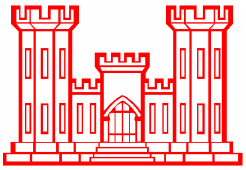
FINAL

ADDENDUM
SOURCE AREA REMEDIATION
GASOLINE ALLEY, AREA 3805C
FORT DRUM, NEW YORK

Contract DACA31-01-D-0031
Task Order 0003

Prepared for:



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CAPE Project 20031.003
August 2007

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LIST OF ABBREVIATIONS AND ACRONYMS

AAS	aquifer air sparging
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CAPE	CAPE, Inc.
CHSM	Corporate Health and Safety Manager
CQCSM	Contractor Quality Control System Manager
CSS	Construction Site Superintendent
LNAPL	light nonaqueous-phase liquid
OSL	Old Sanitary Landfill
PGM	Program Manager
PM	Project Manager
psi	pounds per square inch
QA	quality assurance
QA Director	Director of Quality Assurance
QCM	Quality Control Manager
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
USACE	U.S. Army Corps of Engineers
UST	underground storage tank

1.0 INTRODUCTION

This document is an addendum to the Source Area Remediation Gasoline Alley, Areas 3805 and 1995 at Fort Drum, New York. It contains specific information regarding the addition of 18 Aquifer Air Sparging (AAS) wells in Area 3805. The objective of this modification is to address the concern that contaminated environmental media, in the form of a dissolved-phase BTEX (benzene, toluene, ethylbenzene, and total xylenes) plume, is migrating, unimpeded, outside the source area toward the Old Sanitary Landfill (OSL) area. Specifically, it is assumed that the placement of 18 additional AAS wells on the northwest (eight AAS wells) and southeast (10 AAS wells) sides of the existing well field (3805C system) will act as an *in situ* barrier and prevent further contaminant migration.

1.1 Site Background and Description

Previous investigations indicated that an extensive free-product plume extends from the former underground storage tank (UST) areas between Oneida and Ontario avenues on Fort Drum. This area is known as "Gasoline Alley." The vadose zone in the area of the former USTs is impacted with petroleum hydrocarbons. In addition, light nonaqueous-phase liquid (LNAPL) and petroleum hydrocarbons are present at the water table interface and extend approximately 1,000 feet hydraulically downgradient in a northeastern direction from Area 3805 and approximately 500 feet hydraulically downgradient in a northwestern direction from Area 1995. A dissolved-phase petroleum hydrocarbon groundwater plume extends northeast of the Area 3805 former UST areas and northwest of the Area 1995 former UST areas toward the OSL. A dissolved-phase petroleum hydrocarbon groundwater plume extends nearly 2,500 feet northeast of the Area 3805 former UST areas. Contaminated groundwater discharges to a creek on the site and has impacted both the surface water and sediment associated with the creek.

2.0 KEY PERSONNEL

The following is a list of key personnel assigned to conduct the remedial actions outlined in this addendum:

- Program Manager (PGM), Dave Bettendorf, Professional Geologist, (240) 276-1994, Cell (240) 625-4409
- Project Manager (PM), Greg Birch, (410) 751-2622
- Director of Quality Assurance (QA Director), Chris Caviness, Professional Engineer, *Juris Doctor,* (770) 908-7200
- Corporate Quality Assurance/Quality Control Manager (QA/QCM), Henry Vaca, (770) 908-7200
- Corporate Health and Safety Manager (CHSM), Glen Mayekawa, (714) 599-7099
- Contractor Quality Control System Manager (CQCSM), Eric Lynch, (610) 594-8606, Cell (484) 467-7232

- Construction Site Superintendent (CSS), John Hudacek, (516) 449-6578
- Site Safety and Health Officer (SSHO), Eric Lynch, (610) 594-8606, Cell (484) 467-7232
- Site Geologist, Thomas West, (443) 276-2078.

3.0 SCOPE OF WORK

This Addendum for Source Area Remediation at Area 3805C, Fort Drum, New York, has been developed to outline the activities needed to address the concern that contaminated environmental media, in the form of a dissolved-phase BTEX plume, is migrating, unimpeded, outside the source area toward the OSL area. The scope of work covered by this addendum includes the installation of 18 additional AAS wells within Area 3805C. It is assumed that installation of these 18 additional wells will not require the construction of an additional treatment system; rather, the wells will tie into the existing 3805C treatment system. The primary field activities include the following:

- Mobilization
- Site preparation
  - Limited clearing and grubbing
  - Site survey
  - Well siting
  - Safety and erosion control measure installation
- Well installation
  - Drill rig mobilization
- Well development
- Modification (piping) to current air sparge system (3805C system)
- Well field piping/vault installation
  - Excavator mobilization
- Electrical installation
- System start-up
- Site restoration
- Demobilization.

A project schedule for completion of the above-mentioned activities is presented in Appendix A. The following sections outline the construction activities associated with completion of the remedial action presented in this addendum.

4.0 PRECONSTRUCTION AND CONSTRUCTION ACTIVITIES

4.1 Basis of Design

Specific information regarding well construction, system design/modification, operation, and well pipe "tie-in" are presented in the *Basis of Design: Area 3805 "C" Expansion Remedial Design/Remedial Action* presented in Appendix B. In summary, the additional operating pressure of 8 pounds per square inch (psi) (cumulative) is within the capacity of the existing 10-psi blower. The required operating air flow, following system modifications, of 84 cubic feet per minute can be accomplished by adjusting the speed of the existing blower (Sutorbilt 3M with 7.5-horsepower motor) to 2,240 revolutions per minute. This can be accomplished by resizing and replacing the blower and/or motor sheaves. The expansion of the air sparging system will include heat tracing in the 18 new well vaults and heat tracing the exposed sections of the three new header lines near the existing equipment trailer. It has been determined that the existing electrical service (460-Volt/200-amp/three-phase) at Area 3805C is sized to accommodate the electrical requirement of the additional heat tracing.

4.2 Mobilization

It is anticipated that personnel associated with completion of the remedial action activities at Area 3805C will mobilize to the site on April 3, 2007. The Construction Site Superintendent will coordinate with the Fort Drum Contracting Officer's Representative to ensure that all employees and vehicles are properly identified before entering the site.

Equipment mobilization is anticipated to include the following (at minimum):

- Personnel/Area monitoring equipment (as discussed in the Site Safety and Health Plan (SSHP) [CAPE,2003])
- Personnel and equipment
- Sampling equipment
- Well drilling rigs
- Miscellaneous construction materials (hand tools, shovels, hoses, etc.)
- Backhoe, excavator, compactor

All construction on site will strictly adhere to the CAPE, Inc. (CAPE) SSHP (CAPE, 2003a), and U.S. Army Corps of Engineers (USACE) Safety Manual, EM 385-1-1. The CAPE Safety and Health Manager has developed activity hazard analysis sheets for the anticipated activities associated with excavation/trenching activities, construction and installation of the AAS wells, electrical, and mechanical connections of the surface equipment. These activity hazard analyses are included in the USACE-approved SSHP.

4.3 Site Preparation

Site preparation will consist of the construction of support features such as orange safety fence, erosion-control measures, vehicle decontamination area, clearing and grubbing activities, and utility clearance investigations. To date, all well locations and associated trenching areas have been sited. Table 1 presents the coordinates for the 18 AAS wells to be installed as part of this task.

4.4 Well Installation

A total of 18 additional AAS wells will be installed within the boundaries of Area 3805C. Drawings C-2, C-3, and C-4 (in Appendix C) identify the location of all new wells to be installed. In addition, Table 1 provides the coordinates as well as ground surface elevation for each well scheduled to be installed. All wells will be installed as outlined in the *Work Plan for Source Area Remediation, Gasoline Alley Areas 3805 and 1995 at Fort Drum, New York*, which was submitted under separate cover.

4.5 Modification to 3805C System

To accommodate the addition of 18 new AAS wells, the air sparge treatment system (3805C system) piping will be modified. Modifications will be made in accordance with all design documentation, and are presented in Appendix C, Drawing C-5.

4.6 Well Field Piping/Vault Installation

The location of the AAS pipeline trench and excavation trench details for the installation of the 18 new AAS wells in Area 3805 are detailed on the drawings presented in Appendix C. Excavated material will be segregated to identify unsuitable backfill material and contaminated material that has a photoionization detector reading greater than 10 parts per million. All unsuitable and/or contaminated material will be transported via dump truck to the "Soil Barn" located just north of Route 26, adjacent to the Gasoline Alley entrance. However, based on the construction of the original Area 3805 "C" system, where all the excavated material was returned to the trench, it is not anticipated that any unsuitable backfill will be encountered.

