅ 88

Using this example, the notification threshold is reached roughly every 40 minutes (Trend Interval X Notification Threshold)/60, and then the Envision for BACtalk server is notified to gather data. The server has roughly 88 minutes to gather data before samples are lost. This process is just a way of converting the number of samples to a time value.

Note The global controller only notifies the Envision for BACtalk server when the notification threshold, or a multiple of the threshold, is reached (80 samples, 160 samples, 240 samples, for example). If the Envision for BACtalk server is offline when the 80, 160, and 240 notifications are sent, and it comes back online at 250 samples, it will not process the log until it receives the 320 sample notification. If the buffer size was set to 256 samples, 64 samples will have been lost by the time the Envision for BACtalk server receives the 320 sample notification (320 - 256 = 64).

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Viewing trendlogs

The trendlog view function enables you to view trendlog samples in tabular or chart format. This topic provides instructions for viewing trendlog data, updating trendlog data while you are viewing, and customizing how you view trendlog data.

An advanced viewer is available. See “Using the Enhanced Trendlog Viewer” on page 190.

Note If you do not update the From and To settings or there are no samples for the most recent day, no data appears in the trendlog viewer. Change the From and To dates, and then press F5 to update data. See “Updating trendlog data while viewing” on page 184 for information.

When you open a trendlog to view (BACtalk>Trendlog Management>Trendlogs>[select a trendlog]>View), Envision for BACtalk displays the data in table view by default. You can also view data in graph view, which plots the data visually for you, or event view, which is useful mostly for trendlog and system troubleshooting.

Note It is good practice to close the trendlog window when you are finished working with trendlog data. Leaving the trendlog window open, especially if you have Auto Update selected from the Options menu, can increase network traffic.

Table view

This view appears by default with the default sort order being by Time. For the Time column, you can select ascending or descending order and the last ascending/descending sort order selected is retained the next time Trendlog View is opened. Use table view to display trendlog data side-by-side.

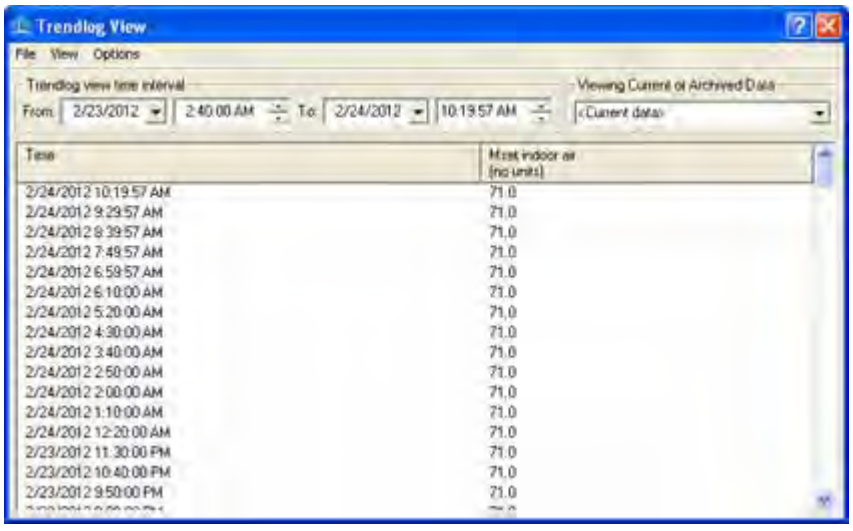

Figure 8.5 Trendlog viewer–table view

Change the order in which trendlogs are displayed using the Options menu.

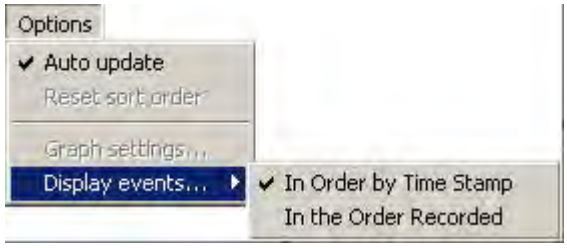

Figure 8.6 Display trendlogs in Table View in order by time stamp or in the order recorded

Note Sort orders are not retained when you switch between Trendlog views (Table View, Graph View, and Event View). Time is always the primary sort order when Trendlog Table View opens.

By default, trendlog samples are displayed In Order by Time Stamp. If the view is changed to In the Order Recorded, this becomes the default view the next time the trendlog viewer is opened.

The Reset Sort Order option restores trendlogs to sorted by Time. This option is disabled if Auto Update is selected or if the view is already in the default sort order.

Note When viewing trendlogs In the Order Recorded, companion logs are not displayed and companion log configuration is not available.

There are several ways to refresh trendlog data while working in Trendlog Table View:

- Click **Reset Sort Order** on the Options menu
- Add or delete a companion trendlog
- Click **Display Events** on the Options menu, and then select a different sort order
- Switch to a different trendlog view (Table View, Graph View, or Event View)
- Resort the Table View by the Time column

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Graph view

Use this view to display trendlog data graphically. Drag the mouse across the graph to zoom in on a specific portion of the graph.

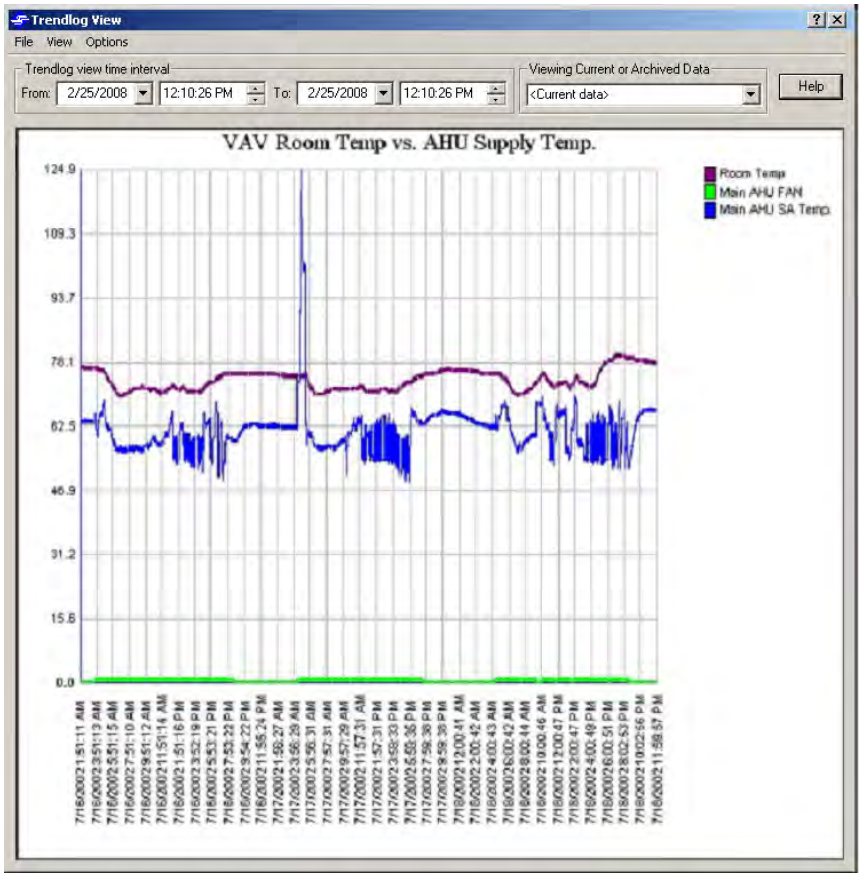

Figure 8.7 Trendlog viewer–graph view

Note When you view data as a line graph, Envision for BACtalk compresses the X axis to view all the samples in the date/time range you specify in the From and To boxes. In bar graph view, the display is limited to approximately 45 samples at a time, and Envision for BACtalk displays samples beginning with the From date. If you switch back to line graph mode, only those first samples are displayed. Right-click anywhere on the graph and then click **Zoom Out** on the shortcut menu to return to the compressed view.

Event view

The event view can be useful when troubleshooting to see if any error events were transmitted along with the data sample. If you see a strange data sample or group of samples, you may want to check event view to see if Envision for BACtalk recorded an error event.

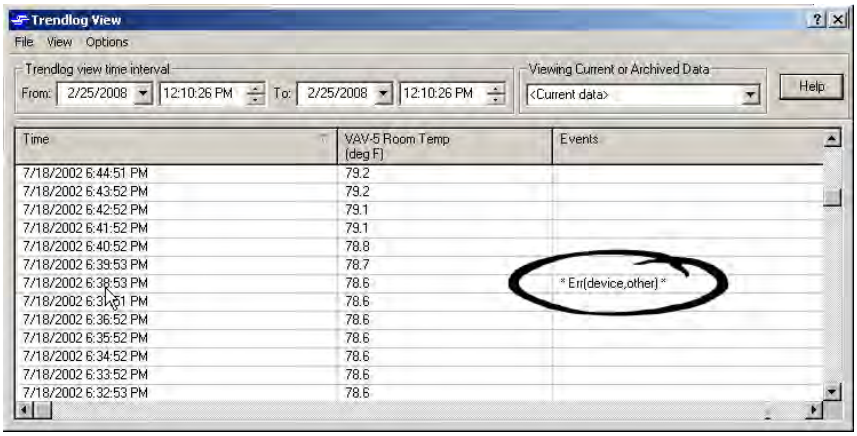

Figure 8.8 Trendlog viewer–event view

Note If companion logs are included, they are hidden while event view is active.

Adding companion logs

Companion logs enable you to view multiple data sets together. Data from the logs appear side-by-side with the primary log. You can view up to 10 data sets at once. You set up companion logs in table view. Once you set up companion logs, you can switch to graph view. Until companion logs are deleted, they are displayed when their primary logs are displayed.

Note When viewing trendlogs In the Order Recorded, companion logs are not displayed and companion log configuration is not available.

