COLONIE FUSRAP SITE RECORD OF DECISION
COLONIE SITE GROUNDWATER

COLONIE FUSRAP SITE

April 2010

U. S. ARMY CORPS OF ENGINEERS
NEW YORK DISTRICT OFFICE

FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

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TABLE OF CONTENTS

I. DECLARATION 6
A. Site Name and Location 6
B. Statement of Basis and Purpose 6
C. Assessment of Site 6
D. Description of Selected Remedy 6
E. Statutory Determinations 7
F. Data Certification Checklist 7
G. Authorizing Signatures 8
II. DECISION SUMMARY 9
A. Site Name, Location and Description 9
B Site History and Enforcement Activities 9
B.1 Site History 9
B.2 Removal Action for the Main Site Soils 10
B.3 Removal Action for the CSX VP 11
B.4 Site Investigation for Unnamed Tributary, Patroon Creek, and Three Mile Reservoir 11
B.5 Limited Removal Action for Unnamed Tributary 12
B.6 Post-RI Off-Site Indoor Air Data Assessment 12
C. Community Participation 13
D. Scope and Role of Remedial Action 13
E. Site Characteristics 14
E.1 Conceptual Site Model 14
E.2 Surface and Subsurface Features 14
E.3 Sampling Strategy 16
E.4 Nature and Extent of Contamination 17
F. Current and Potential Future Land and Water Uses 18
F.1 Current Land Use 18
F.2 Future Land Use 19
F.3 Groundwater and Surface Water Uses 19
G. Summary of Site Risks 19
G.1 Human Health Risk Assessment 20
G.2 Ecological Risk Assessment 23
G.3 Baseline Risk Assessment Summary 23
H. Remedial Action Objectives 24
I. Description of Alternatives 25
I.1 Description of Remedy Components 25
I.2 Common Elements and Distinguishing Features of Each Alternative 29
I.3 Expected Outcomes of Each Alternative 30

J. Comparative Analysis of Alternatives ... 30
J.1 Threshold Criteria ... 30
J.2 Primary Balancing Criteria ... 31
J.3 Modifying Criteria ... 34
K. Principal Threat Wastes ... 35
L. Selected Remedy ... 35
L.1 Summary of the Rationale for the Selected Remedy ... 35
L.2 Detailed Description of the Selected Remedy ... 36
L.3 Cost Estimate for the Selected Remedy ... 37
L.4 Estimated Outcomes of the Selected Remedy ... 38
M. Statutory Determinations ... 38
M.1 Protection of Human Health and the Environment ... 38
M.2 Compliance with ARARs ... 38
M.3 Cost-Effectiveness ... 38
M.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable ... 39
M.5 Preference for Treatment as a Principal Element ... 39
M.6 Five-Year Review Requirements ... 39
III. RESPONSIVENESS SUMMARY ... 40
IV. REFERENCES ... 52

LIST OF TABLES

Table 1: Summary of VOC Concentrations in Upper Silt (2002 to 2008)
Table 2: Human Health Risk Assessment Summary
Table 3: Comparative Analysis of Alternatives – Groundwater
Table 4: Detailed Cost Estimate – Alternative 3, MNA with LUCs

LIST OF FIGURES

Figure 1: Location Map: Colonie FUSRAP Site
Figure 2: Site Map
Figure 3: Conceptual Site Model for Groundwater
Figure 4: Geological Cross-Section
Figure 5: Groundwater Contours
Figure 6: Estimated Extent of Onsite VOC Plume in Excess of RAO Concentration (2002-2005)
Figure 7: Soil Excavation Areas and Estimated VOC Plume in Groundwater (2002-2005)
Figure 8: Land Use Map
Figure 9: Long Term Monitoring Well Map

ACRONYMS AND ABBREVIATIONS

AEC	Atomic Energy Commission
ARAR	Applicable or Relevant and Appropriate Requirement
AM	Action Memorandum
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHEM OX	Chemical Oxidation
COPCs	Chemical of Potential Concern
CSM	Conceptual Site Model
cy	cubic yard(s)
COC	Contaminant of Concern
DCE	1,2-Dichloroethene
DNAPL	Dense, Non-Aqueous Phase Liquid
DOE	U.S Department of Energy
EAB	Enhanced Anaerobic Bioremediation
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Difference
FS	Feasibility Study
ft	foot (feet)
ft/d	foot (feet) per day
FUSRAP	Formerly Utilized Sites Remedial Action Program
GSA	General Services Administration
HHRA	Human Health Risk Assessment
HI	Hazard Index
LUC	Land Use Control
µg/L	microgram(s) per liter
mg/kg	milligram(s) per kilogram
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
MSL	Mean Sea Level
MW	monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NiMo	Niagara Mohawk
NL	National Lead
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSGQS	New York State Groundwater Quality Standards
O&M	Operations and Maintenance
PAHs	Polyaromatic Hydrocarbons