An excavator will be used to excavate the pipeline trench (approximately 1,500 linear feet). Trench widths will vary from 2 feet to 4 feet in width according to the number of pipelines being installed at different locations of the pipeline layout. The depth of the trench will be no greater than 6.5 feet deep, but all trenches/excavations deeper than 4 feet will be benched and/or sloped. The trench bottom will be continuous, relatively smooth, and free of rocks. In the unlikely event that hardpan or boulders are encountered, the trench bottom will be padded using a minimum of 4 inches of tamped sand beneath the pipe. The trench depth will allow for the top of the pipe to be at least 5 feet below ground surface.

The trench will be excavated to the required alignment and depth shown on the construction drawings (Appendix C), and only so far in advance of pipe-laying that will allow for testing and backfilling operations to occur while new trench is being excavated.

Wellheads will be protected from weather and traffic by installing steel well vaults surrounded by concrete over each AAS well. Vault covers for all wells will be rated for water loading. Well vault and cover details are shown in Appendix C, Drawing C-4.

Self-regulating heating cables will be installed to provide freeze protection to the AAS piping within the wellhead vaults (Appendix C, Drawing C-5). The heat output of the cable varies in response to the surrounding conditions along the entire length of a circuit. Whenever the heat loss of the pipe increases (as ambient temperature drops), the heat output of the cable increases. Conversely, when the heat loss decreases (as the ambient temperature rises or product flows), the cable reacts by reducing its heat output.

All dewatering, pipe installation, welding, leak testing, backfill and compaction, pipe marking, and site restoration will strictly follow the procedures outlined in the *Work Plan for Source Area Remediation, Gasoline Alley Areas 3805 and 1995 at Fort Drum, New York* (CAPE, 2003b), which was submitted under separate cover.

4.7 Site Restoration

Every effort will be made to minimize the impact of field activities on facility operations and the surrounding natural environment. All equipment will be secured at the end of each day. Equipment will not be left unattended in the work zone. In addition to the normal housekeeping procedures typically employed on work sites, the work areas will be policed for any garbage and be completely picked up and restored to as natural a condition as practical at the conclusion of daily activities. Excavations and any equipment or vehicular ruts that occur as a result of work performance will be backfilled and dressed to conform to the existing landscape.

4.8 Well Operational Sequence

The planned operational sequence is to alternate operation of the "front" line and "back" line on a weekly basis. The switch will be performed manually using valves at the proposed manifold.

4.9 Performance Monitoring

Area monitoring wells are sampled biannually as part of a base-wide sampling plan. Data from monitoring wells downgradient of the sparging line will be evaluated to monitor the effectiveness of the sparging line. In addition, dissolved oxygen, depth-to-water, and subsurface pressure data are routinely collected as part of EA Engineering's operations and maintenance activities at the subject site.

5.0 REFERENCES

CAPE, Inc., 2003a. *Site Safety and Health Plan for Source Area Remediation Gasoline Alley Areas 3805 and 1995, Fort Drum, New York.*

CAPE, Inc., 2003b. *Final Work Plan for Source Area Remediation Gasoline Alley, Areas 3805 and 1995 at Fort Drum, New York*

TABLES

Table 1

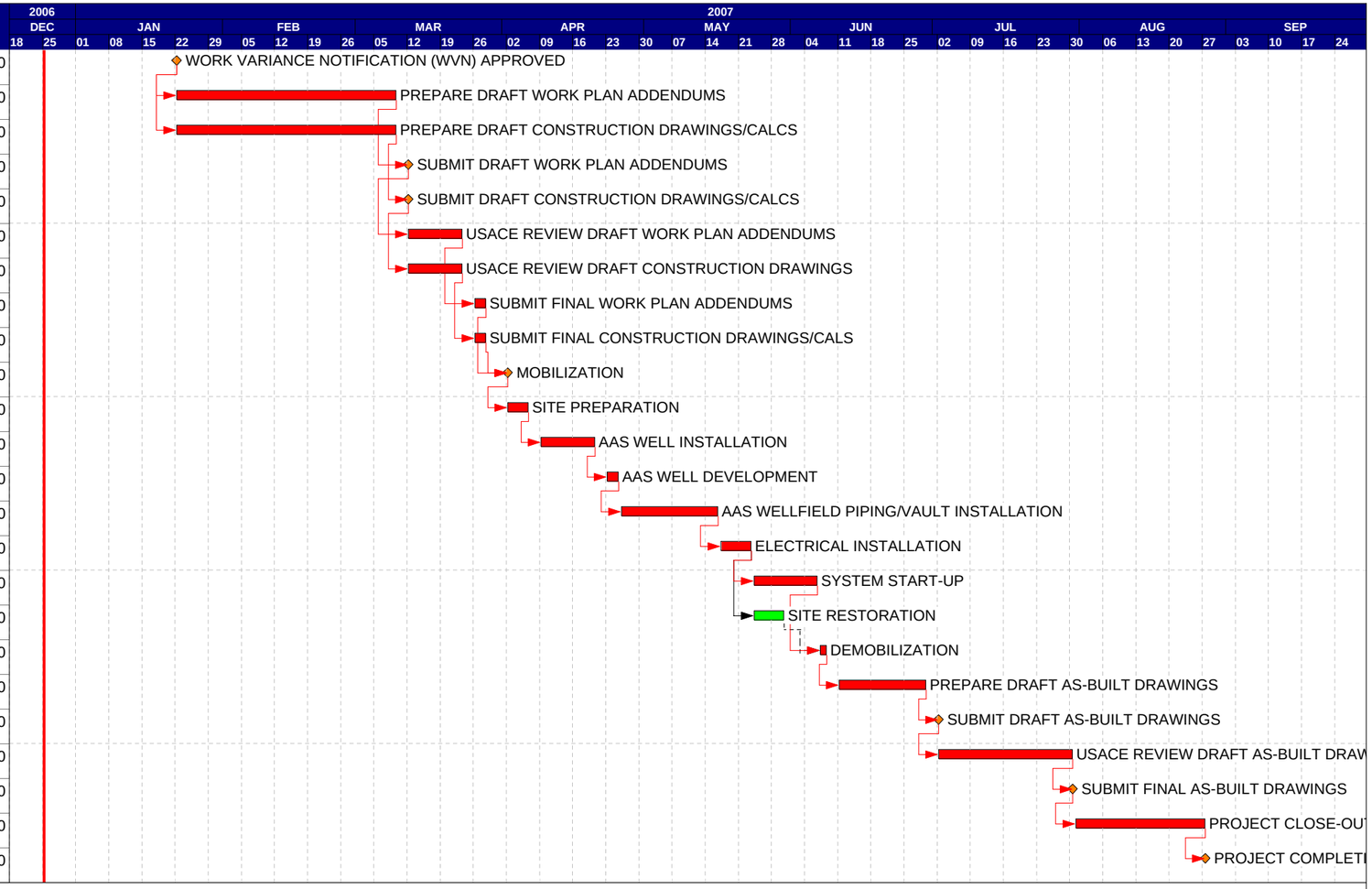
AAS WELL COORDINATES:
AREA 3805

Well Name	Northing	Easting	Ground Surface Elevation (ft AMSL)	AAS Screen (ft bgs)
2-7A	1476077.77	1041394.32	653.90	33.60
2-8A	1476100.36	1041461.72	652.35	31.25
2-9A	1476029.34	1041451.58	655.30	33.70
2-10A	1476051.93	1041518.99	654.35	32.05
2-11A	1475980.92	1041508.85	656.70	33.60
2-12A	1476003.50	1041576.25	655.20	31.70
2-13A	1475932.49	1041566.12	657.40	33.30
2-14A	1475952.75	1041631.62	657.90	33.40
2-15A	1475884.06	1041623.39	658.55	33.05
2-16A	1475906.65	1041690.79	659.00	32.00
2-17A	1476490.04	1040997.86	652.40	37.60
2-18A	1476419.40	1040987.78	650.98	35.98
2-19A	1476441.99	1041055.18	652.98	37.58
2-20A	1476371.60	1041045.05	651.05	35.15
2-21A	1476393.94	1041112.50	652.55	36.45
2-22A	1476323.55	1041102.37	651.15	34.75
2-23A	1476345.89	1041169.82	652.30	35.40
2-24A	1476275.26	1041159.74	652.15	35.05