▶ **To add a companion log to table view**

1. On the BACtalk menu, click **Trendlog Management** and then click **Trendlogs**.
2. Select the trendlog you want to view, and then click **View**.
3. Right-click the heading for the trendlog, and then click **Add Companion Log**.
4. In the list of trendlogs, click the companion logs you want to view, and then click **Select**.

   The companion log appears to the right of the currently selected trendlog.

Updating trendlog data while viewing

When you view trendlog data, you view samples from the database at the Envision for BACtalk server. When you first open a trendlog, Envision for

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BACtalk retrieves the most recent samples from the global controller or building controller.

Select **Auto Update** on the **Options** menu (BACtalk>Trendlog Management>Trendlogs>View) to ensure that the data in the trendlog viewer updates whenever the server retrieves samples from the controller. See “How trendlog samples are gathered and saved” on page 166 for more information.

There are essentially three ways that the trendlog database can be updated with samples from the controller while you are viewing a trendlog:

- Change the To date and time to a time more recent than the most recent sample in the database and then press F5**.**
- Close the trendlog viewer and re-open it.
- With Auto Update selected, wait for the Envision for BACtalk server to receive log data at the interval established in the log handler.

Archiving trendlog data

Envision for BACtalk enables you to archive trendlog data as a comma-separated values (*.csv) file or an Access (*.mdb) file. These files are saved on the Envision for BACtalk server in the server’s Archive directory. Specify the Archive directory using the Site Configuration dialog box (General System Setup>Network>Site Configuration).

Most spreadsheet and database programs can read .csv files. This is useful for exploring trendlog data for sophisticated analysis.

The Access (*.mdb) file format supports viewing archived data in the trendlog viewer. This is the option selected by default.

From the list of trendlogs (BACtalk>Trendlog Management>Trendlogs), select the trendlogs you want to archive. Use Shift+click to select a range and then Ctrl+click to add or remove a trendlog. Click Archive to archive your selected trendlogs.

Use the auto-archive feature to set the BACtalk server to automatically archive trendlog data (BACtalk>Trendlog Management>Trendlogs). You can archive records daily, weekly, twice a month, monthly, quarterly, twice a year, and yearly.

Archive trendlog data from the BACtalk server or client workstations. However, archived data is always stored on the server.

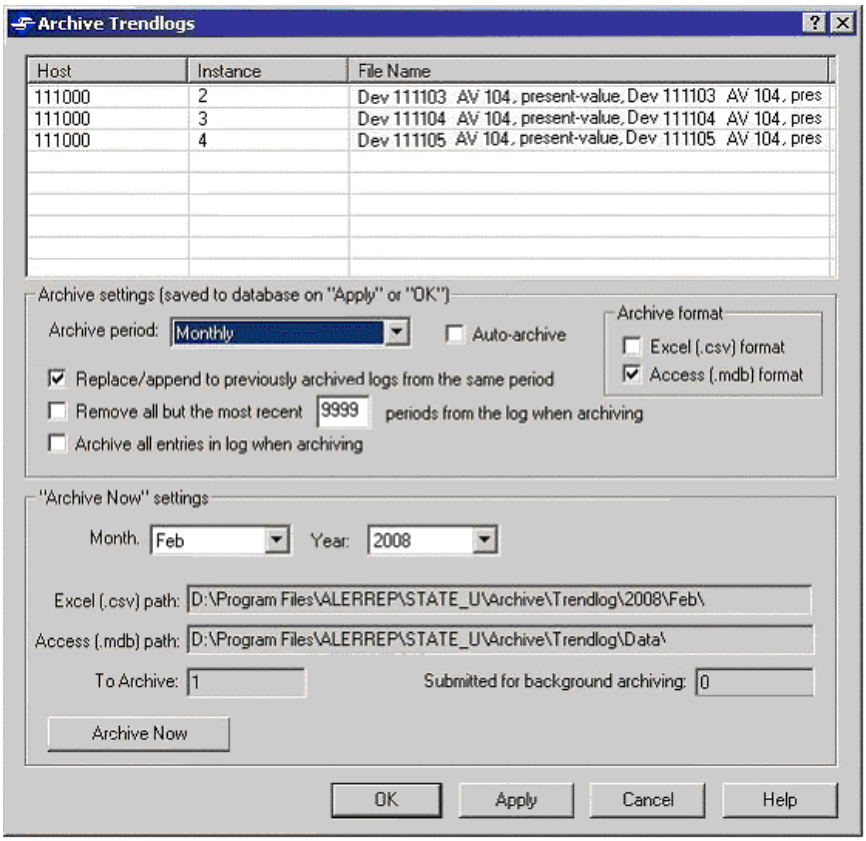

Figure 8.9 Archive Trendlogs dialog box

Envision for BACtalk displays the trendlog list you have selected.

The current archive settings for the displayed trendlogs are also shown. Where settings are different between trendlogs, the setting is blank or gray. Changing a setting forces that setting to be used by all the selected trendlogs.

The Archive Now area controls the actual date range to be used when manually archiving trendlogs. Select the date range you want and then click Archive Now to immediately send the data to the server for archiving in the Archive directory. View the archive operation's progress in the User Request Monitor.

Note If you change the archive settings to do Archive Now but do not want to permanently change the settings used for auto-archiving, click Cancel after the Archive Now operation is complete. Otherwise, the updated archive settings you last used for Archive Now are saved to the database and they will be used for all subsequent auto-archive operations.

Auto-archive

Selecting the "Auto-archive" check box causes the selected trendlogs to automatically archive starting at midnight following the selected archive period. For example, a log that is archived Monthly will archive the previous month's data at midnight on the first of each month. As part of the auto-archive operation,

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the latest trendlog data from the host device is gathered and stored in the database prior to archiving.

Auto-archiving occurs according to the following schedule. Weeks are defined as Sunday through Saturday. Therefore, weekly auto-archiving happens on Sunday morning at midnight for the previous week ending Sunday night at 23:59:59. All times are local time.

Table 8.6 Auto-archive scheduling

Auto-archive period	Scheduled start time
Daily	At 12:00:00 midnight for the previous day
Weekly	Sunday at midnight for the previous week
Semi-monthly	The 1st and 16th of each month at midnight for the previous period
Monthly	The 1st of each month at midnight for the previous month
Quarterly	The 1st of January, April, July, October at midnight for the previous quarter
Semi-annual	The 1st of January and July at midnight for the previous half-year
Annual	The 1st of January at midnight for the previous year

Replacing or appending to previously archived data

If you create an archive file using “Archive Now” and then decide to set up a log for auto-archiving, perform auto-archiving and BACtalk will add new data to your existing archive file. If the default “Replace/append to previously archived logs from the same period” setting is checked, .csv files get overwritten if they exist and .mdb files get appended if they exist.

If this check box is not checked and the archive file for the selected period already exists, then the archive operation is skipped.

Data for each archive period is saved with a unique file name. For example, monthly archive data for February 2008 is saved in a different file than monthly archive data for Mar 2008. File names are also different based on the archive period. For example, weekly archive data will have different file names than monthly archive data.

Removing old log entries

The “Remove all but the most recent ___ periods from the log when archiving” option allows you to clear out old data from the current database during an archive operation. Data from the selected period is archived, and then any old data is removed from the current database. The age of data to be removed is controlled by the number of periods entered. The default number of periods is 9999 to prevent inadvertent loss of data in case the check box is accidentally checked. For example, if you have “Monthly” selected and check the “Remove all but the most recent ___ periods from the log when archiving” option with the number of periods set to 12, all but the most recent 12 months’ worth of data will be removed from the current database once the archive operation completes.

If you have “Daily” selected and check the “Remove” check box with the number of periods set to 365, all but the most recent 365 day’s worth of data gets removed from the current database after the archive operation completes.

Note If an error occurs during the archive operation, no data will be removed. This prevents inadvertent data loss.

Archiving all entries

If you check "Archive all entries in the log when archiving" check box, all data in the current database gets copied to the appropriate archive file when archiving, regardless of the selected archive period. However, the file name(s) for the archived data will be based on the selected archive time period.

This option is especially useful for "Archive Now" operations the first time you set up your system for auto-archiving. By selecting those trendlogs you want to auto-archive and performing an "Archive Now" operation with the "Archive all entries in the log when archiving" check box checked, you will essentially create an on-line backup copy of all of your old trendlog data to which you can refer once you start removing old data (using the "Remove all but the most recent _____ periods from the log when archiving" option) as a part of the auto-archiving operation.

You probably do NOT want to check this option for auto-archiving, since you will end up with additional copies of the entire database on the server disk each time auto-archive runs. This can fill up the disk rapidly, especially for frequent archives, such as Daily or Weekly.

Purging trendlog data

Purging trendlog data clears all samples from the Envision for BACtalk server and from the controller, at your discretion, but retains the trendlog setup.

From the list of trendlogs (BACtalk>Trendlog Management>Trendlogs), select the trendlogs you want to purge. Use Shift+click to select a range and Ctrl+click to add or remove a trendlog from a selection. Then click the Purge button.

The options to purge from global controller memory or from workstation hard disk apply to all selected trendlogs.

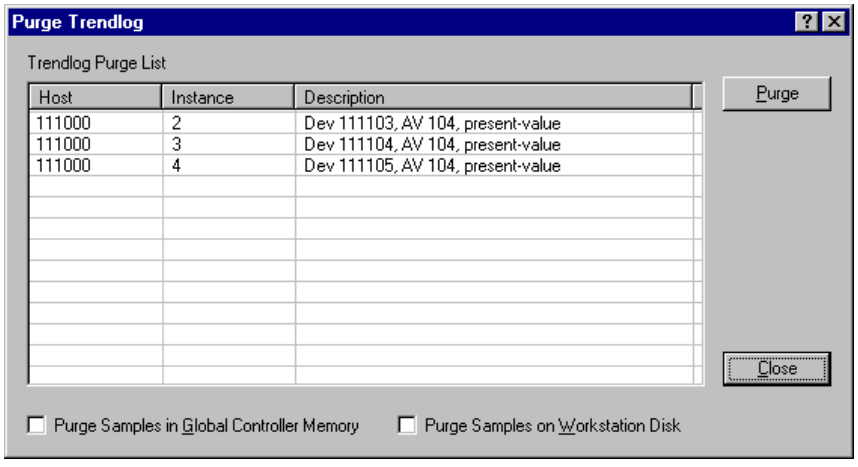

Figure 8.10 Purge Trendlog dialog box

 © Honeywell

Printing a trendlog view or list

Once you have trendlog samples sorted and displayed the way you want in table, graph, or event view, click **Print** on the File menu. You can then select a printer connected to the local operator workstation from the Windows print manager.