PCE	Tetrachloroethene
pCi/g	picocurie(s) per gram
PRG	Preliminary Remediation Goal
PVC	polyvinyl chloride
RAO	Remedial Action Objective
RCO	remedial cleanup objective
ROD	Record of Decision
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act
SLERA	Screening-Level Ecological Risk Assessment
SPDES	State Pollutant Discharge Elimination System
SVOC	Semi-Volatile Organic Compound
TCE	Trichloroethene
Th-232	Thorium-232
UIC	Underground Injection Control
USACE	U. S. Army Corps of Engineers
U-238	Uranium-238
VC	Vinyl Chloride
VOC	Volatile Organic Compound
VP	Vicinity Property

I. DECLARATION

A. Site Name and Location

Colonie FUSRAP Site
1130 Central Avenue (New York State Route 5)
Town of Colonie, Albany County, New York

B. Statement of Basis and Purpose

This decision document presents the selected remedial action for groundwater at the Formerly Utilized Sites Remedial Action Program (FUSRAP) Colonie Site (hereafter referred to as "Colonie" or the "Site"). The selected remedial action was chosen in accordance with the requirements of the *Comprehensive Environmental Response, Compensation and Liability Act* (CERCLA) as amended by *Superfund Amendments and Reauthorization Act* (SARA), 42 U.S.C §9601-9675, and to the extent practicable, the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP), as amended, 40 Code of Federal Regulations (CFR) Part 300. The decisions are based on information contained in the Administrative Record File for the Colonie Site and have been made by the United States Army Corps of Engineers (USACE) in conjunction with the New York State Department of Environmental Conservation (NYSDEC). Comments on the *Proposed Plan* for the Colonie Groundwater were received from the State and local community and were considered during the selection of the final remedy. These comments, and associated responses, are documented in Section III – Responsiveness Summary. The NYSDEC has concurred with the Selected Remedy.

C. Assessment of Site

The response action for groundwater selected in this *Record of Decision* (ROD) is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

D. Description of Selected Remedy

Major components of the selected remedy, Alternative 3, Monitored Natural Attenuation (MNA) with Land Use Controls (LUCs) include the following (full descriptions of this and other Alternatives are presented in Section II.I of this ROD):

- A two-to- five year enhanced data collection period will be conducted to assess the rate of natural attenuation processes and document that geochemical conditions have returned to a state of equilibrium. MNA refers to the process of documenting the progress and effectiveness of natural attenuation through a defined monitoring program. Natural attenuation is the combination of physical, chemical, and biological processes that result in reasonably predictable reductions in contaminant concentrations over time.

- At the end of the data collection period, the progress of MNA will be assessed in order to refine timeframes. As necessary, subsequent long-term monitoring will be implemented until compliance with the target cleanup goals has been achieved. The timeframe for compliance has been estimated at 15 years.

Temporary land use controls will be utilized as appropriate to limit potential future onsite residential exposure to groundwater contaminants until the target cleanup goals are achieved. In addition, restrictions will be put in place at the Colonie Site regarding well drilling and/or groundwater pumping activities to insure that the groundwater is not used for potable or irrigation purposes.

- The remedial action will be considered complete and monitoring will be discontinued when it is determined that compliance has been achieved, based on data from onsite monitoring wells included in the monitoring program

E. Statutory Determinations

The selected remedy, as documented in this ROD, is protective of human health and the environment, and is cost-effective. No Federal or State laws or regulations have been deemed applicable or relevant and appropriate to the remedial action. While the remedy does not satisfy the statutory preference for treatment as a principal element, it does utilize permanent solutions to the maximum extent practicable. Soil removal activities have resulted in the elimination of the source of volatile organic compound (VOC) contamination, and a significant decrease in groundwater VOC concentrations has already been documented.