APPENDIX A

PROJECT SCHEDULE

Act ID	Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float	%
1000	WORK VARIANCE NOTIFICATION (WVN)	0	0	22JAN07 *		0	0
1010	PREPARE DRAFT WORK PLAN ADDENDUMS	35d	35d	22JAN07	09MAR07	0	0
1020	PREPARE DRAFT CONSTRUCTION	35d	35d	22JAN07	09MAR07	0	0
1030	SUBMIT DRAFT WORK PLAN ADDENDUMS	0	0	12MAR07		0	0
1040	SUBMIT DRAFT CONSTRUCTION	0	0	12MAR07		0	0
1050	USACE REVIEW DRAFT WORK PLAN ADDENDUMS	10d	10d	12MAR07	23MAR07	0	0
1060	USACE REVIEW DRAFT CONSTRUCTION	10d	10d	12MAR07	23MAR07	0	0
1070	SUBMIT FINAL WORK PLAN ADDENDUMS	3d	3d	26MAR07	28MAR07	0	0
1080	SUBMIT FINAL CONSTRUCTION DRAWINGS/CALS	3d	3d	26MAR07	28MAR07	0	0
1090	MOBILIZATION	0	0	02APR07		0	0
1100	SITE PREPARATION	5d	5d	02APR07	06APR07	0	0
1110	AAS WELL INSTALLATION	10d	10d	09APR07	20APR07	0	0
1120	AAS WELL DEVELOPMENT	3d	3d	23APR07	25APR07	0	0
1130	AAS WELLFIELD PIPING/VAULT INSTALLATION	15d	15d	26APR07	16MAY07	0	0
1140	ELECTRICAL INSTALLATION	5d	5d	17MAY07	23MAY07	0	0
1150	SYSTEM START-UP	10d	10d	24MAY07	06JUN07	0	0
1160	SITE RESTORATION	5d	5d	24MAY07	30MAY07	5d	0
1170	DEMOBILIZATION	2d	2d	07JUN07	08JUN07	0	0
1180	PREPARE DRAFT AS-BUILT DRAWINGS	15d	15d	11JUN07	29JUN07	0	0
1190	SUBMIT DRAFT AS-BUILT DRAWINGS	0	0	02JUL07		0	0
1200	USACE REVIEW DRAFT AS-BUILT DRAWINGS	20d	20d	02JUL07	30JUL07	0	0
1210	SUBMIT FINAL AS-BUILT DRAWINGS	0	0		30JUL07	0	0
1220	PROJECT CLOSE-OUT	20d	20d	31JUL07	27AUG07	0	0
1230	PROJECT COMPLETION	0	0		27AUG07	0	0



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Finish date	27AUG07
Data date	25DEC06
Run date	27FEB07
Page number	1A

AREA 3805C AIR SPARGE LINE EXTENSION

FORT DRUM, NEW YORK

PRELIMINARY PROJECT SCHEDULE

- Early bar
- Progress bar
- Critical bar
- Summary bar
- Start milestone point
- Finish milestone point

APPENDIX B

BASIS OF DESIGN: AREA 3805 "C" EXPANSION
REMEDIAL DESIGN/REMEDIAL ACTION

BASIS OF DESIGN
AREA 3805 "C" EXPANSION REMEDIAL DESIGN/REMEDIAL ACTION

Basis of Design – Wells

The proposed vertical AAS well locations are based on the current alignment of AAS wells installed at Areas 3805 "C" area. The system expansion is designed to provide coverage across the current width of the plume in the area just north of Route 26.

The AAS well construction will include filter sand extending 0.5 ft above the top of screen and a bentonite seal thickness of 1 ft, followed by a bentonite/grout mix to 6 feet bls. The remaining 6 feet shall be backfilled with sand to grade. The well casing shall be temporarily completed approximately 3 feet above grade and covered with an unglued PVC slip cap, pending completion of the piping network with vault installation at each well.

Basis of Design – Aquifer Air Sparging System

1. Operating Pressure - AAS

The depth of the AAS well screen will be set based on the historical low water table elevation in order to ensure sparging capability during the anticipated low water table condition. Thus, the design will be based on the top of the AAS well screen positioned 7 ft below the low water table, which will match the configuration of the existing AAS wells at Area 3805 "C".

Where:

Amount of water head	=	7 ft (amount below low water table)
	+	4.5 ft (for high water table condition)
	+	2 ft (to account for section of AAS well screen)
Maximum water head	=	13.5 ft

Injected Air Pressure must overcome water head at high water table:

Design Air Pressure = 13.5 ft x 0.43 psi/ft = 5.8 psi

Pressure Required to Overcome Friction Losses in Pipe/Valves:

Total Loss = 3 psi

Operating Pressure Required at Blower:

5.8 psi/well + 3 psi = 8.8 psi

Conclusion: The required 8.8 psi is well within the capacity of the existing blower (Sutorbilt 3M w/ 7.5 Hp motor) of 10 psi.

2. Operating Air Flow - AAS

The Area 3805 "C" expansion is based on previous pilot testing prior to the design of the original 3805/1995 systems. The results from operation of the AAS well indicated pressure and soil gas influence up to 40 ft away from the sparge well, and the results of the helium tracer test indicated an influence as much as 70 ft from the sparging well. A conservative radius of influence of 40 ft was incorporated into the Areas 3805 and 1995 full-scale design in order to address potential variability in geologic conditions across the site.

The expansion of the AAS system at Area 3805 "C" includes extending the piping network approximately 320 feet to the west and 380 feet to the east. The system reconfiguration will result in four laterals, two to the east and two to the west of the equipment.

West	- OSL Landfill -	East
4 AAS wells	Rear Line	8 AAS wells
4 AAS wells	Front Line	8 AAS wells
	- Route 26 -	

The four laterals will be connected to a new manifold in the equipment trailer and will allow alternating operation of a "front" and "rear" lines via a set of manual valves to be installed on the manifold. Each line will consist of 12 AAS wells.

Thus, the design requirement for the AAS system is as follows:

12 AAS wells x 7 max cfm/well = 84 cfm

Conclusion: The required 84 cfm can be accomplished by adjusting the speed of the existing blower (Sutorbilt 3M w/ 7.5 Hp motor) to 2,240 rpm. This can be accomplished by re-sizing and replacing the blower and/or motor sheaves.

3. Additional Load on Electrical Service – Heat Tracing

The Area 3805 "C" expansion of the sparging system will include heat tracing in the 18 new well vaults and heat tracing the exposed sections of the three new header lines near the existing equipment trailer.

Additional Heat Tracing	**Anticipated Load**
18 vaults X 6' per vault X 7 watts/ft =	756 watts
3 laterals X 20' per lateral X 7 watts/ft =	420 watts
Total additional load =	1.2 kW

The existing electrical service [460V / 200 amps / 3-phase] at Area 3805 "C" is sized to accommodate the electrical requirement of the additional heat tracing. A new breaker can be installed in the existing 208 volt distribution box to accommodate the new heat tracing circuit.

4. Automation of AAS Operations

EA considered whether automation of the existing sparging system should be performed in conjunction with expansion of System "C". Automation of remedial systems is sometimes done in order to reduce O&M efforts and/or reduce the costs associated with operating the equipment. At this time, EA does not recommend automation of the sparging systems for the following reasons:

- Due to the amount/type of equipment (i.e., valves, timers, flow regulators) and changes to control logic (via the PLC) which would be necessary, the system would likely be more complicated to reliably operate and maintain than the existing system
- The positive-displacement blowers used in the existing systems should be started "unloaded" (i.e. no back pressure – 0 psi). The current O&M SOP includes opening the dilution valve at the blower discharge and slowly closing the valve to bring the blower gradually up to pressure. This procedure would be difficult to automate.
- There are also Safety & Health concerns related to automatically starting a belt-driven mechanical device and associated pressure system.