If you need to print a listing of all the trendlogs set up in your system, click the Print button in the Trendlogs dialog box.

Using the Enhanced Trendlog Viewer

About Enhanced Trendlog Viewer

Enhanced Trendlog Viewer extends Envision for BACtalk's built-in trendlog viewing functionality. It helps you troubleshoot the behavior of a building control system and allows you to see how data from one trendlog relates to other trendlog data. It shows data from as many as ten trendlogs on an interactive line graph.

See the Enhanced Trendlog Viewer Installation Instructions (LTBT-TM-TLVINST) for information about installing Enhanced Trendlog Viewer.

Configuring Enhanced Trendlog Viewer

Before you begin using Enhanced Trendlog Viewer, consider limiting the size of search results. If your network includes a NAT firewall, you must add an entry to bactalk.ini to enable communication across the firewall.

Limiting the size of search results

Large search results can consume network bandwidth and take a long time to process. Limiting the number of trendlogs returned by a search can minimize network traffic and reduce the time required to display results.

The **Max Trendlogs to Display** text box on the **Trendlog Selection** dialog box allows the user to set the maximum number of trendlogs returned. If the number of trendlogs that meet the search criteria exceeds the limit, Enhanced Trendlog Viewer shows an error message.

You can limit the number the user can enter in **Max Trendlogs to Display** by setting the **MaxTrendlogSearchResults** entry in the bactalk.ini file.

▶ **To set MaxTrendlogSearchResults**

1. Open bactalk.ini in a text editor such as Notepad. The default location of bactalk.ini is C:\Alerton\BACtalk\3.0.
2. In the TrendlogViewer section, set **MaxTrendlogSearchResults** to the desired value. The default value is 5000.
3. Save your changes and close bactalk.ini.
4. Refresh the Enhanced Trendlog Viewer page.

NAT firewall issues

If there is a NAT firewall between the Envision for BACtalk server and an Envision for BACtalk client, you must edit the client's bactalk.ini file to ensure the client can communicate with the server.

▶ **To configure clients in a NAT environment**

1. On the client computer, open the bactalk.ini file. The default location is C:\Alerton\BACtalk\3.0.
2. In the [Niagara] section, add two entries - PublicHostName and PublicHttpPort.

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3. If the client is separated from the server by a NAT firewall, use the server's public hostname and port (as assigned by the network administrator) to populate the PublicHostName and PublicHttpPort entries in the bactalk.ini file.

   Note If the client is not separated from the server, it uses the server's local hostname and port to populate the PublicHostName and PublicHttpPort entries in the bactalk.ini file. You do not need to change these entries.

4. Save the changed bactalk.ini file and then refresh the Enhanced Trendlog Viewer page.

Starting Enhanced Trendlog Viewer

Starting Enhanced Trendlog Viewer requires a valid Envision for BACtalk user profile. When you start Enhanced Trendlog Viewer, it opens in the default web browser.

▶ **To start Enhanced Trendlog Viewer from a server**

1. Log in to Envision for BACtalk.
2. On the BACtalk menu, select **Trendlog Management** and then click **Enhanced Trendlog Viewer**.

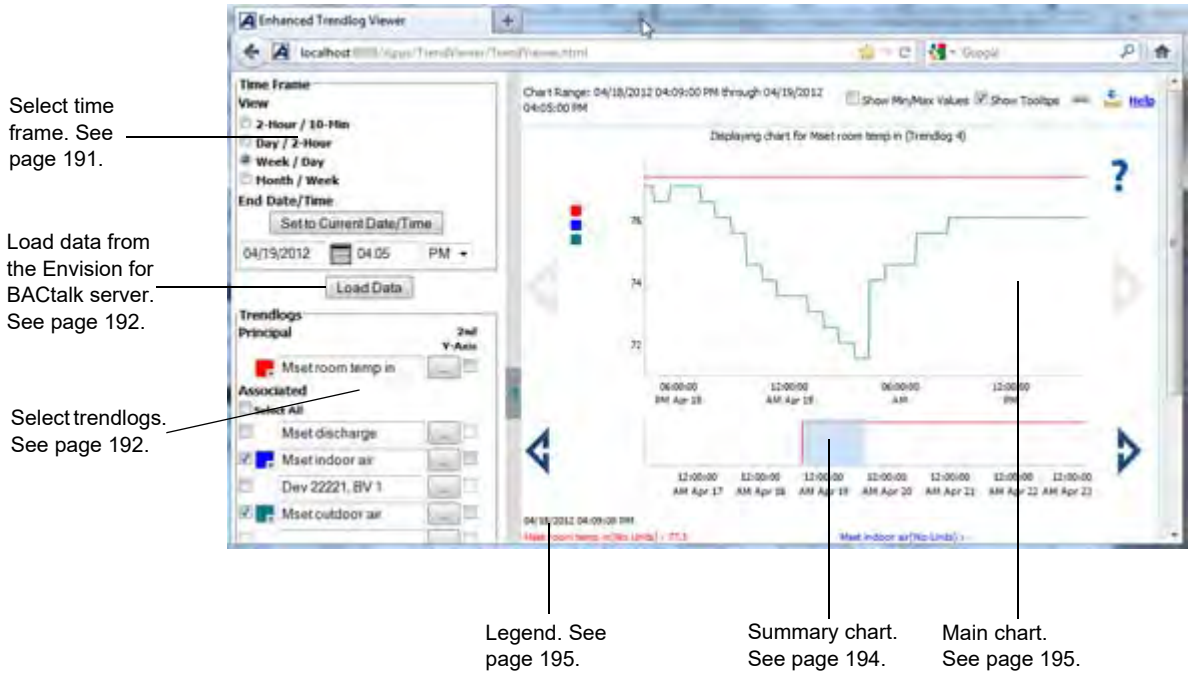

Figure 8.11 Enhanced Trendlog Viewer user interface

Setting the time frame

This is where you select the time frame for the data that is retrieved and how much of that data is displayed on the charts. The range is shown just above the main chart.

Views

Trendlog data is shown in one of four views - 2-Hour/10-Minute, Day/2-Hour, Week/Day, and Week/Month. Views are named to reflect the date/time ranges shown in the summary and main charts.

When you select a view, the application retrieves more data than it shows on the charts. You can view the additional data by panning. You can also view a subset of the displayed data by zooming.

2 Hour/10 Minutes When you select 2-Hour/10-Minute view, Enhanced Trendlog Viewer retrieves data for the 24 hours preceding the End date/time. It displays two hours of data in the summary chart and ten minutes of data in the main chart.

1 Day/2 Hour When you select Day/2-Hour view, Enhanced Trendlog Viewer retrieves data for the two days preceding the End date/time. It displays one day of data in the summary chart and two hours of data in the main chart.

1 Week/1 Day When you select Week/Day view, Enhanced Trendlog Viewer retrieves data for the two weeks preceding the End date/time. It displays one week of data in the summary chart and one day of data in the main chart.

1 Month/1 Week When you select Month/Week view, Enhanced Trendlog Viewer retrieves data for one month preceding the End date/time. It displays one month of data in the summary chart and one week of data in the main chart.

Set to Current Date/Time

This button sets the End Date and End Time to the present date/time on the Envision for BACtalk server and then retrieves data based on the view selected.

End Date/Time

Use the date picker or type the date of the latest data you want to retrieve from the server. Type an end time and then click Load.

Loading data

When you select a principal trendlog, Enhanced Trendlog Viewer loads data for that trendlog and up to three associated trendlogs. When you select a new view or click **Set to Current Date/Time**, Enhanced Trendlog Viewer loads data. If you change the date or time, or if you change the associated trendlog selections, you must click **Load Data** to load data from the server.

Selecting trendlogs

Select a principal trendlog and, optionally, associated trendlogs to show in the charts.

Principal trendlog

The principal trendlog will appear in the summary chart and the main chart.

▶ **To select a principal trendlog**

1. Click the selection button.
   The **Trendlog Selection** dialog box appears.

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2. Type part of a trendlog name or description and then click **Search**. You can search without typing search criteria, but this will return all trendlogs and the list may be difficult to sort through.
3. If the search returns more trendlogs than the number set in the Max Trendlogs to Display field, a message appears. Refine your search criteria or increase the **Max Trendlogs to Display**.
4. If you are using a touchscreen device, click the selector arrow to display the list of trendlogs.
5. Select a trendlog and then click **OK**.
   Enhanced Trendlog Viewer retrieves data for the trendlog and displays it in the charts.

If the principal trendlog has companion logs configured in Envision for BACtalk, Enhanced Trendlog Viewer shows up to nine of them as associated trendlogs and displays data for the first three.

Associated trendlogs

Associated trendlogs appear only in the main chart and can be toggled ON or OFF.

Do not confuse associated trendlogs with companion logs. Associated trendlogs are associated with a principal trendlog only for the duration of the Enhanced Trendlog Viewer session. See Envision for BACtalk online Help for information about companion logs.