Five year reviews will be conducted as a matter of law, as the remedy will take more than five years to obtain protective levels allowing for unlimited use and unrestricted exposure. USACE may discontinue these reviews after documenting that the contaminants of concern have achieved cleanup criteria in all wells.

F. Data Certification Checklist

The following table provides the location of key groundwater remedy selection information contained in the ROD, Section II, Decision Summary. Additional information can be found in the Administrative Record File for the Site.

ROD Data Checklist Item	ROD Section Number Reference
Constituents of concern and their respective concentrations.	II.E.4
Current and reasonably anticipated future land use assumptions used in the baseline risk assessment and ROD	II.F
Baseline risk represented by the constituents of concern.	II.G
How principal threats are addressed.	II.K
Key factors that led to the selection of the remedy.	II.L.1
Estimated capital, annual operation and maintenance, and the total present worth costs, discount rate, and the number of	II.L.3

years over which the remedy cost estimates are projected.	
Potential land and groundwater use that will be available at the Site as a result of the selected remedy.	II.L.4

G. Authorizing Signatures

Peter A. DeLuca
Colonel (P), Corps of Engineers
Division Engineer

9 APR 10
Date

II. DECISION SUMMARY

This section presents a summary of USACE decisions regarding groundwater present on the Colonie FUSRAP Site that has been identified as requiring:

1) Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs)

A. Site Name, Location and Description

The Colonie Site in Albany County, New York is currently part of USACE's FUSRAP program. The Colonie Site was owned and operated by National Lead (NL) Industries from 1937 to 1984. Authority for remediation of the Site (as well as ownership) was assigned to the U.S. Department of Energy (DOE) by Congress through the *Energy and Water Development Appropriations Act* of 1984. USACE assumed responsibilities for site environmental restoration from the DOE per Congressional action in October 1997. USACE is the lead agency for site activities. The NYSDEC is the lead regulatory agency for the Colonie Site. Restoration activities are also being coordinated with the New York State Department of Health (NYSDOH) and the Albany County Department of Health. Funding for remediation activities is provided on an annual basis by congressional appropriations under the *Energy and Water Development Appropriations Act.*

USACE is utilizing the administrative, procedural, and regulatory provisions of CERCLA and the NCP to guide the remediation process at the Colonie Site.

The Colonie FUSRAP Site consists of an 11.2 acre property located at 1130 Central Avenue (New York State Route 5) in the Town of Colonie, Albany County, New York (Figure 1). As shown in Figure 2, the Site is bounded by a heavily wooded lot on the west (7 Railroad Ave), CSX (formerly Conrail) rail tracks on the southwest and south, active commercial properties on the east and northeast, New York State Route 5 (Central Avenue) on the north, and a Niagara Mohawk (NiMo) electrical substation on the northwest. The surrounding area consists of residential and commercial properties. The town of Colonie has a population of approximately 80,000.

Site remediation is being conducted in two phases: 1) soils on the main Site and three Vicinity Properties (VPs) and 2) Site groundwater. This ROD addresses the groundwater media present at the Colonie FUSRAP Site.

B Site History and Enforcement Activities

B.1 Site History

Industrial operations at the Site began in 1923, when a facility was built for manufacturing wood products and toys. In 1927, the facility was converted to a brass foundry for manufacturing railroad components. In 1937, NL purchased the facility for conducting electroplating operations. Chemicals used in the plating operations included various acids, bases, metals, and degreasing solvents. NL also bought an adjacent lot that contained a portion of Patroon Lake.

Prior to 1941, NL began filling Patroon Lake with used casting sand. The lake was subsequently used for additional waste disposal through 1961.

Based on a review of historical surveys, aerial photographs, and results of previous investigations, one burial area (Patroon Lake area) and chemical contamination of surfaces within the processing building were identified as the most likely sources of organic contamination at the Site.

In 1958, the nuclear division of NL began producing items manufactured from uranium and thorium under a license issued by the Atomic Energy Commission (AEC). The plant handled enriched uranium from 1960 to 1972, and during that time, NL held several contracts to manufacture fuel from enriched uranium for use in experimental nuclear reactors.