APPENDIX C

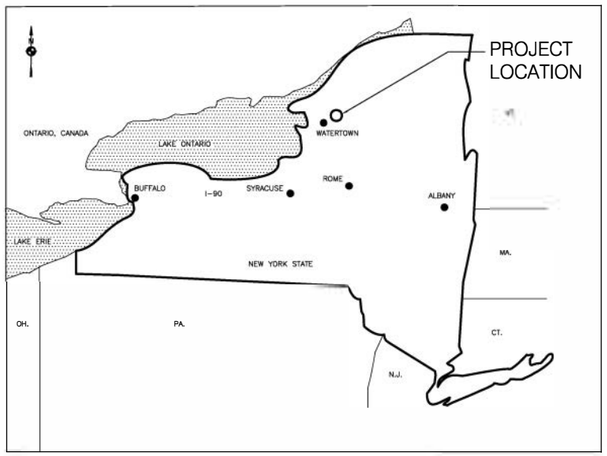
CONSTRUCTION DRAWINGS

Drawing	Drawing Title
T-1	Title Sheet
C-1	Preconstruction Conditions Site Plan
C-2	AAS/Biosparging Well Installation Plan
C-3	Air Sparge Treatment System Plan and Piping Profile
C-4	Construction Details
C-5	Construction Details

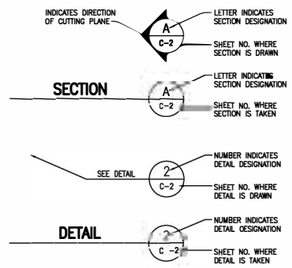
FINAL
REMEDIAL DESIGN CONSTRUCTION DRAWINGS
GASOLINE ALLEY AREA 3805 SYSTEM "C" EXPANSION
FORT DRUM, NEW YORK

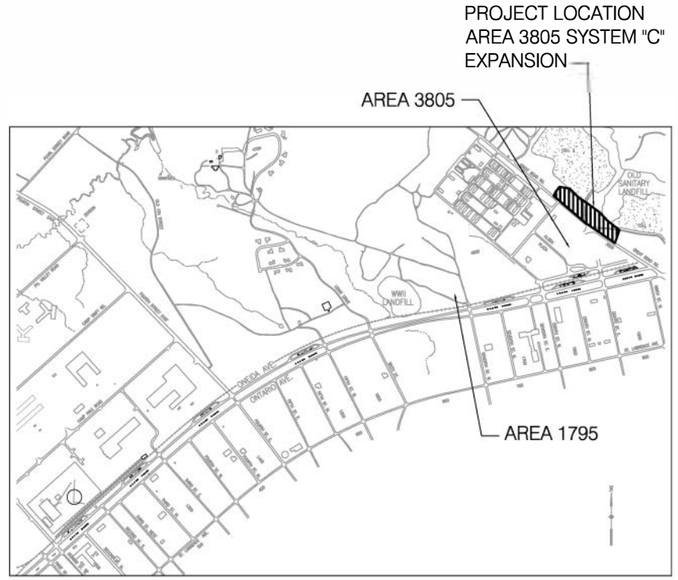
Prepared For
U.S. ARMY CORPS OF ENGINEERS - BALTIMORE DISTRICT
BALTIMORE, MARYLAND

Submitted By
CAPE ENVIRONMENTAL MANAGEMENT, INC.
EXTON, PENNSYLVANIA



LOCATION MAP





SITE VICINITY PLAN

DRAWING INDEX

DRAWING	TITLE
T-1	TITLE SHEET
C-1	PRE-CONSTRUCTION CONDITIONS SITE PLAN
C-2	AAS/BIOSPARGING WELL INSTALLATION PLAN
C-3	AIR SPARGE TREATMENT SYSTEM PLAN AND PIPING PROFILE
C-4	CONSTRUCTION DETAILS SHEET 1
C-5	CONSTRUCTION DETAILS SHEET 2

FINAL

US Army Corps of Engineers — U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

SOURCE AREA REMEDIAL SYSTEM
GASOLINE ALLEY AREA 3805 SYSTEM "C" EXPANSION
FORT DRUM, NEW YORK

TITLE SHEET

EA ENGINEERING, P.C. | DRAWING NUMBER: N/A | PLATE: T-1
SCALE: AS NOTED | DATE: JUNE 2007 | SHEET 1 of 6

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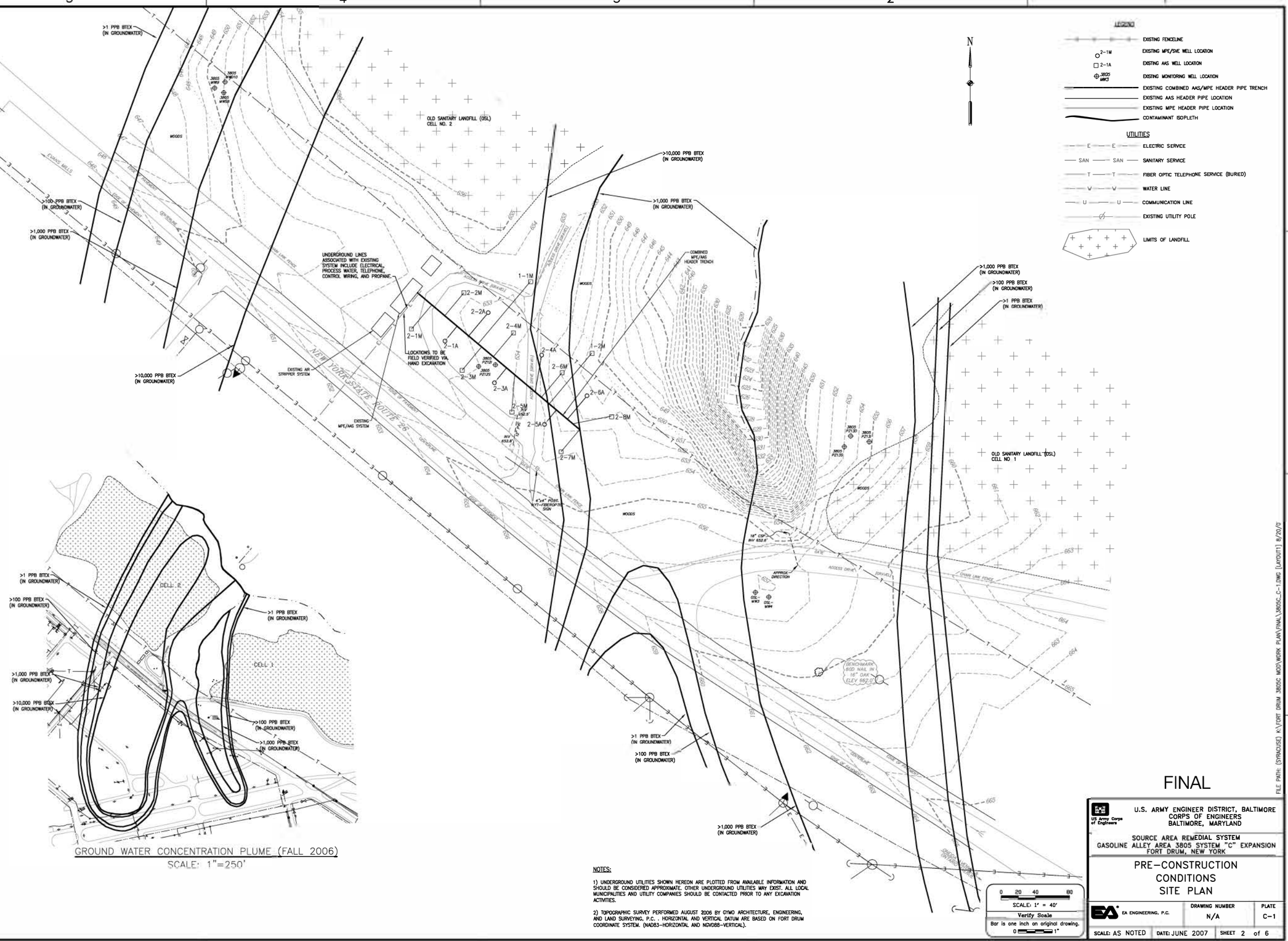

GROUND WATER CONCENTRATION PLUME (FALL 2006)

NOTES:

1) UNDERGROUND UTILITIES SHOWN HEREON ARE PLOTTED FROM AVAILABLE INFORMATION AND SHOULD BE CONSIDERED APPROXIMATE. OTHER UNDERGROUND UTILITIES MAY EXIST. ALL LOCAL MUNICIPALITIES AND UTILITY COMPANIES SHOULD BE CONTACTED PRIOR TO ANY EXCAVATION ACTIVITIES.

2) TOPOGRAPHIC SURVEY PERFORMED AUGUST 2006 BY GYMO ARCHITECTURE, ENGINEERING, AND LAND SURVEYING, P.C. . HORIZONTAL AND VERTICAL DATUM ARE BASED ON FORT DRUM COORDINATE SYSTEM. (NAD83-HORIZONTAL AND NGVD88-VERTICAL).

FINAL

US Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

SOURCE AREA REMEDIAL SYSTEM
GASOLINE ALLEY AREA 3805 SYSTEM "C" EXPANSION
FORT DRUM, NEW YORK

PRE-CONSTRUCTION CONDITIONS SITE PLAN

EA ENGINEERING, P.C.