▶ **To select associated trendlogs**

1. Click the selection button.
   The Trendlog Selection dialog box appears.
2. Type part of a trendlog name or description and then click **Search**. You can search without typing search criteria, but this will return all trendlogs and the list may be large.
3. If the search returns more trendlogs than the number set in the **Max Trendlogs to Display** field, a message appears. Refine your search criteria or increase the **Max Trendlogs to Display**.
4. If you are using a touchscreen device, tap the selector arrow to display the list of trendlogs.
5. Select a trendlog and then click **OK**.
   Enhanced Trendlog Viewer retrieves data for the trendlog and displays it in the main chart.

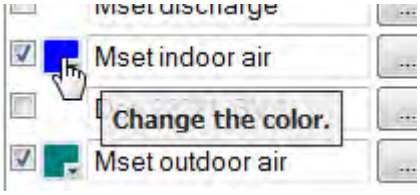
To remove an associated trendlog from the main chart, clear the check box next to it. The associated line disappears from the chart and the trendlog name and description appear dimmed.

Color selection

When Enhanced Trendlog Viewer loads trendlog data, each trendlog is represented in a different color. If a color is associated with the trendlog in Envision for BACtalk, that color is used. Otherwise, Enhanced Trendlog Viewer assigns a color.

▶ **To select a new color**

1. Click the colored button to the left of the trendlog name.



The Color Selection dialog box appears.

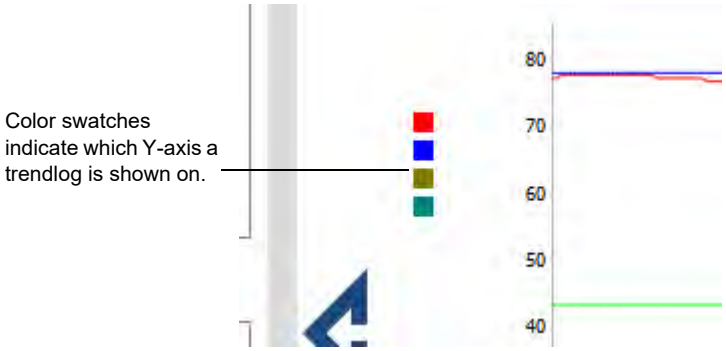
2. Select a color and then click **OK**.
3. Click **Load Data**.

Secondary Y-axis

If an associated trendlog is measured on a scale or in units different from the principal trendlog, you can display the associated trendlog data on a secondary Y-axis. The secondary Y-axis appears on the right side of the main chart.

To show a secondary Y-axis for an associated trendlog, click the check box button to the right of the trendlog description and then click **Load Data**.

When data for a trendlog is shown on the secondary Y-axis, a corresponding color swatch appears next to the axis. This helps you know which axis a trendlog is shown on each axis.



Viewing data on the charts

Enhanced Trendlog Viewer shows data in two charts - the summary chart and the main chart.

Trendlog data is represented on the charts by colored lines. The amount of data shown on the charts depends on which view you have selected.

Summary chart

The summary chart shows all of the data retrieved from the Envision for BACtalk server.

Only the principal trendlog is represented on the summary chart. Use the panning arrows to pan forward and back.

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A shaded area on the summary chart indicates the time frame of the data shown in the main chart. You can click and drag this highlighted area to pan through data.

Main chart

The main chart shows a subset of the data shown on the summary chart in greater detail.

You can zoom in on specific areas of the chart and then pan forward and backward through the data (see “Panning and zooming” on page 197). Each selected trendlog is represented on the main chart.

Chart range Shows the date/time range of the data displayed in the main chart.

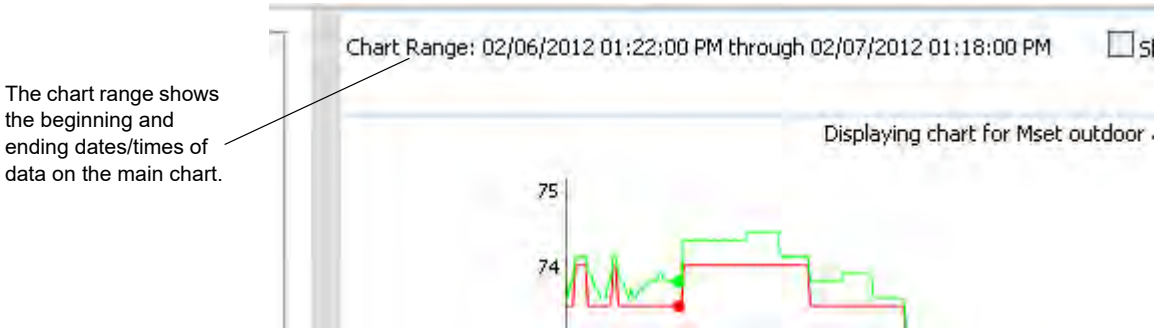

Figure 8.12 Enhanced Trendlog Viewer chart range

Legend The chart legend, located below the summary chart, shows the date/time and trendlog values based on the location of the cursor in the main chart. Trendlog names/descriptions and values are shown in their associated colors.

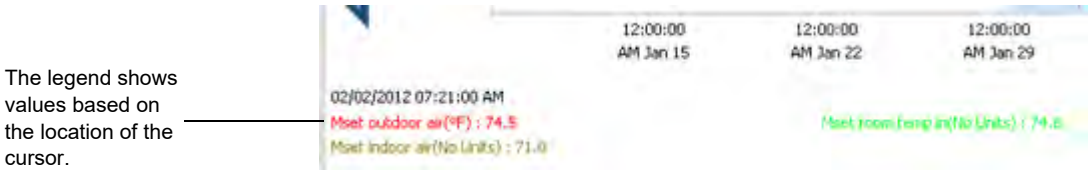

Figure 8.13 Enhanced Trendlog Viewer legend

The legend shows blank values until the cursor moves onto the main chart. Then it shows the date/time and values as the cursor moves across the chart. Small dots appear on the lines in the main chart to indicate the date/time being shown.

When the cursor is moved off of the main chart, the legend shows the values that were shown at the time the cursor was moved off.

Tools

Use the tools above the main chart to enable or disable min/max values, copy URLs, toggle tooltips on or off, and to export data.

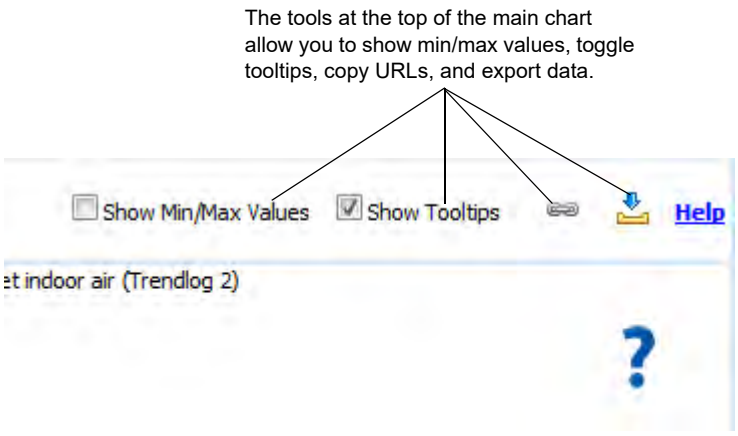

Figure 8.14 Enhanced Trendlog Viewer tools

Show Min-Max Values The line that represents trendlog data on the main chart is an averaged value. When Show Min-Max Values is selected, the minimum and maximum values are displaced as shadows below and above the trendlog line. Not selected by default.

Show Tooltips When this option is selected and you hover the mouse cursor over a button or check box, a tooltip is displayed that explains the function of that button or check box. Show Tooltips is selected by default.

NOTE: Tooltips are not supported on touchscreen devices.

Copying URLs If you want to link to a particular trendlog view, you can copy the URL to your computer's clipboard. Then you can paste it into an email, create a link on a graphic display, or paste the URL into a web browser and bookmark it.

When you copy an Enhanced Trendlog Viewer URL, the URL includes information about the view and the trendlogs you have selected. It also includes any secondary Y-axis selections and whether secondary trendlogs are selected for display on the main chart.

URLs do not include end date/time data.

Users must have view privileges for the trendlogs or Enhanced Trendlog Viewer will not display the data.

▶ **To copy a URL**

1. Click the Copy URL icon at the top of the main chart area.

   The **Copy URL** dialog box opens.

2. Ensure the URL is selected (highlighted).
3. Press **Ctrl+C**.
4. Click **OK**.

 © Honeywell

5. Navigate to where you want to use the URL and then press **Ctrl+V** to paste the URL.

Exporting to CSV If you want to view trendlog data in another program, you can export the data to a comma separated value (CSV) file. Select the trendlogs and time frame you want to export and click the export icon.

If you select a large data set that will takes a long time to export, Enhanced Trendlog Viewer will ask you to confirm the operation.

Note The Export to CSV function is not available on touchscreen devices.

Panning and zooming

Navigate the data by panning through the summary and main charts and by zooming in on the main chart.

Panning

Use the panning arrows to move backward and forward through the data. You can also pan by clicking and dragging the shaded area in the summary chart

Main chart panning You can only pan across the main chart after you have zoomed in. See “Zooming” on page 197.

When you click a panning arrow next to the main chart, Enhanced Trendlog Viewer moves the selected data by 25% of the selected date/time range. Selected data is shown as a shaded area in the summary chart. When you are zoomed in, the date/time range shown in the main chart is represented as a darker shaded area within the shaded area on the summary chart.

Summary chart panning

When you click a panning arrow next to the summary chart, Enhanced Trendlog Viewer moves the selected date/time range according to the view you have selected.

Table 8.7 Panning behavior of Enhanced Trendlog Viewer

If you are in this view:	Enhanced Trendlog Viewer will move:
2-Hour / 10-Min	10 minutes
Day / 2-Hour	2 hours
Week / Day	One day
Month / Week	One week

Zooming

Select a subset of data to view by clicking and dragging in the main chart. The main chart will refresh to show the range of data selected. The axis labels on the chart will reflect the values of the zoomed view.

Horizontal zooming Zoom in on a date/time range by clicking and dragging in the main chart.