The New York State Supreme Court shut down the NL plant in 1984 due to environmental concerns, and ownership of the Site was transferred to DOE. From 1984 to fall 1997, DOE investigated the Site and 56 VPs, and initiated the restoration process. During this time, fifty-three of the VPs were addressed and all NL buildings were demolished. In 1997, USACE assumed control of the Site and responsibility for the cleanup of the main Site and remaining three VPs.

B.2 Removal Action for the Main Site Soils

Soil removal activities at the Colonie Site were completed in accordance with the *Final Action Memorandum* (AM) (USACE, 2001). Removal activities were originally initiated in 1999, based upon the results of a 1995 *Engineering Evaluation/Cost Analysis* (EE/CA) report and the original DOE AM (DOE, 1997). These documents selected Alternative 3B, Moderate Excavation and Cap and Cover. Due to subsequent uncertainties regarding implementability, physical constraints of the site, and local community resistance, the alternative was re-evaluated after USACE assumed responsibility for the site. The AM was subsequently revised to document the selection of Alternative 2B, Large-Scale Excavation and Disposal, (rather than Alternative 3B). The Final AM (USACE, 2001) also provided revised cleanup criteria for metals and radiological constituents (uranium-238 [U-238] and thorium-232 [Th-232]) as follows: arsenic (7.4 milligrams per kilogram [mg/kg]); copper (1,912 mg/kg); lead (450 mg/kg); U-238 (35 picocuries per gram [pCi/g]); and Th-232 (2.8 pCi/g).

All radioactively contaminated soils exceeding cleanup goals were removed from the Site regardless of depth, and all metals-contaminated soils exceeding cleanup goals were excavated to a depth of 9 feet (ft) below original grade, as specified in the AM. In areas where metals contamination in excess of the cleanup criteria was detected following soil removal to the specified depth, USACE chose to perform additional excavation. Therefore, final soil removal depths for metals ranged from 1 ft to 12 ft below original grade. Where VOC sources were encountered, these soils were also removed with excavations generally extending to a maximum of 5 ft below the surface of the water table.

Detailed information regarding site soil excavation activities can be located in the *Final Post Remedial Action Report* (Shaw, 2010).

At the completion of Site remediation activities in January 2007, a total of 135,244 cubic yards (cy) of soil had been excavated from the main Site and the Town of Colonie VP, which was remediated in conjunction with the main Site soils.

No excavation was required at the NiMo Electrical Power Substation vicinity property. Remediation of the CSX VP is discussed below.

To facilitate excavation activities, an onsite temporary water treatment system was constructed for the management of groundwater generated from dewatering wells, and storm water that accumulated within excavations. A combined volume of approximately 31 million gallons of groundwater and storm water were treated in this system and discharged from the Site in accordance with the approved State Pollutant Discharge Elimination System (SPDES) Permit.

While soil removal was based on radiological and metals cleanup criteria, the bulk of the residual VOC contamination in the western portion of the Site was also removed (URS, 2008). Empty drums that were found in the former landfill area were removed along with the surrounding impacted soils. Radiological and metals contaminated soils were removed to depths of up to 15 ft below original grade in the western portion of the site based on clean post-excavation sample results. Similarly, excavation activities in the eastern portion of the Site resulted in the removal of VOC source areas in those locations, as well. A secondary benefit of the soil excavation and removal of residual VOC source material has been a significant reduction in VOC concentrations in the underlying groundwater.

B.3 Removal Action for the CSX VP

The selected alternative for remediating soils on the 6.5 acre CSX VP was documented in the *CSX Vicinity Property Action Memorandum* (USACE, 2006). Alternative 4, Removal and Off-Site Disposal of Soil, With No Impact to the High-Speed Rail Line or the Utility Rail Spur, encompassed the removal of soils with U-238 concentrations greater than 96 pCi/g, with no impact to the structural integrity of the high speed rail line or the utility rail spur. The cleanup criterion for this VP was derived through the use of risk-based radiological modeling based on a "residential encroachment upon industrial land use" exposure scenario.

By August 2007, a total of 2,871 cy of impacted soil had been removed from the CSX VP. No soils were removed from underneath the utility rail spur, as they were considered inaccessible due to the active rail line. Detailed information regarding CSX VP soil excavation activities are presented in the *Final Colonie FUSRAP Site CSX Vicinity Property Report* (USACE, 2008).