DRAWING NUMBER	PLATE
N/A	C-1

SCALE: AS NOTED | DATE: JUNE 2007 | SHEET 2 of 6

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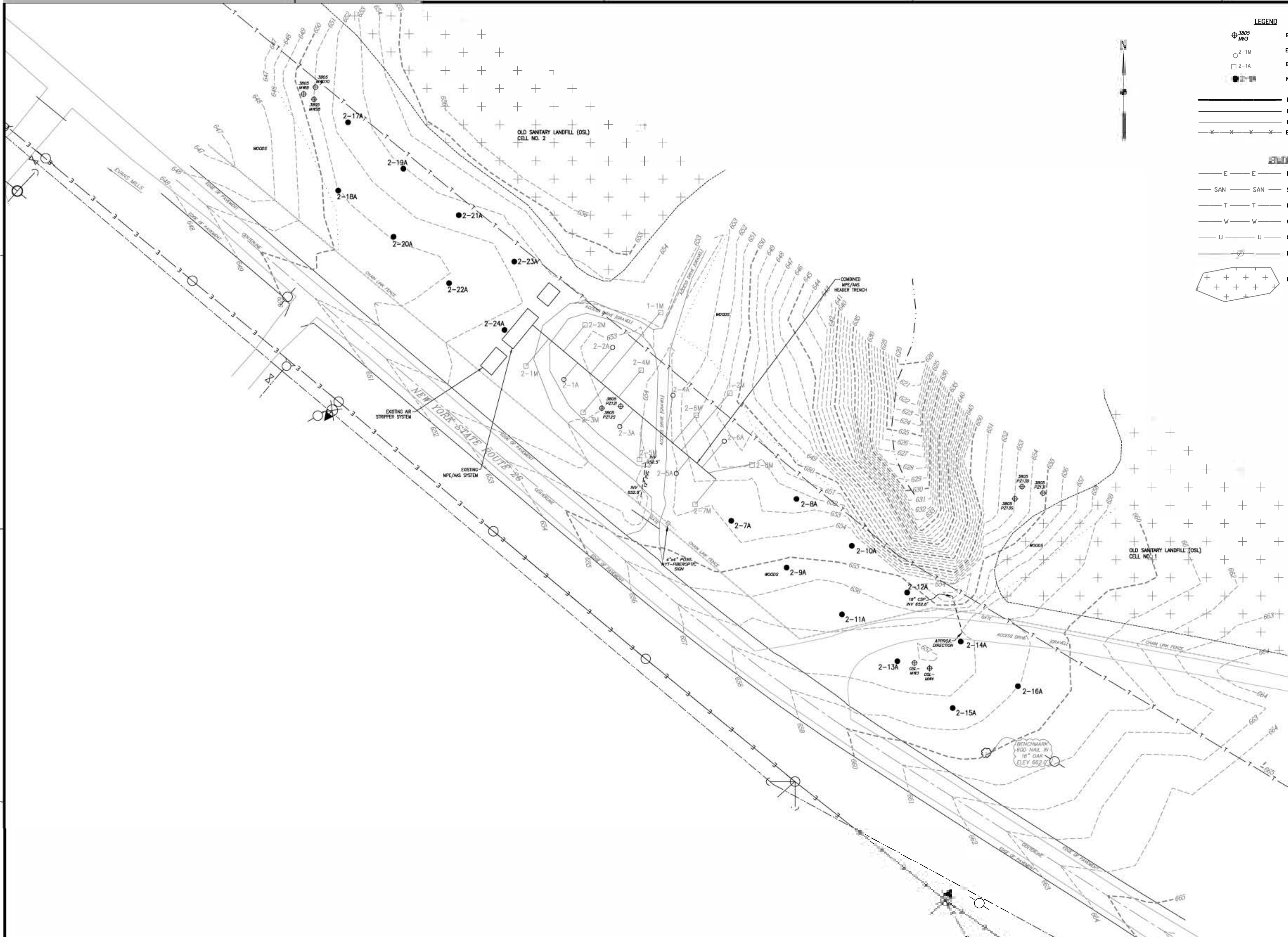


FINAL

NOTES:

1) UNDERGROUND UTILITIES SHOWN HEREON ARE PLOTTED FROM AVAILABLE INFORMATION AND SHOULD BE CONSIDERED APPROXIMATE. OTHER UNDERGROUND UTILITIES MAY EXIST. ALL LOCAL MUNICIPALITIES AND UTILITY COMPANIES SHOULD BE CONTACTED PRIOR TO ANY EXCAVATION ACTIVITIES.

2) TOPOGRAPHIC SURVEY PERFORMED AUGUST 2006 BY GYMO ARCHITECTURE, ENGINEERING, AND LAND SURVEYING, P.C. . HORIZONTAL AND VERTICAL DATUM ARE BASED ON FORT DRUM COORDINATE SYSTEM. (NAD83-HORIZONTAL AND NGVD88-VERTICAL).

3) SEE PLATE C-4 FOR WELL DETAILS.

0 20 40 80

SCALE: 1" = 40'

Verify Scale

Bar is one inch on original drawing.

0 1"

US Army Corps of Engineers

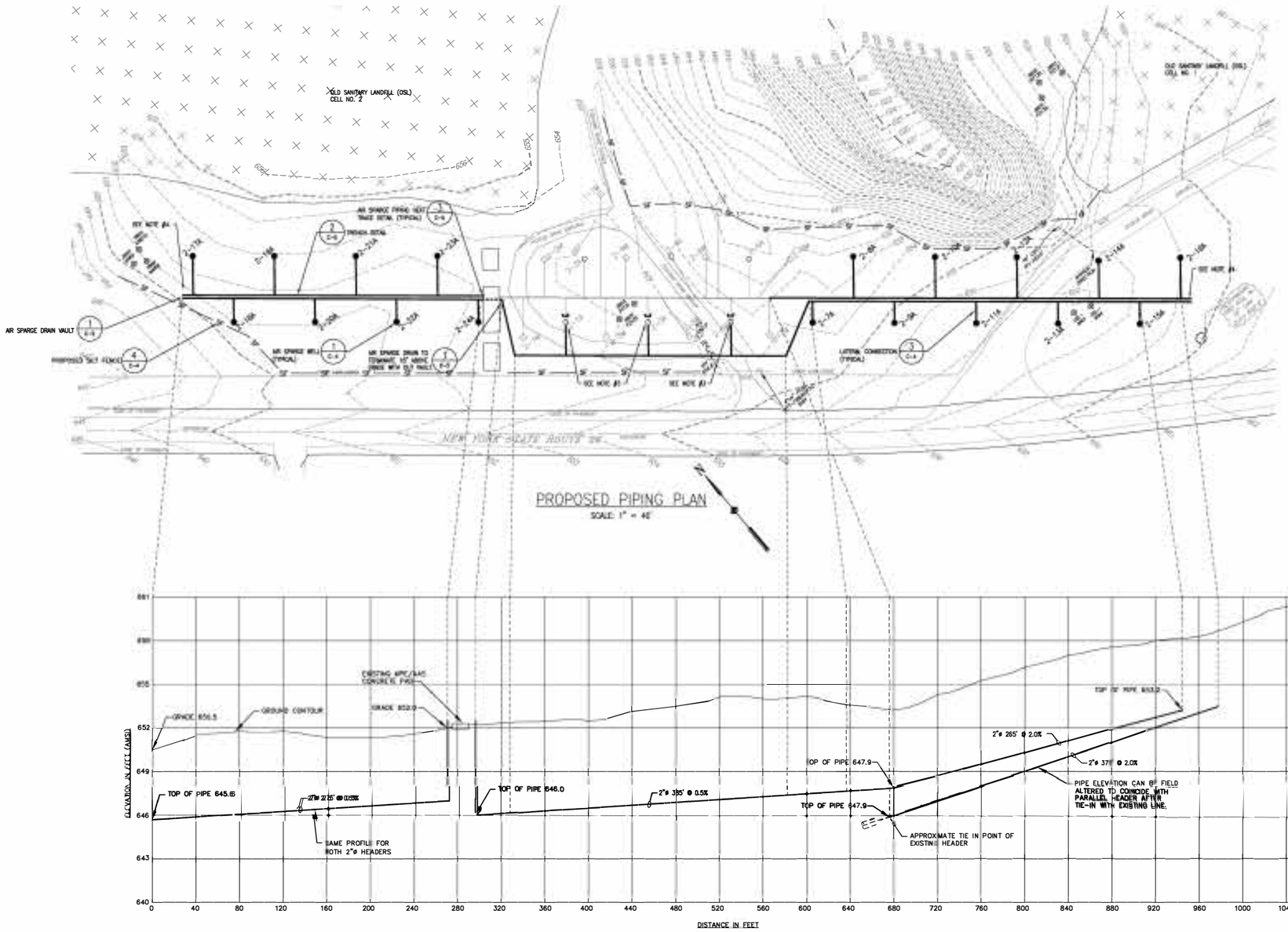
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

SOURCE AREA REMEDIAL SYSTEM
GASOLINE ALLEY AREA 3805 SYSTEM "C" EXPANSION
FORT DRUM, NEW YORK

AAS/BIOSPARGING WELL INSTALLATION PLAN

EA ENGINEERING, P.C.	DRAWING NUMBER	PLATE
	N/A	C-2
SCALE: AS NOTED	DATE: JUNE 2007	SHEET 3 of 6

FILE PATH:



PIPING PROFILE
SCALE: HORIZONTAL: 1" = 40'
VERTICAL: 1" = 3'

LEGEND

- □ 2-1M — EXISTING MPE/SVE WELL LOCATION
- ○ 2-1A — EXISTING AAS WELLLOCATION
- ● 2-9A — NEW AAS WELL LOCATION (2 / C-4)
- ⊕ 3805 MW3 — EXISTING MONITORING WELL LOCATION
- EXISTING AAS/MPE PIPING
- EXISTING FENCELINE
- PROPOSED AMS BRANCH PIPE
- PROPOSED AMS HEADER PIPE
- SF SF PROPOSED SILT FENCE (4 / C-4)

UTILITIES

- E E ELECTRIC SERVICE
- SAN SAN SANITARY SERVICE
- T T FIBER OPTIC TELEPHONE SERVICE (BURIED)
- W W WATER LINE
- U U COMMUNICATION LINE
- EXISTING UTILITY POLE
- LIMITS OF LANDFILL

NOTES:

1) UNDERGROUND UTILITIES SHOWN HEREON ARE PLOTTED FROM AVAILABLE INFORMATION AND SHOULD BE CONSIDERED APPROXIMATE. OTHER UNDERGROUND UTILITIES MAY EXIST. ALL LOCAL MUNICIPALITIES AND UTILITY COMPANIES SHOULD BE CONTACTED PRIOR TO ANY EXCAVATION ACTIVITIES.

2) TOPOGRAPHIC SURVEY PERFORMED AUGUST 2006 BY CYMO ARCHITECTURE, ENGINEERING, AND LAND SURVEYING, P.C. . HORIZONTAL AND VERTICAL DATUM ARE BASED ON FORT DRUM COORDINATE SYSTEM. (NAD83-HORIZONTAL AND NGVD88-VERTICAL).

3) ASWS 2-1A, 2-3A, AND 2-5A, WILL BE CONNECTED TO NEW AAS HEADER, VAULTS SHALL BE REPLACED OR RELOCATED TO ACCOMMODATE NEW LATERALS. OLD LATERAL SHALL BE TERMINATED WITH BLIND FLANGE.

4) EXTEND HEADER LINES APPROXIMATELY 10 FEET BEYOND LAST LATERAL TEE AND TERMINATE W/ BLIND FLANGE FOR FUTURE EXPANSION.

FINAL

US Army Corps of Engineers
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

SOURCE AREA REMEDIAL SYSTEM
GASOLINE ALLEY AREA 3805 SYSTEM "C" EXPANSION
FORT DRUM, NEW YORK

AIR SPARGE TREATMENT SYSTEM PLAN AND PIPING PROFILE

EA ENGINEERING, P.C.

DRAWING NUMBER	PLATE
N/A	C-3

SCALE: AS NOTED | DATE: JUNE 2007 | SHEET 4 of

GRAPHIC SCALE IN FEET
SCALE: 1" = 40'
Verify Scale
Bar is one inch on original drawing.

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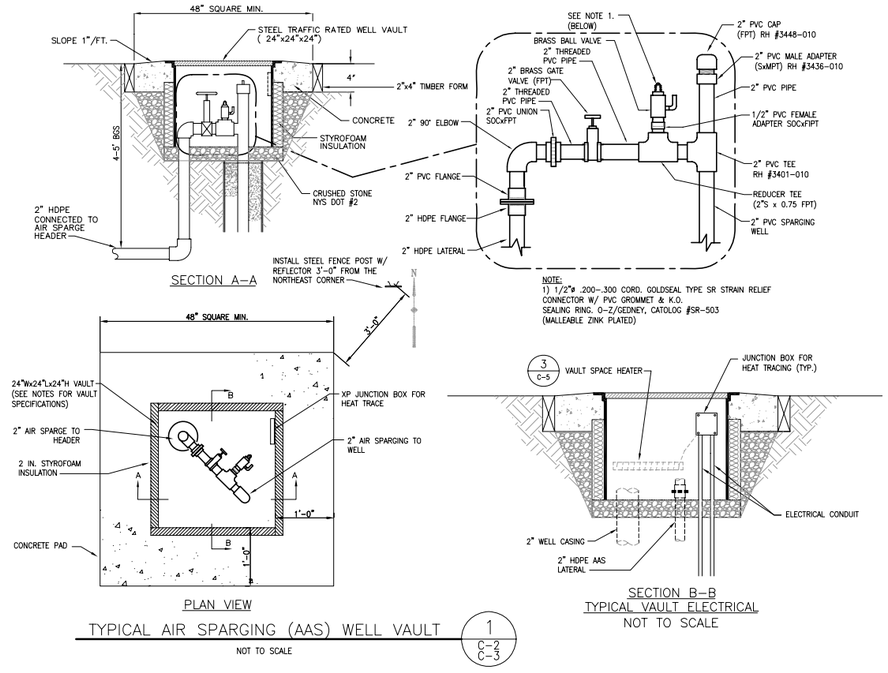
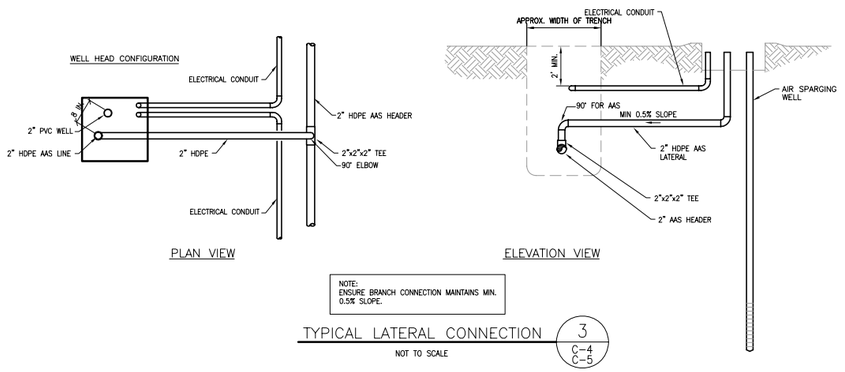
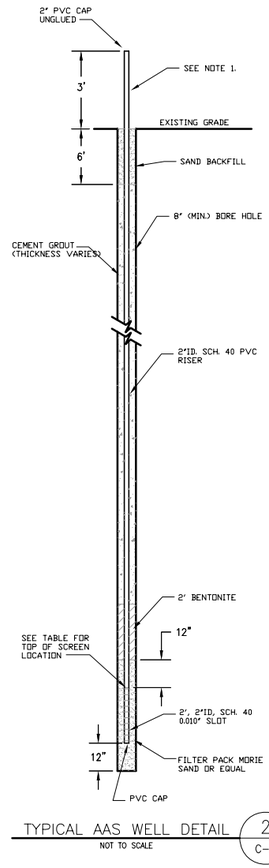
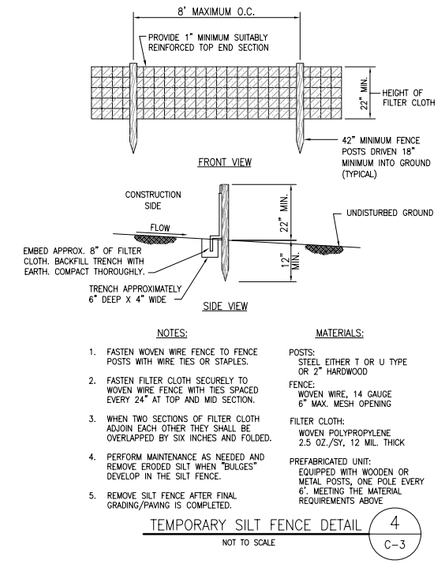






Well Name	Northing	Easting	Ground Surface Elevation (ft AMSL)	Top of AAS Screen (ft bgs)	Bottom of AAS Screen (ft bgs)
2-7A	1476077.77	1041394.32	653.90	31.60	33.60
2-8A	1476100.36	1041461.72	652.35	29.25	31.25
2-9A	1476029.34	1041451.58	655.30	31.70	33.70
2-10A	1476051.93	1041518.99	654.35	30.05	32.05
2-11A	1475980.92	1041508.85	656.70	31.60	33.60
2-12A	1476003.50	1041576.25	655.20	29.70	31.70
2-13A	1475932.49	1041566.12	657.40	31.30	33.30
2-14A	1475952.75	1041631.62	657.90	31.40	33.40
2-15A	1475884.06	1041623.39	658.55	31.05	33.05
2-16A	1475906.65	1041690.79	659.00	30.00	32.00
2-17A	1476490.04	1040997.86	652.40	35.60	37.60
2-18A	1476419.40	1040987.78	650.98	33.98	35.98
2-19A	1476441.99	1041055.18	652.98	35.58	37.58
2-20A	1476371.60	1041045.05	651.05	33.15	35.15
2-21A	1476393.94	1041112.50	652.55	34.45	36.45
2-22A	1476323.55	1041102.37	651.15	32.75	34.75
2-23A	1476345.89	1041169.82	652.30	33.40	35.40
2-24A	1476275.26	1041159.74	652.15	33.05	35.05



NOTES:

1. FASTEN WOVEN WIRE FENCE TO FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FASTEN FILTER CLOTH SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY SIX INCHES AND FOLDED.
4. PERFORM MAINTENANCE AS NEEDED AND REMOVE ERODED SILT WHEN "BULGES" DEVELOP IN THE SILT FENCE.
5. REMOVE SILT FENCE AFTER FINAL GRADING/PAVING IS COMPLETED.