You can zoom in multiple times. To return to the un-zoomed view, double-click the main chart or click the zoom out icon.

On a touchscreen device, use standard touchscreen actions to zoom.

When you zoom in horizontally, the summary chart shows the zoomed-in time frame as a dark area in the context of the currently selected view.

Figure 8.15 Summary chart showing zoomed-in view

Vertical zooming Zoom in on a subset of data by clicking the desired starting point and dragging your mouse up or down to the desired end point.

You can zoom in multiple times. To return to the un-zoomed view, double-click the main chart or click the zoom out icon.

On a touchscreen device, use standard touchscreen actions to zoom.

Copying URLs

If you want to link to a particular trendlog view, you can copy the URL to your computer's clipboard. Then you can paste it into an email, create a link on a graphic display, or paste the URL into a web browser and bookmark it.

When you copy an Enhanced Trendlog Viewer URL, the URL includes information about the view and the trendlogs you have selected. It also includes any secondary Y-axis selections and whether secondary trendlogs are selected for display on the main chart. URLs do not include end date/time data.

Users must have view privileges for the trendlogs or Enhanced Trendlog Viewer will not display the data.

▶ **To copy a URL**

1. Click the Copy URL icon at the top of the main chart area.
2. The Copy URL dialog box opens.
3. Ensure the URL is selected (highlighted).
4. Press Ctrl+C.
5. Click OK.
6. Navigate to where you want to use the URL and then press Ctrl+V to paste the URL.

 © Honeywell

For touchscreen users

When viewed on a touchscreen device, the Enhanced Trendlog Viewer interface has a few differences from the PC interface:

- To start Enhanced Trendlog Viewer, you must type the URL in a web browser.
- Tooltips are not supported on touchscreen devices.
- CSV export is not supported on touchscreen devices.
- In the trendlog selection dialog box, after you search for trendlogs you must click the down arrow to see the trendlog list. On a PC the list is populated automatically.

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Appendix I
Off-Site Sub-Slab Depressurization System Operation and Maintenance Manual

FINAL PLAN

House #5 Operation and Maintenance Plan

Old Erie Canal Site
Clyde, New York

Parker Hannifin Corporation
Cleveland, Ohio

General Electric Company
Albany, New York

November 2007

O'BRIEN & GERE

Job No. 02109/35313

FINAL PLAN

House #5 Operation and Maintenance Plan

Old Erie Canal Site
Clyde, New York

Parker Hannifin Corporation
Cleveland, Ohio

General Electric Company
Albany, New York

Ralph E. Morse, C.P.G., Managing Scientist
O'Brien & Gere Engineers, Inc.

November 2007

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435 New Karner Road
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A Vapor Intrusion Mitigation System Documents

1. Introduction

1.1. General

This work plan describes the activities associated with the operation and maintenance (O&M) of the vapor intrusion mitigation system installed at the structure located at 155 Columbia Street, Clyde New York.

1.2. Background

Based on the soil vapor results presented in the RI Addendum No.1 Report (O'Brien & Gere, May 13, 2005), the NYSDEC required that an off-site vapor intrusion investigation be performed. The initial investigation included additional soil gas sampling, the sampling of sub-structure soil gas at residential property's located within a planned study area and the completion of an air sampling program at selected structures.

Based on the results of the indoor air sampling at House #5, the NYSDEC and NYSDOH requested that mitigation be performed at this structure. In accordance with this request, a work plan for activities associated with the design and installation of a vapor intrusion mitigation system was developed. The work plan provided a summary of the vapor intrusion mitigation system design and how it will be installed, commissioned, operated and maintained. The Vapor Intrusion Mitigation System Work Plan was subsequently submitted to NYSDEC in a June 23, 2006 letter.

2. Vapor Intrusion Mitigation System Design and Installation

2.1. Mitigation System Design

A site visit to 155 Columbia Street was conducted on April 5, 2006. The purpose of the visit was to evaluate potential mitigation measures that could be installed at this structure. As part of this site visit, an O'Brien & Gere design engineer reviewed property-specific design considerations such as the type of building construction, site layout, basement conditions, and evaluation of possible extraction points, possible exhaust piping routes, and exhaust fan locations.

In addition to evaluating building conditions, building materials that would be disturbed by the mitigation system installation were inspected for potential asbestos containing materials (ACMs). Samples of mortar, duct insulation, ceiling plaster and debris/duct insulation found on the floor were collected and sent to AmeriSci New York to be analyzed for ACMs. Laboratory results, provided in Appendix A, indicate that the duct insulation material found in the basement contains asbestos. Abscope Environmental, Inc. removed the duct insulation material on June 26, 2006. The procedures for the removal of the ACMs were conducted in accordance with the New York State Industrial Code Rule 56 and federal regulations 29CFR 1926.1101.

Based on the results of the site visit, the mitigation system that was chosen for this structure consists of a sub-slab depressurization system (SDS). The SDS includes the following:

- Trenching and installation of perforated piping in the existing basement floor
- Installation of an inaccessible crawlspace ventilation system suction point and sealing of the crawlspace
- Installation of a 4-inch thick concrete slab in the basement
- Installation of one sub-slab system suction point and a system fan and exterior housing
- Sealing of openings around crawlspace
- Installation of a sump system to remove water from below the basement floor

A SDS is designed and installed as a permanent addition to the structure. The system incorporates design features to lower the sub-slab/membrane vapor pressure, limit energy usage and avoid moisture accumulation. A SDS creates a negative pressure gradient and collects soil gas, if any, directly under the structure. Collected gases are routed from the sub-slab extraction point(s) to the atmosphere via piping attached to the exterior of the structure.

2.2. Sub-Slab Depressurization System Installation and Commissioning

The ventilation system was installed during the week of June 26, 2006. During the installation, the following tasks were completed:

1. Sealing of evident wall cracks using caulk.

2. Trenching and installation of perforated piping in the existing basement floor as shown on Figure 1 in Appendix A. Installation of SSP1 using 4-inch diameter PVC pipe at the location indicated on Figure 1 in Appendix A. The pipe was sealed to the hole in the concrete floor and rises up and

penetrates through the north wall of the structure. In this particular design, the installation crew installed a "tee" fitting to allow for installation of SSP2 that will ventilate the inaccessible crawlspace.

3. The SSP1/SSP2 pipe was routed to a Model HP-220 low pressure and high flow centrifugal fan, located on the northern exterior wall of the building. From this fan unit, a discharge stack was installed to a point 1 foot above the eave of the roof.

4. The fan unit was hardwired into the circuit breaker panel. The circuit load was tested, and a circuit exhibiting less than 80 percent load was utilized to operate the fan. A lockable switch (lockable using a tie strap) was installed between the junction box and the fan.

5. Permanent stickers were placed accordingly to identify all piping and electrical connections. A U-tube manometer was placed on the suction pipe at eye-level so the property owner can use it as an operational check of the system. The manometer will continuously measure the static pressure (vacuum) in the suction pipe.

6. Upon completion of the installation, the system was commissioned. With the fan on, communication testing was conducted utilizing the communication test points (CTP) identified on Figure 1 in Appendix A. The CTPs yielded negative sub-slab pressure readings from 0.041"wg to 0.755"wg which were above the acceptable minimum of 0.002" wg (as measured with a micro-manometer).

7. Innocuous smoke testing of pipe joints and SSP seal(s) was conducted to verify that no leaks were present in the SDS. Additionally, smoke testing was used to verify that the SDS was not creating a back-draft condition on the building's hot water heater.

8. Upon completion of commissioning activities, the property owner was briefed on the SDS components. During this step, the property owner was instructed on how to check system performance (using the U-tube manometer), and what to do in the event of a system shutdown. Electrical connections including the SDS switch and junction box tie-in location were pointed out to the property owner. The owner was given a Fact Sheet that describes the system's operation and the owner's responsibilities.

Field forms documenting the successful completion and results of the above activities are located in Appendix A. An as-built drawing was completed showing pipe routing, fan location, and electrical connections, see Figure 1 in Appendix A. Digital photographs were also taken of installed SDS components.

2.3. Post-Mitigation Sampling

Indoor air sampling was conducted following the start of the heating season, during the week of October 31, 2006. The sampling was performed beyond the NYSDOH recommended 30 day waiting period after the SDS installation and commissioning in order to collect post mitigation samples during the heating season. Three samples were collected: one basement, one indoor on the first floor, and one ambient (outside). The sampling protocol was performed in accordance with the NYSDEC-approved RI/FS Work Plan.

The results of the post mitigation air samples from house # 5 indicate that COCs were not detected at their respective practical quantitation limits. The analytical results for the air samples are summarized in Table 1.

3. Sub-Slab Depressurization System Operation and Maintenance

A routine maintenance program which includes conducting regular inspections of the ventilation system will be performed to verify the continued system performance in accordance with the design and performance criteria identified in the design and IC/OC.

Sub-slab depressurization systems are a simple, reliable, proven and the preferred method for preventing subsurface vapor intrusion into structures. The particular low pressure and high flow centrifugal fan that was be used on this project comes with a 5-year manufacturer's warranty and has a 10-year life expectancy.

As part of a long-term O&M program, the property owner has assumed primary responsibility for verifying SDS operation through periodic checks of the U-tube manometer installed at each SSP. If the owner observes a change in manometer reading, they will contact Parker-Hannifin. A telephone number was provided to the owner to be used for maintenance requests.

The owner of the building was also asked to notify Parker-Hannifin in the event that any remodeling of the structure, additions to the structure, or updating of heating units are planned. System modifications and/or re-commissioning may be necessary dependent on the structure change that takes place. These changes will be evaluated on an individual basis by Parker-Hannifin, and necessary action should be taken such that the system provides effective depressurization as designed and commissioned.

Reimbursements for the operating costs of the ventilation systems are being made directly to the property owner.