B.4 Site Investigation for Unnamed Tributary, Patroon Creek, and Three Mile Reservoir

A site investigation was conducted in 2003 for the unnamed tributary, Patroon Creek, and Three Mile Reservoir. The objective of the investigation was to determine if radiological contamination potentially resulting from past activities conducted at the Colonie Site had adversely impacted sediments with each surface water body. Results from the 32 sediment locations sampled were less than the radiological cleanup criteria for U-238 (35 pCi/g) and Th-232 (208 pCi/g). Detailed information regarding this investigation is presented in the *Site Investigation Report for the Unnamed Tributary of Patroon Creek and the Three Mile Reservoir* (Shaw, 2004).

B.5 Limited Removal Action for Unnamed Tributary

During the surveying and sampling phase for CSX Vicinity Property (Unit CL1-5), evidence was uncovered suggesting that radiological contamination may have migrated off the steep southern slope and been deposited in the unnamed tributary. USACE determined that a limited removal action in the unnamed tributary was warranted, and during March and April 2007 approximately 393 cy of impacted sediments were removed from the bed of the unnamed tributary. Off-site analytical data associated with the unnamed tributary indicated full compliance with the radiological cleanup criteria of 35 pCi/g for U-238. This limited removal action is documented in the *Final CSX Vicinity Property Report* (USACE, 2008).

B.6 Post-RI Off-Site Indoor Air Data Assessment

Groundwater sampling conducted at the Site (Shaw, 2003) indicated the presence of low levels of chlorinated VOCs, including tetrachloroethene (PCE), tricholoroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC). Fuel-related compounds including benzene, toluene, ethylbenzene, and xylenes (BTEX) have also been detected in the groundwater, but only at low concentrations that rarely exceed groundwater quality standards.

Indoor air sampling was conducted at selected off-site locations downgradient of the Site along Yardboro Avenue. The investigation included sampling of indoor air, sub-slab vapors, and ambient outdoor air at a total of seven residences. Four rounds of sampling were conducted between July 2002 and March 2005, which included sampling at various buildings during each sampling event. The indoor air, outdoor air, and sub-slab sampling results obtained during this investigation were compared to a variety of guideline values, including NYSDOH Study Background Levels, NYSDOH Air Guideline Values, and U.S. Environmental Protection Agency (EPA) Preliminary Remediation Goals (PRGs).

Based on the four rounds of indoor air, outdoor air, and sub-slab sampling results and the NYSDOH Decision Matrix (which provides recommended actions for TCE and PCE), USACE recommended No Further Action for six locations. NYSDOH concurred with the recommendation. A fifth round of sampling was performed in March 2006 at one location, and the results showed that no TCE or PCE was detected in the indoor air samples. USACE then recommended No Further Action at this location. Upon review of the data, NYSDOH concurred.

While benzene was detected in some of the indoor air results, evaluation of the indoor air to sub-slab ratios (as well as the minimal BTEX groundwater contamination reported for the Site) indicated that the subsurface (i.e., groundwater) was not a likely source of BTEX compounds. Rather, ambient background and household products were the likely sources. Common BTEX-containing household products observed at the various locations included latex paint, paint remover, adhesives, spray products, gasoline, and mineral spirits. Accordingly, USACE recommended No Further Action with respect to BTEX. NYSDOH concurred with the recommendation.

The results of the indoor air investigation are presented in the *Final Indoor Air Assessment Report* (Shaw, 2005).

C. Community Participation

Community participation activities provide the public with an opportunity to express its views on the preferred remedial action. USACE, in consultation with NYSDEC, considered public input from the community participation activities conducted during the *Remedial Investigation/Feasibility Study* (RI/FS) phase for groundwater remediation.

The *Proposed Plan* for Colonie Site Groundwater was released to the public on July 9, 2009. The document was made available to the public in the *Administrative Record* maintained at the William K. Sanford Town Library, 629 Albany Shaker Road, Loudonville, New York 12211. The notice of availability was published in local newspapers. A public comment period was held from July 9, 2009 through August 31, 2009. In addition, a public meeting was held on July 30, 2009. At this meeting, representatives from USACE provided information and answered questions regarding groundwater contamination at the Colonie Site and the remedial alternatives under consideration. A response to the comments received during the comment period is included in the *Responsiveness Summary*, which is Section III of this ROD. A transcript of the public meeting is available to the public and has been included in the *Administrative Record* file and information repository.