MATERIALS:

POSTS:
STEEL EITHER T OR U TYPE OR 2" HARDWOOD

FENCE:
WOVEN WIRE, 14 GAUGE 6" MAX. MESH OPENING

FILTER CLOTH:
WOVEN POLYPROPYLENE 2.5 OZ./SY, 12 MIL. THICK

PREFABRICATED UNIT:
EQUIPPED WITH WOODEN OR METAL POSTS, ONE POLE EVERY 6', MEETING THE MATERIAL REQUIREMENTS ABOVE

TEMPORARY SILT FENCE DETAIL
NOT TO SCALE
4 C-3

CONCRETE TESTING:

CONCRETE TESTING WILL BE PROVIDED BY CONTRACTOR. FOLLOWING TESTS WILL BE PERFORMED.

SLUMP, ASTM C143; AIR ENTRAINMENT ASTM C231. IF SLUMP OR AIR CONTENT FALL OUTSIDE OF SPECIFIED LIMIT, A CHECK TEST WILL BE PERFORMED ON ANOTHER PORTION OF SAME SAMPLE. IF THE SECOND TEST FAILS, CONCRETE LOAD WILL BE REJECTED. THE FREQUENCY FOR TESTING WILL BE ONE FOR EACH LOAD OF CONCRETE DELIVERED.
COMPRESSIVE STRENGTH, ASTM C31 AND C39. TEST CYLINDERS WILL BE TESTED FOR COMPRESSIVE STRENGTH AT 7 AND 28 DAYS FOLLOWING CONCRETE PLACEMENT. IN THE EVENT DESIGN COMPRESSIVE STRENGTH IS ACHIEVED AT 7 DAYS, THE OWNER MAY WAIVE SUBSEQUENT COMPRESSIVE STRENGTH TEST(S). THE FREQUENCY FOR TESTING WILL BE ONE SET OF CYLINDERS ON EACH DAY CONCRETE IS DELIVERED TO THE SITE.

CONCRETE MIX: MEASURE AND COMBINE CEMENT, AGGREGATES, WATER AND ADMIXTURES IN ACCORDANCE WITH ASTM C94.

1. MINIMUM CEMENT CONTENT: 5-3/4-BAGS/CU YD.
2. MINIMUM STRENGTH: 4,000 PSI. @28 DAYS
3. AIR CONTENT: 6%+/-1%.
4. MAXIMUM SLUMP: 4 IN.
5. FIBER MESH ADDITIVE.

COMPACTION TESTING:

TRENCH BACKFILL COMPACTION:

95% OF MAXIMUM DRY DENSITY BASED ON MODIFIED PROCTOR, ONE TEST PER 200 LINEAR FEET OF TRENCH IN PAVED AREAS.

DO NOT COMPACT DIRECTLY OVER PIPES UNTIL 8-INCHES OF COVER HAS BEEN INSTALLED ABOVE THE PIPE. COMPACTION OF BACKFILL MATERIAL AROUND THE PIPE SHALL BE PERFORMED WITH EQUIPMENT THAT WILL NOT DAMAGE OR DISTORT THE PIPE.

PRESSURE TESTING OF PIPE:

PRESSURE TESTING OF PIPE SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

Vault Construction Notes:

ALL WELL VAULTS SHALL BE MODEL 104 (24"Wx24"Lx24"H min.)

VAULT CONSTRUCTION:

PEMCO
PETROLEUM EQUIPMENT MANUFACTURING CO.
1-800-448-3286

1. QUANTITY OF 18, MODEL #104242424 WITH HINGED AND LOCKABLE COVER, TO BE INSTALLED FOR NEW AAS WELLS AND AAS DRAIN VAULTS.

2. QUANTITY OF 4, MODEL #104242424 WITH HINGED AND LOCKABLE COVER AND EXTRA REINFORCING UNDER COVER, TO BE INSTALLED FOR 2-13A, 2-14A, 2-15A, AND 2-16A VAULTS.

THE BOTTOM OF THE VAULT SHALL BE SET AND LEVELED ON 4" OF TAMPED CRUSHED STONE APPROXIMATELY 23" BELOW GRADE, LEAVING THE TOP OF THE VAULT 1" ABOVE SURROUNDING GRADE. THE CONTRACTOR SHALL INSULATE THE VAULT SKIRT WITH EXTRUDED POLYSTYRENE INSULATION PER ASTM C 578 TYPE IV. THE INSULATION SHALL HAVE A MINIMUM THICKNESS OF 2", AN R VALUE OF 10 AND MINIMUM COMPRESSIVE STRENGTH OF 10 PSI. THE INSULATION CAN BE HELD IN PLACE WITH BACKFILL. THE INSULATION SHALL BE STYROFOAM SQUARE EDGE INSULATION (STANDARD BOARD SIZE IS 24" X 96") AS MANUFACTURED BY:

DOW BUILDING MATERIALS
P.O. BOX 1206
MIDLAND, MI 48641-1206
PHONE: (866) 583-2583
FAX: (989) 832-1465

THE CONTRACTOR SHALL BACKFILL AROUND THE OUTSIDE OF THE VAULT TO 4" BELOW GRADE. THE CONTRACTOR SHALL USE 2"X4" LUMBER TO CONSTRUCT A FORM FOR A CONCRETE "COLLAR" TO BE INSTALLED AROUND THE VAULT. READY MIX CONCRETE (4,000 PSI W/ FIBERMESH ADDITIVE) SHALL BE PLACED AROUND THE VAULT TO FORM A 12" WIDE COLLAR AROUND THE PERIMETER OF THE VAULT. THE CONCRETE COLLAR SHALL BE SLOPED FROM THE TOP OF THE VAULT TO THE TOP OF THE FORM (PLACED AT GRADE). THE GOAL IS TO PREVENT THE VAULTS FROM BEING INSTALLED AT LOW POINTS IN THE TOPOGRAPHY AND COLLECTING WATER DURING PRECIPITATION EVENTS.

ABBREVIATIONS:

PVC	= POLYVINYL CHLORIDE
HDPE	= HIGH DENSITY POLYETHYLENE
SOC or (S)	= SOCKET
FPT	= FEMALE PIPE THREAD
MPT	= MALE PIPE THREAD

NOTES:

1) WELLS SHALL BE COMPLETED WITH A MINIMUM OF APPROXIMATELY 3'-0" OF RISER ABOVE THE GROUND SURFACE.

2) THE WELL COORDINATES ARE IN STATE PLANE NAD 1983 (US SURVEY FEET).

3) GROUT THICKNESS SHALL BE MINIMUM 6".

4) THICKNESS OF SAND BACKFILL TO VARY WITH WELL LOCATION.

FINAL

US Army Corps of Engineers

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

SOURCE AREA REMEDIAL SYSTEM
GASOLINE ALLEY AREA 3805 SYSTEM "C" EXPANSION
FORT DRUM, NEW YORK

CONSTRUCTION DETAILS SHEET 1

EA ENGINEERING, P.C.