3.1. Routine inspections

The SDS should also be inspected on a routine basis. This inspection will include a visual inspection of the complete system both indoors and outdoors. Items inspected will include the majority of the items included in the original IC/OC protocol including, but not limited to:

- Recording fan and suction point vacuums,
- Inspecting the fan for mechanical operation, noise and vibration,
- Inspecting all piping and piping connections (indoors and outdoors),
- Checking the sealing of cracks in walls and floors,
- Checking the sealing of membrane installations in crawl spaces, and
- Ensuring all piping supports are properly anchored.

The vacuum readings at each suction point on the system and at the inlet of each fan are important data points when assessing system performance. This information will be compared to the original data recorded during the system's original IC/OC or the latest system inspection to confirm that the system is performing within its acceptable range of operation. If it is determined that the system is not performing within its acceptable range of operation, a complete re-commissioning of the system will be implemented until acceptable performance is attained.

Within 18 months after the first system inspection, the system will be inspected a second time. Based on a demonstration of system reliability, an alternative inspection frequency may be proposed thereafter.

3.2. Reporting to the agencies

The results of any non-routine maintenance visit and/or each routine system inspection will be reported to the agencies by summarizing the information in the monthly progress report for the period in which the visit was made.

3.3. Ongoing communications

During the second quarter of each year during the O&M program, a letter will be sent to the property owner that will remind them of the following:

- How to check on the proper operation of the system.
- To keep the systems operating on a continuous basis.
- To contact Parker-Hannifin if there will be any structure changes or new combustion appliances.
- How to contact Parker-Hannifin for non-routine maintenance.
- Upcoming routine maintenance activities, if any.
- The energy reimbursement program.

Tables

Table 1
House #5 Post Mitigtion Air Sampling Results

Old Erie Canal Site
Clyde, New York

HOUSE # 5 - Post Mitigation			
Sample ID Sample Date	AA-155COLUMBIA 11/2/2006	B-5 11/2/2006	FF-5 11/2/2006
Chemical Name			
1,1,1-Trichloroethane	0.44 U	0.44 U	0.083 U
1,1,2,2-Tetrachloroethane	0.55 U	0.55 U	0.15 U
1,1,2-Trichloroethane	0.44 U	0.44 U	0.11 U
1,1-Dichloroethane	0.32 U	0.32 U	0.091 U
1,1-Dichloroethene	0.32 U	0.32 U	0.13 U
1,2-Dibromoethane (EDB)	0.61 U	0.61 U	0.14 U
1,2-Dichlorobenzene	0.48 U	0.48 U	0.15 U
1,2-Dichloroethane	0.32 U	0.32 U	0.092 U
1,2-Dichloropropane	0.37 U	0.37 U	0.070 U
1,3-Dichlorobenzene	0.48 U	0.48 U	0.15 U
1,4-Dichlorobenzene	0.48 U	0.48 U	0.13 U
4-Methyl-2-pentanone	0.82 U	**2.7**	**1.0**
Acetone	**12**	**33**	**45**
Benzene	**0.83**	**0.55**	**2.1**
Bromodichloromethane	0.54 U	0.54 U	0.096 U
Bromoform	0.83 U	0.83 U	0.19 U
Bromomethane	0.31 U	0.31 U	0.16 U
Carbon disulfide	0.62 U	0.62 U	0.039 U
Carbon tetrachloride	0.50 U	0.50 U	**0.68**
Chlorobenzene	0.37 U	0.37 U	0.087 U
Chloroethane	0.21 U	0.21 U	0.042 U
Chloroform	0.39 U	0.39 U	**1.7**
Chloromethane	0.11 U	**0.84**	**2.2**
cis-1,2-Dichloroethene	0.32 U	0.32 U	0.17 U
cis-1,3-Dichloropropene	0.36 U	0.36 U	0.073 U
Dibromochloromethane	0.68 U	0.68 U	0.11 U
Ethylbenzene	0.35 U	**0.79**	**2.2**
Freon TF	0.61 U	0.61 U	0.074 U
M,P-XYLENE (SUM OF ISOMERS)	**1.0**	**2.6**	**5.2**
Methyl Butyl Ketone	0.82 U	0.82 U	0.20 U
Methyl Ethyl Ketone	1.2 U	**4.4**	**3.5**
Methyl tert butyl ether	1.4 U	1.4 U	0.14 U
Methylene chloride	**0.83**	0.69 U	**27**
o-Xylene	**0.40**	**0.96**	**1.7**
Styrene	**0.49**	0.34 U	**0.77**
Tetrachloroethene	0.54 U	0.54 U	0.087 U
Toluene	**2.1**	**3.7**	**12**
trans-1,2-Dichloroethene	0.32 U	0.32 U	0.22 U
trans-1,3-Dichloropropene	0.36 U	0.36 U	0.29 U
Trichloroethene	0.25 U	0.25 U	0.071 U
Trichlorofluoromethane (CFC-11)	**1.2**	**1.2**	**1.7**
VINYL ACETATE	1.4 U	1.4 U	0.18 U
Vinyl chloride	0.20 U	0.20 U	0.052 U

Notes:

1. Results are expressed in micrograms per cubic meter (ug/m3).
2. U indicates that the compound was not detected at or above the practical quantitation limit shown.
3. J indicates an estimated concentration reported by the laboratory above the method detection limit, but below the practical quantitation limit.
4. AA indicates outside ambient air sample.
5. B indicates basement or crawlspace air sample.
6. FF indicates first floor air sample.

Appendices

APPENDIX A

Vapor Intrusion Mitigation System Documents

O'BRIEN & GERE

June 23, 2006

Mr. A.C. Brown
Parker Hannifin Corporation
6035 Parkland Boulevard
Cleveland, Ohio 44124-4141

Mr. Lewis S. Streeter
Corporate Environmental Programs
General Electric Company
319 Great Oaks Boulevard
Albany, New York 12203

Re: Vapor Intrusion Mitigation System
Work Plan
155 Columbia Street
Clyde, New York

File: 35313

Dear Mr. Brown and Mr. Streeter:

Per your request, O'Brien & Gere has developed the following work plan for activities associated with the design and installation of a vapor intrusion mitigation system at the structure located at 155 Columbia Street in Clyde, New York. Installation of a mitigation system is being performed in response to comments received from the New York State Department of Environmental Conservation (NYSDEC) in an email dated March 9, 2006 from D. Pratt to A.C. Brown Parker Hannifin Corporation (Parker-Hannifin) and L. Streeter General Electric Company (GE) as further clarified in NYSDEC's April 11, 2006 letter.

Based on the results of the indoor air sampling at 155 Columbia Street, the NYSDEC and NYSDOH have requested that mitigation be performed at this structure. In accordance with this request, mitigation measures have been offered for this structure. This work plan provides a summary of the vapor intrusion mitigation system design and how it will be installed, commissioned, operated and maintained. Also included is a schedule for the system installation and commissioning.

Mitigation system design

A site visit to 155 Columbia Street was conducted on April 5, 2006. The purpose of the visit was to evaluate potential mitigation measures that could be installed at this structure. As part of this site visit, an O'Brien & Gere design engineer reviewed property-specific design considerations such as the type of building construction, site layout, basement conditions, and evaluation of possible extraction points, possible exhaust piping routes, and exhaust fan locations.

In addition to evaluating building conditions, building materials that would be disturbed by the mitigation system installation were inspected for potential asbestos containing materials (ACMs). Samples of mortar, duct insulation, ceiling plaster and debris/duct insulation found on the floor were collected and sent to AmeriSci New York to be analyzed for ACMs. Laboratory results, provided in Attachment A, indicate that the duct insulation material found in the basement contains asbestos. Therefore, a New York State licensed and certified asbestos abatement contractor will remove the duct insulation material that will be disturbed during installation of the vapor intrusion mitigation system. The contractor will follow the New York State Industrial Code Rule 56 and federal regulations 29CFR 1926.1101.

Based on the results of the site visit, the mitigation system chosen for this structure consists of a sub-slab depressurization system (SDS). The SDS would include the following:

- Trenching and installation of perforated piping in the existing basement floor
- Installation of an inaccessible crawlspace ventilation system suction point and sealing of the crawlspace
- installation of a 4-inch thick concrete slab in the basement
- Inspection of the interior block wall and sealing of the block openings, if necessary
- installation of one sub-slab system suction point and a system fan and exterior housing
- Sealing of openings around crawlspace
- installation of a sump system to remove water from below the basement floor

A SDS would be designed and installed as a permanent, integral addition to the structure. The system would incorporate design features to lower the sub-slab/membrane vapor pressure, limit energy usage and avoid moisture accumulation. A SDS creates a negative pressure gradient and collects soil gas directly under the structure. Collected gases are routed from the sub-slab extraction point(s) to the atmosphere via piping attached to the exterior of the structure.

Sub-slab depressurization system installation and commissioning

The ventilation system will be installed at a time scheduled between the installation crew and the property owner. During the installation, the following will occur:

1. Sealing of evident wall cracks using caulk.

2. Trenching and installation of perforated piping in the existing basement floor as shown on Figure 1. Installation of SSP1 using 4-inch diameter PVC pipe at the location indicated on Figure 1. The pipe will be sealed to the hole in the concrete floor and rise up and penetrate through the north wall of the structure. In this particular design, the installation crew will install a "tee" fitting to allow for installation of SSP2 that will be used to ventilate the inaccessible crawlspace.

3. The SSP1/SSP2 pipe will be routed to a Model HP-220 low pressure and high flow centrifugal fan, located on the northern exterior wall of the building. From this fan unit, a discharge stack will be installed to a point at least 1 foot above the eave of the roof.

4. The fan unit will be hardwired into an existing junction box or directly into the circuit breaker panel. The circuit load will be tested, and only a circuit exhibiting less than 80 percent load will be utilized to operate the fan. A lockable switch (lockable using a tie strap) will be installed between the junction box and the fan.