A community relations plan, available in the *Administrative Record* file, has been prepared and implemented to keep the public informed of site activities and to invite community input. As part of the plan, USACE has produced progress update fact sheets, developed a public website, maintained the *Administrative Record* files, published press releases and legal notices, and maintained a project mailing list. In addition, neighborhood/small group meetings were conducted and coordination/informational activities were performed for residential vicinity property owners during implementation of the indoor air surveys.

D. Scope and Role of Remedial Action

The scope of the proposed Colonie Site groundwater remedial action is to address onsite groundwater containing VOC concentrations above risk-based cleanup criteria. The role of the proposed remedial action is to 1) minimize potential health and environmental impacts due to current or future exposure to VOCs in groundwater, and 2) to comply with Applicable or Relevant and Appropriate Requirements (ARARs). The selected remedy will combine temporary LUCs designed to limit potential future onsite residential exposure via vapor intrusion during the remediation period with a long-term groundwater monitoring program to determine whether natural environmental processes are reducing the contamination to concentrations below cleanup levels. The soil removal actions effectively removed the VOC source material from the Site, which is expected to assist in achieving the primary objectives presented in this ROD. Groundwater sampling results have indicated a decrease in VOC concentrations in groundwater subsequent to the soil removal action. As a result, MNA of the remaining contamination is considered a viable means of improving the quality of the groundwater at the Colonie Site.

E. Site Characteristics

E.1 Conceptual Site Model

The Conceptual Site Model (CSM) presented in this ROD summarizes potential exposure pathways for VOC-contaminated groundwater only because the Site soils have been remediated to acceptable levels for all identified contaminants of concern (COCs). Potential sources of contamination to groundwater, as depicted in Figure 3, have been identified as the footprint of the former NL plant and the buried drums and associated contaminated soils from the Patroon Lake area. Prior to remediation of these sources, VOCs had migrated into the subsurface soils via infiltration, percolation, and spillage. The contamination subsequently migrated to groundwater. Based on this scenario, several exposure routes and associated receptors (human and ecological) were identified. The potential exposure pathways include hypothetical groundwater consumption (both onsite and off-site); vapor intrusion (both onsite and off-site), and direct recreational contact (off-site). The groundwater consumption and vapor intrusion pathways are not currently complete, as no consumption of the groundwater is occurring, nor are there residential structures on the Site. These pathways may become complete in the future; thus, they are depicted in the CSM. Direct recreational contact may occur from contact to surface water and sediment potentially contaminated by groundwater after discharge to the surface along the unnamed tributary of Patroon Creek.

E.2 Surface and Subsurface Features

The Colonie Site is located on the eastern edge of the Central Plateau physiographic province, with the Adirondack province to the north and the northern extension of the Valley and Ridge province to the east. The Colonie Site is located on relatively flat, slightly rolling terrain in the Pine Bush area within the Mohawk-Hudson lowland.

Maximum topographic relief across the Site is about 15 ft. The highest point on the property, located in the northwest corner, has an elevation of approximately 235 ft above mean sea level (MSL). The land slopes gently from the northwest toward the south-southeast. A steep embankment exists between the CSX rail line, which parallels the southern Site boundary, and the properties along Yardboro Avenue.

An unnamed tributary of Patroon Creek, (a portion of which is an underground culvert) crosses the Site from the west to the south and east, ultimately discharging into Patroon Creek south of the Site. The unnamed tributary drains an area of approximately 300 acres in the Town of Colonie. The unnamed tributary is in an urban area; therefore, the stream has been significantly altered. During the early 1900's, a dam was constructed on the tributary to form Patroon Lake. Patroon Creek is a perennial stream that drains an area of approximately 13 square miles in Colonie and Albany. The drainage basin is mostly urban with commercial and residential properties. The creek is approximately 7 miles long, from its headwaters to where it discharges into the Hudson River.

Figure 4 provides a cross-section of the region's geological units, which comprise the Pine Bush Aquifer. A brief description of the geological units, from the uppermost unit to the lowermost unit, is provided below.

Artificial Fill and Flood Plain Sediments: This unit consists of fill materials placed at the Site, including Patroon Lake, and consists of gravel, sand, brick fragments, metal barrels, glass, foundry tools, foundry slag, and disturbed sediment. The Flood Plain Sediments unit represents thin deposits of materials related to sedimentation in the former Patroon Lake and from floods of the unnamed tributary of Patroon Creek.