DRAWING NUMBER	PLATE
N/A	C-4

SCALE: AS NOTED	DATE: JUNE 2007	SHEET 5 of 6

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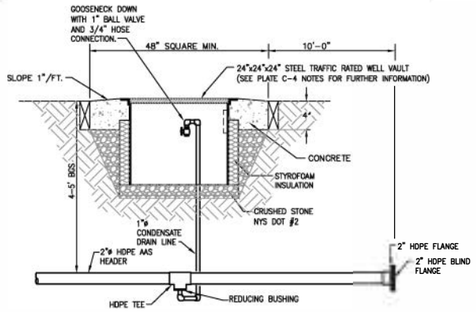
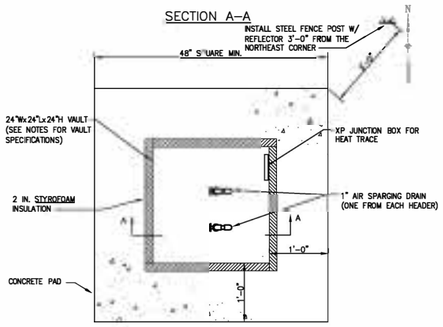
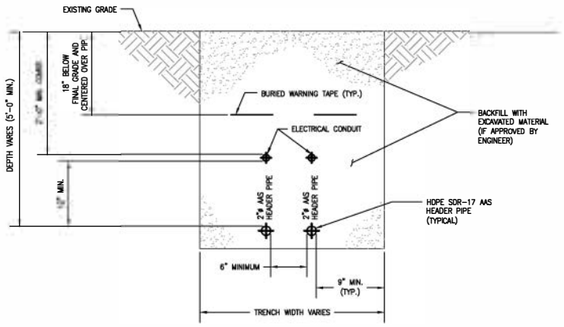




TYPICAL AIR SPARGING (AAS) DRAIN
NOT TO SCALE — 1 / C-3



MULTIPLE AAS PIPE TRENCH DETAIL
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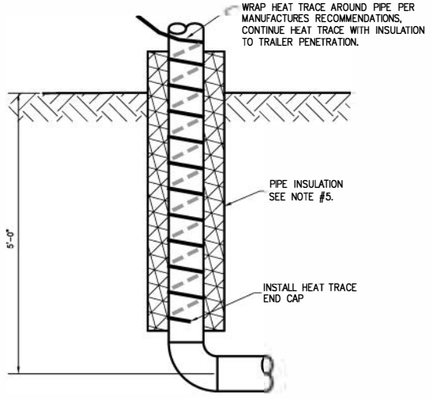
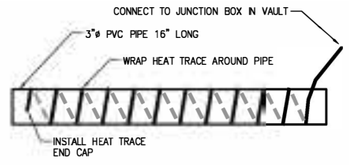


NOTE: ALL VERTICAL WATER LINES AND VERTICAL PORTION OF AAS HEADERS SHALL BE HEAT TRACED AND INSULATED.

AIR SPARGE PIPING HEAT TRACE DETAIL
NOT TO SCALE — 3 / C-3



VAULT SPACE HEATER DETAIL
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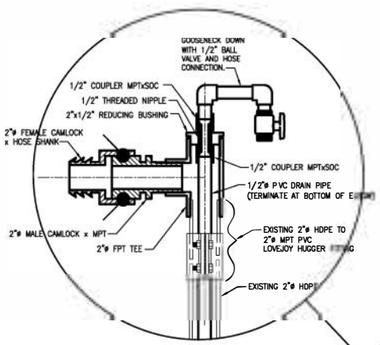
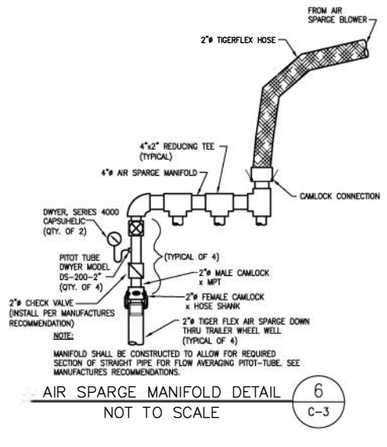
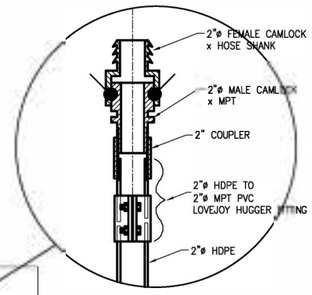
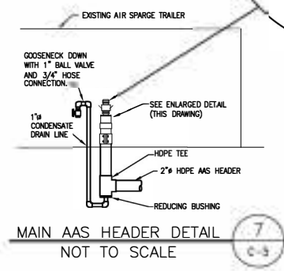




AIR SPARGE MANIFOLD DETAIL
NOT TO SCALE — 6 / C-3





MAIN AAS HEADER DETAIL
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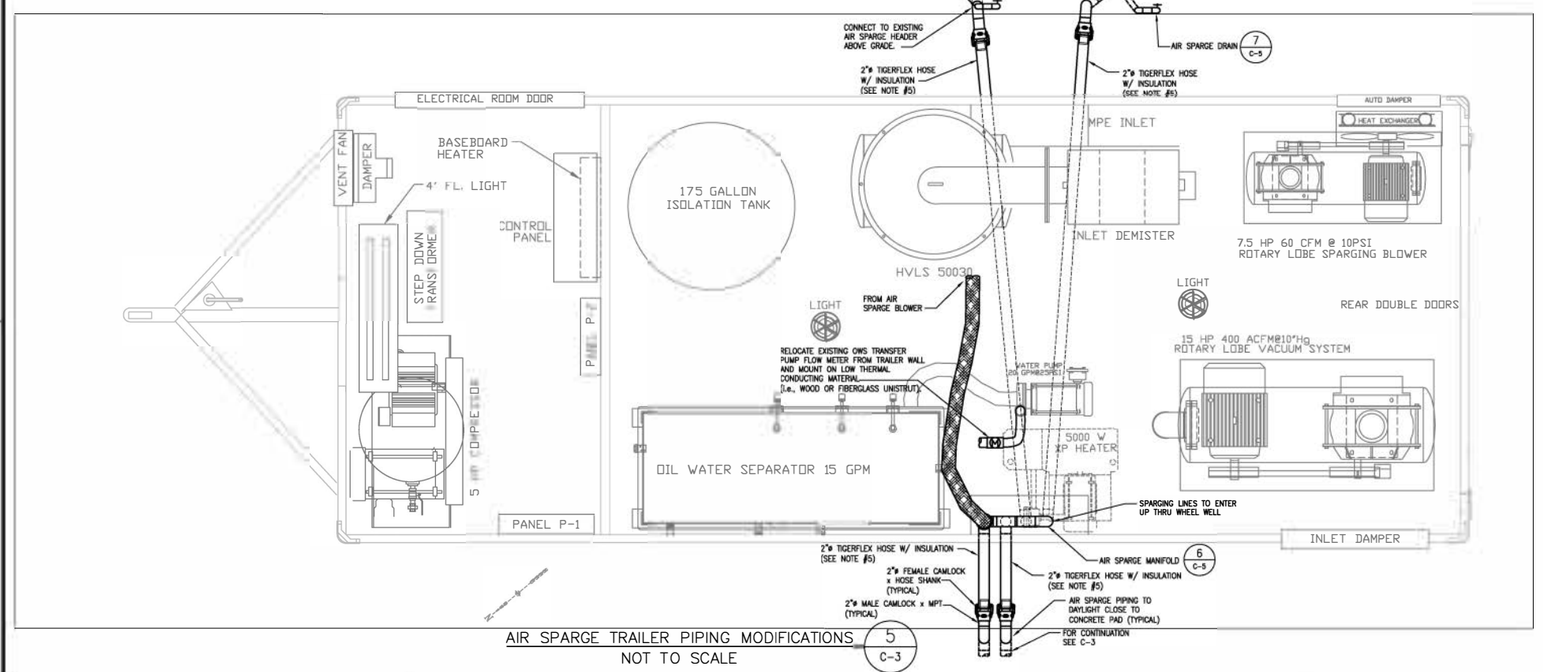

AIR SPARGE TRAILER PIPING MODIFICATIONS
NOT TO SCALE — 5 / C-3

NOTES:

1) WELLS SHALL BE COMPLETED WITH A MINIMUM OF APPROXIMATELY 3'-0" OF RISER ABOVE THE GROUND SURFACE. SEE PLATE C-4 FOR FINAL COMPLETION.

2) THE WELL COORDINATES ARE IN STATE PLANE NAD 1983 (US SURVEY FEET).

3) GROUT THICKNESS SHALL BE MINIMUM 6".

4) THICKNESS OF SAND BACKFILL TO VARY WITH WELL LOCATION.

5) FLEXIBLE ELASTOMERIC "SEAM SEAL" PIPE INSULATION TO PROVIDE A MINIMUM "R" VALUE OF 4, MINIMUM THICKNESS OF 3/4".

ABBREVIATIONS:

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CONSTRUCTION DETAILS SHEET 2

EA ENGINEERING, P.C. | DRAWING NUMBER: N/A | PLATE: C-5

SCALE: AS NOTED | DATE: JUNE 2007 | SHEET 6 of 8

FILE PATH: (SYRACUSE) K:\FORT DRUM 3805C MOD\WORK PLAN\FINAL\3805C_C-5.DWG [LAYOUT1] 8/20/07