5. Permanent stickers will be placed accordingly to identify all piping and electrical connections. A U-tube manometer will be placed on the suction pipe at eye-level so the property owner can use it as an operational check of the system. The manometer will continuously measure the static pressure (vacuum) in the suction pipe.

6. Upon completion of the installation, the system will be commissioned. With the fan on, communication testing will be conducted utilizing the communication test points (CTP) identified on Figure 1. The system will be considered effective if each CTP yields negative sub-slab pressure greater than <0.002"wg (as measured with a micro-manometer). Communication testing will again be conducted to verify effective communication in all quadrants of the slab.

7. Innocuous smoke testing of pipe joints and SSP seal(s) will be conducted to verify that no leaks are present in the SDS. Additionally, smoke testing will be used to verify that the SDS has not created a back-draft condition on the building's hot water heater.

8. Upon completion of commissioning activities, the property owner will be briefed on the SDS components. During this step, the property owner will be instructed on how to check system performance (using the U-tube manometer), and what to do in the event of a system shutdown. Electrical connections including the SDS switch and junction box tie-in location will be pointed out to the property owner. The owner will be given a Fact Sheet that describes the system's operation and the owner's responsibilities.

The successful completion and results of the above activities will be documented on field forms (examples of which are contained in Attachment B of this document). Digital photographs will also be taken of installed SDS components. An as-built drawing will be completed showing pipe routing, fan location, and electrical connections. The documentation and drawing will be submitted to the Department for its records.

Post-mitigation sampling

To confirm the effectiveness of the SDS at lowering vapor intrusion, indoor, sub-slab and outdoor air sampling will be conducted. Four samples will be collected: one sub-slab, one basement, one indoor on the first floor, and one ambient. The sampling protocol will be performed in accordance with the NYSDEC-approved RI/FS Work Plan with the exception that the analytical laboratory will be instructed to achieve a reporting limit of 0.25 micrograms per cubic meter for TCE.

The post-mitigation sampling will be performed no less than 30 days after installation and commissioning of the system. In order to obtain data representative of heating season conditions, the post-mitigation sampling is tentatively scheduled to be performed in late October/early November 2006. However, this timeframe may vary depending on weather conditions.

A letter report will be submitted to the State within six weeks after sample collection. The letter will present the results of the sampling and include the laboratory reports.

Sub-slab depressurization system operation and maintenance

Sub-slab depressurization systems are a simple, reliable, proven and the preferred method for preventing subsurface vapor intrusion into structures. The particular low pressure and high flow centrifugal fan that will be used on this project comes with a 5-year manufacturer's warranty and has a 10-year life expectancy.

As part of a long-term operation and maintenance (O&M) program, the property owner will assume primary responsibility for verifying SDS operation through periodic checks of the U-tube manometer installed at each SSP. If the owner observes a change in manometer reading, they will contact Parker-Hannifin. A telephone number will be provided to the owner to be used for maintenance requests.

The owner of the building will also be asked to notify Parker-Hannifin in the event that any remodeling of the structure, additions to the structure, or updating of heating units are planned. System modifications and/or re-commissioning may be necessary dependent on the structure change that takes place. These changes will be evaluated on an individual basis by Parker-Hannifin, and necessary action should be taken such that the system provides effective depressurization as designed and commissioned.

The SDS should also be inspected on a routine basis. O'Brien and Gere will complete the initial O&M inspection within 18 months of its original commissioning date. The inspection will consist of a visual inspection of the components both indoors and outdoors. An inspection of the fan will focus on noise, vibration, and operational issues. Piping, piping connections, and piping supports will be checked. Manometer readings at the fan and at each SSP will be recorded and compared to commissioned values. If the readings indicate possible degradation of the sub-slab depressurization, communication testing will be conducted to evaluate whether the depressurization had dropped below 0.002"wg. If it has, the system will be modified and re-commissioned. Inspections and tests will be documented. Subsequent inspections should follow the same schedule of 18-month intervals until such a time that the necessity of the SDS operation is re-evaluated by the Department and NYSDOH.

Schedule

The asbestos removal from the basement is scheduled to be completed on June 26, 2006. Installation and commissioning of the SDS are also scheduled to be completed during the week of July 10, 2006. We anticipate that it will require approximately four days to complete the installation and commissioning. The documentation and drawing discussed above will be submitted within four weeks thereafter.

We appreciate the opportunity to provide continued services to Parker-Hannifin and GE. Should you have any questions regarding this scope of work or schedule, please do not hesitate to contact me at (518) 452-9392 at your convenience.

Very truly yours,

O'BRIEN & GERE ENGINEERS, INC.

Ralph E. Morse, C.P.G.
Managing Scientist

VI Mitigation System WP_155 Columbia St_Rev1.doc

cc: Douglas M. Crawford, P.E. - O'Brien & Gere
John Kleniatis, P.E. – O'Brien & Gere
Paul Mazurkiewicz, P.E. – O'Brien & Gere

Attachment A

Asbestos Sample Results

AMERI SCI

AmeriSci New York
117 EAST 30TH STREET
NEW YORK, NY 10016
TEL: (212) 679-8600 • FAX: (212) 679-9392

PLM Bulk Asbestos Report

O'Brien & Gere Engineers, Inc.
Attn: John Shaheen
5000 Brittonfield Parkway
East Syracuse, NY 13057

Date Received 04/14/06 **AmeriSci Job No.**206042709
Date Examined 04/15/06 **P.O. #** 35313-009.009
ELAP Number 11480 **Page** 1 **of** 2
RE 35313-009.009; Parker Hannifin; Vapor Mitigation 155 Columbia

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
W1-1	206042709-01	*No*	NAD

Location: Basement - White Mortar

Description: White, Homogeneous, Non-Fibrous, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 100. %

W1-2	206042709-02	*No*	NAD

Location: Basement - Gray Mortar

Description: Grey, Homogeneous, Non-Fibrous, Cementitious, Bulk Material
Asbestos Types:
Other Material: Non-fibrous 100. %

T1-1	206042709-03	*Yes*	57 %

Location: Basement - Duct Insulation

Description: Grey, Homogeneous, Non-Fibrous, Bulk Material
Asbestos Types: Chrysotile 57. %
Other Material: Cellulose 10. %, Non-fibrous 33. %

T2-1	206042709-04	*No*	NAD

Location: Basement - Debris / Duct Insulation

Description: Black, Homogeneous, Fibrous, Bulk Material
Asbestos Types:
Other Material: Cellulose 80. %, Non-fibrous 20. %

C1-1	206042709-05	*No*	NAD

Location: Basement - Ceiling Plaster

Description: Brown, Homogeneous, Non-Fibrous, Cementitious, Bulk Material
Asbestos Types:
Other Material: Animal hair 2. %, Cellulose 1. %, Non-fibrous 97. %

AmeriSci New York
117 EAST 30TH STREET
NEW YORK, NY 10016
TEL: (212) 679-8600 • FAX: (212) 679-9392

PLM Bulk Asbestos Report

O'Brien & Gere Engineers, Inc.
Attn: John Shaheen
5000 Brittonfield Parkway
East Syracuse, NY 13057

Date Received 04/14/06 **AmeriSci Job No.**206042709
Date Examined 04/15/06 **P.O. #** 35313-009.009
ELAP Number 11480 **Page** 2 **of** 2
RE 35313-009.009; Parker Hannifin; Vapor Mitigation 155 Columbia

Reporting Notes:

Analyzed by: Charmel Dozier

*NAD/NSD =no asbestos detected;NA =not analyzed; NA/PS=not analyzed/positive stop;PLM Bulk Asbestos Analysis by EPA 600/M4-82-020 per 40 CFR 763 (NVLAP Lab #200546-0) and ELAP PLM Analysis Protocol 198.1 for New York friable samples and 198.6 for NOB samples (NYSDOH ELAP Lab#11480);Note:PLM is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. TEM is currently the only method that can be used to determine if this material can be considered or treated as non asbestos-containing in NY State (also see EPA Advisory for floor tile,FR 59,146,38970,8/1/94). National Institute of Standards and Technology Accreditation requirements mandate that this report must not be reproduced except in full without the approval of the lab. This PLM report relates ONLY to the items tested. AIHA# 102843.

Reviewed By:

Attachment B

Field Forms

O'BRIEN & GERE

Installation and Operation Commissioning Checklist

Structure Address: 155 Columbia Street **Date of Commissioning Visit:** 7/21/2006

Structure ID #: NA

Commissioning Engineer Team: JK, JB, BW, MH

System Performance Data

Fan Inlet Static Pressure (vacuum)

Fan System	1
Fan Model	HP220
U-Tube Reading ("w.g)	2

Is each fan mounted securely? ☑ Yes ☐ No

SSP Static Pressure (vacuum)

SSP#	Static Pressure ("w.g.)	Fan System
1	2.0	1
2	2.0	1
3	NA	1

Final Communication Test Results

Communication test point	A	B	C	D
Manometer reading ("w.g.)	0.043	0.755	0.041	0.285
Distance to closest SSP (ft.)	9	2.5	5.5	5.5

Were all fans in operation during final communication test? ☑ Yes ☐ No

Were all valves locked prior to final communication test? ☑ Yes ☐ No ☐ NA

Was the pressure reading at each test point • -0.002"w.g.? ☑ Yes ☐ No

Were winter conditions simulated during test? ☑ Yes ☐ No

Was there precipitation during the previous 24 hours? ☑ Yes ☐ No

What was the apparent wind speed? ☑ Calm ☐ Light ☐ Strong

Accessible Crawlspace Performance Inspection

Was each membrane joint and perimeter smoke tested and found to be sealed? ☐ Yes ☐ No ☑ NA

Inaccessible Crawlspace Data ☐ NA

	Crawlspace 1
SSP#	3
Crawlspace volume (ft^3)	395
Suction pipe diameter (in.)	1.5
Measured velocity (fpm)	276
Flow rate out of crawlspace (cfm)	3.9
Number of air exchanges	0.59
Meets criteria (Yes/No)	Yes