Dune Sand: This unit is fine-grained sand that is light yellow-brown and cross-laminated. Regionally, it is the unit that makes up the Pine Bush Aquifer. Based on lithologic logs, this unit thins from northwest to southwest across the Site and is near the ground surface predominantly positioned above the water table.

Upper Silt: Previously referred to as the Upper Sand. This unit is composed of lake sand and lake silt and sand. Grain size analyses consistently show significant silt fractions in samples collected from this unit.

Upper Clay: This unit is most easily identified in conductivity logs and consists of a varied sequence of clay and silt.

Lower Silt: Previously referred to as Lower Sand. This unit consists predominantly of silt with some clay and lies above the Lower Clay.

Lower Clay: The clay is observed to be olive gray and very homogenous, showing few signs of silt or sand interbeds. Based on geophysical surveys, it was determined that no major channel cut features or topographic divides were apparent along the top of the Lower Clay. The absence of these features further supports geological background information and geotechnical testing that identify the Lower Clay as the basal hydrogeologic boundary.

Till: This unit is described as dark gray and poorly sorted (10% sand, 40% gravel, and 50% clay). One Site borehole penetrated the till at a depth of 160 ft below grade. Bedrock underlies this till.

The Upper Silt unit forms the shallow saturated zone at the Site. The base of the Upper Silt ranges from elevations of approximately 202 to 205 ft above MSL in the western portion of the Site. Water levels from December 2002 indicate a saturated thickness of more than 20 ft in the north portion of the Site to less than 15 ft in the south portion, near the property line. The thickness of the Upper Clay in the western portion of the Site ranges from approximately 12 to 15 ft. The top surface of the Lower Silt is typically encountered at approximately 190 ft above MSL and ranges from 10 to 15 ft thick. The top surface of the Lower Clay is encountered at elevations of 170 to 180 ft above MSL. At the Site, the Lower Clay unit is approximately 100 ft thick. Field tests conducted in 1984 and 1988 indicated permeabilities ranging from 0.04 to 109 feet per day (ft/d) in the Upper Silt unit and 0.29 to 37 ft/d in the Lower Silt unit.

Groundwater levels have been routinely measured in Site wells since 1988. Typically, shallow groundwater at the Site is encountered at less than 10 ft below grade. Water level measurements recorded at the Site indicate that groundwater flows generally to the southeast across the Site, as depicted in Figure 5. There is an observable downward gradient over the northern portions of the Site, with localized upward gradients near the unnamed tributary and Patroon Creek.

Groundwater level data provided in the RI indicate that the hydraulic gradient and general direction of groundwater flow in the Lower Silt unit closely resemble those in the shallow zone. The formations above the Upper Clay likely drain to the unnamed tributary and to Patroon Creek.

E.3 Sampling Strategy

From 1984 through 1988, groundwater samples were collected on a quarterly basis. Results of this sampling were published in annual environmental summary reports, which are available in the Colonie FUSRAP *Administrative Record*. Since taking over responsibility for the Site in 1997, USACE has conducted semi-annual groundwater sampling to monitor for the possible off-site transport of radioactive and chemical contamination. A phased groundwater investigation has been conducted to determine the presence and delineate the extent of VOC contamination in the groundwater, as presented below.

Groundwater samples were collected from a total of 29 sample stations during the 1999 Phase I Geoprobe® Groundwater Sampling event. The samples were acquired using the direct push Geoprobe® (temporary installations) sampling procedure, and were analyzed for VOCs. The sampling approach involved the initial collection of 22 groundwater samples on 50-foot centers along the southern boundary of the Site. This initial line of samples was intended to provide data to assess contaminant concentrations downgradient of potential source areas at the Site, and to evaluate the potential for off-site migration of contaminants. Based on water-level contours for the Site, these sample points were positioned to intercept groundwater as it flowed beyond the Site to the south. The seven remaining samples were collected across the site to provide additional characterization data. Results of the 1999 Phase I Geoprobe® sampling were presented in the *October 1999 Geoprobe Groundwater Sampling Report* (IT, 1999).