Backdraft Test Results

Was commissioning backdraft test performed? ☑ Yes ☐ No

On what combustion appliances was a backdraft test performed? ☑ Hot Water Heater ☑ Furnace / Boiler ☐ Dryer
Other: _____

Is there is a backdraft on any appliance? ☐ Yes ☑ No
(If yes, explain)*

_____

_____

*If backdraft exists, please notify the property owner.
Owner was notified on: (date) _____

Electrical System Installation Inspection

Are all electrical connections secure? ☑ Yes ☐ No

Are all switches locked on? ☑ Yes ☐ No

Electric meter #: 52 538 934

Pipe System Performance

Are all pipe runs properly supported? ☑ Yes ☐ No

Were 10% of all pipe joints smoke tested? ☑ Yes ☐ No

Are manometers installed at each suction point? ☑ Yes ☐ No

Slab/Wall Repair Performance

Was each identified slab/wall crack repair smoke tested? ☑ Yes ☐ No ☐ NA

Labeling Inspection

Are the appropriate labels applied in the proper locations? ☑ Yes ☐ No

Exhaust Vents

Are all system pipe exhausts above the roof eave?	☑ Yes	☐ No
At least 10 ft above ground level?	☑ Yes	☐ No
At least 10 ft away from any adjoining or adjacent buildings, or structure opening or HVAC intake?	☑ Yes	☐ No

Documentation

Were digital photographs taken of post-installation conditions?	☑ Yes	☐ No

Comments:

NA

WASTE SHIPMENT RECORD

REPORT DATE

GENERATOR

1. Work site name and mailing address
SHARP RESIDENCE JOB # 26065
155 COLUMBIA STREET
CLYDE, NY 14433-1044

Owner's Name
SHARP RESIDENCE
"SEE BELOW"

Owner's telephone no.
(315)
923-1413

2. Operator's name and address
ABSCOPE ENVIRONMENTAL, INC. - PROFILE # 506306
1 COMMERCIAL DRIVE
CANASTOTA, NY 13032

Operator's telephone no.
(315)
697-8437

3. Waste Disposal Site (WDS)
Name HIGH ACRES LANDFILL
Mailing Address 425 PERINTON PARKWAY
FAIRPORT, NY 14450
Physical Site Location 425 PERINTON PARKWAY, FAIRPORT, NY

WDS telephone no. 585-223-6132

Additional Information WORK SITE:
SHARP RESIDENCE
155 COLUMBIA ST.
CLYDE, NY 14433

4. Name and address of responsible agency
USEPA, REGION II
26 FEDERAL PLAZA
NEW YORK, NY 10278

5. Description of materials	6. Containers No.	Type	7. Total quantity m^3 (yd^3)
RQ, ASBESTOS, 9, NA2212, III	1	BA	2 (2 YDS)

8. Special handling instructions and additional information

9. OPERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.

Printed/typed name & title	Signature	Month Day Year
Robert Canova (Disp. Supervisor)	Robert Canova	6 - 26 - 06

TRANSPORTER

10. Transporter 1 (Acknowledgment of receipt of materials)

Printed/typed name & title	Signature	Month Day Year
Robert Canova (Driver)	Robert Canova	6 26 06
Address and telephone no. 1 COMMERCIAL DRIVE CANASTOTA, NY 13032 315-697-8437		

11. Transporter 2 (Acknowledgment of receipt of materials)

Printed/typed name & title	Signature	Month Day Year
Address and telephone no.		

DISPOSAL SITE

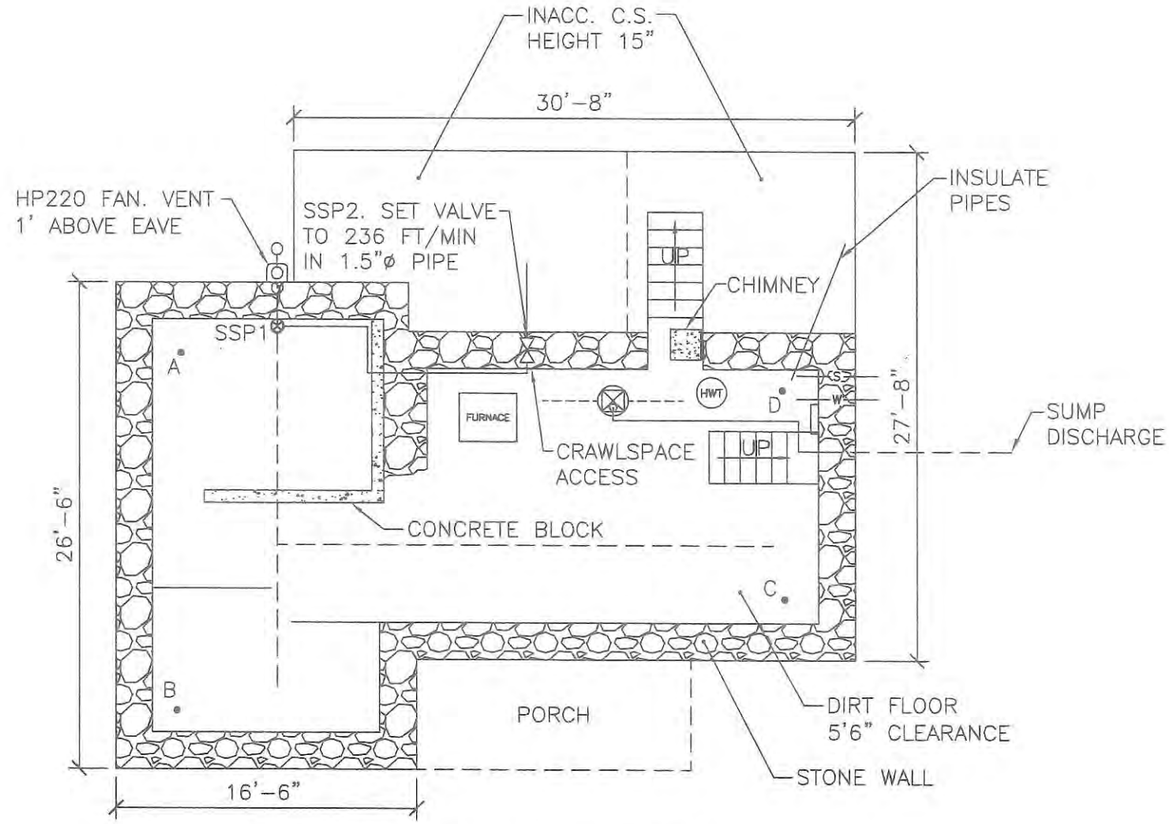
12. Discrepancy indication space

13. Waste disposal site owner or operator: Certification of receipt of asbestos materials covered by this manifest except as noted in Item 12.

Grid Coordinates East ____ North ____ El ____

Printed/typed name & title	Signature	Month Day Year
Paula Schnitzer Dale Lyon		6 26 06

DWG PATH: C:\P-H\155-COLUMBIA.DWG



BASEMENT FLOOR PLAN

SCALE: 1/8" = 1'-0"

GENERAL NOTES:

1. DIMENSIONS SHOWN ON FIGURE ARE APPROXIMATE INSTALLATION LOCATIONS AND SHALL BE FIELD VERIFIED BY INSTALLATION CREW.
2. INSTALLATION CREW SHALL GROUT AND/OR CAULK ALL MAJOR CRACKS AND OPENINGS THAT WOULD IMPAIR VENTILATION SYSTEM PERFORMANCE.
3. INSTALLATION CREW SHALL VERIFY ELECTRICAL TIE-IN LOCATION.
4. INSTALLATION CREW SHALL SECURE EQUIPMENT AND PIPING TO PREVENT ANY MOVEMENT.
5. INSTALL BLADEX VALVES ON ALL SYSTEM SUCTION POINTS.

CRAWLSPACE: 334 cu. ft.

ASBUILT XX/XX/XX

FIGURE 1

LEGEND

- S — SEWER
- G — NATURAL GAS
- W — WATER
- E — ELECTRICAL
- HVAC — HVAC DUCT
- PIPE/DUCT DOWN
- PIPE/DUCT UP
- EXISTING WALL
- WINDOW
- DOOR
- STAIRWAY
- HOT WATER TANK (HWT)
- BOILER
- FURNACE
- J — JUNCTION BOX
- S — FAN SWITCH
- CIRCUIT BREAKER PANEL
- SUMP PUMP
- FLOOR DRAIN
- COMMUNICATION TEST SUCTION HOLE (CTSH)
- COMMUNICATION TEST SUCTION HOLE AND SYSTEM SUCTION POINT
- SYSTEM SUCTION POINT (SSP)
- COMMUNICATION TEST POINT (CTP)
- NEW EXHAUST RISER PIPE
- NEW EXHAUST PIPE

PARKER HANNIFIN
MITIGATION PROGRAM

BASEMENT
FLOOR PLAN

155 COLUMBIA STREET
STRUCTURE 001

8 0 8

1/8"=1'-0"

FILE NO. 35313.XXX.XXX
APRIL 5, 2006

O'BRIEN & GERE
ENGINEERS INC.

Plot Date: 4/6/06 JK

Appendix J
Remedial System Optimization Table of Contents

Appendix J

Remedial System Optimization Table of Contents

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4.1.1 Source Reduction/Treatment
4.1.2 Sampling
4.1.3 Conceptual Site Model (Risk Assessment)
4.2 RECOMMENDATIONS TO IMPROVE PERFORMANCE
4.2.1 Maintenance Improvements
4.2.2 Monitoring Improvements
4.2.3 Process Modifications
4.3 RECOMMENDATIONS TO REDUCE COSTS
4.3.1 Supply Management
4.3.2 Process Improvements or Changes
4.3.3 Optimize Monitoring Program
4.3.4 Maintenance and Repairs
4.4 RECOMMENDATIONS FOR IMPLEMENTATION