Analytical results from the Phase I Geoprobe® Groundwater Sampling indicated the presence of elevated levels of VOCs along the southern site boundary. The Phase II Geoprobe® Groundwater Sampling was designed to further characterize the nature and extent of potential off-site VOC groundwater migration. A pair of shallow and deep Geoprobe® samples was collected at 24 locations. Forty-eight groundwater samples (24 shallow and 24 deep) were collected from the 24 locations on 50-foot centers along the CSX property located directly south of the Site and analyzed for VOCs. As requested by NYSDEC, three samples were also analyzed for radiological parameters, including total uranium, isotopic thorium, and gross alpha/beta contamination. Results of the Phase II Geoprobe® sampling were presented in the *Phase II Geoprobe Groundwater Sampling Report* (IT, 2001).

The Phase III Geoprobe® Sampling event was designed to delineate the extent of VOC contamination identified in the Phase I and Phase II sampling. The Phase III investigation utilized both Geoprobe® groundwater sampling and installation/sampling of additional monitoring wells. Geoprobe® groundwater samples were collected from 47 locations, while 14 new monitoring wells (seven deep wells, designated M, and seven shallow wells, designated S) were installed and subsequently sampled. The results of the Phase III sampling are discussed in the *Final Groundwater Remedial Investigation Report* (Shaw, 2003).

In addition to the phased Geoprobe® investigation, multi-port FLUTe™ wells were installed by USACE to evaluate this technology for possible use at the Site for future groundwater investigations. In general, the FLUTe™ system consists of a flexible liner with multiple depth sampling ports such that various intervals within the aquifer can be sampled from a single well. Three FLUTe™ wells (two deep wells and one shallow well) were installed. Following the FLUTe™ installation, monthly sampling events were conducted from May through October 2001.

E.4 Nature and Extent of Contamination

The Groundwater RI conducted between 1999 and 2002 involved the collection and analysis of groundwater samples from both Geoprobe® and permanent monitoring wells, as well as evaluation of surface water and sediment samples. The RI provided groundwater data for chemicals (e.g., VOCs, semi-volatile organic compounds [SVOCs], total metals, and dissolved metals) and radiological constituents (e.g., uranium, thorium, and gross alpha/beta radiation). Analytical results indicated elevated concentrations of VOCs in monitoring wells within the shallow groundwater (i.e., Upper Silt unit). Total VOC concentrations (i.e., sum of PCE, TCE, DCE, and VC concentrations) ranged from 27 to 2,583 micrograms per liter (µg/L), based on 2002 data, as shown in Table 1). The maximum concentration was detected in the eastern portion of the Site. The RI data indicated that the deeper groundwater (i.e., Lower Silt unit) was not impacted at concentrations above the evaluation criteria (Shaw, 2003).

The presence of PCE breakdown products such as DCE and VC demonstrate that biodegradation processes have been active on the Site historically. Neither DCE nor VC was used on the site (e.g., as commercial solvents), and thus their presence can only reasonably be attributed to biodegradation processes.

Analytical data obtained subsequent to the RI (i.e., between 2003 and 2005) indicated average total VOC concentrations of 0.2 to 762 µg/L in the shallow groundwater. These concentrations were significantly lower than those observed during the RI. The data collected in June 2007 indicated further decreases, with the highest total VOC concentration reported as 63.9 µg/L. The October 2008 data reported the highest total VOC concentration as 49.6 µg/L. In June 2007, the highest concentration of any single VOC constituent was reported as 45 µg/L (PCE), the highest concentration in October 2008 was 31 µg/L PCE. The 2003-2005 dataset reported the highest PCE average value as 355 µg/L. These data, which are presented in Table 1 along with the RI data summary, support the premise that an overall decreasing trend in VOCs is occurring across the Site. The decreasing trend noted between 2005 and 2007 is attributed primarily to the effects of source removal conducted as part of the soils removal action and large-scale dewatering of the main Site. The October 2008 data are the initial results of the additional groundwater sampling being performed to demonstrate that groundwater equilibrium conditions are returning and that naturally occurring *in situ* biodegradation processes are active.

Information presented in the Groundwater RI indicates that the areas of impact have expanded laterally from the source areas toward the railroad tracks, nearby buildings, and the unnamed tributary of Patroon Creek, consistent with the natural direction of groundwater flow.

Figure 6 depicts the estimated extent of the onsite VOC plume, as inferred from the 2003 to 2005 data. Figure 7 depicts the relationship between the locations of the VOC contaminated soil excavation units and the groundwater VOC plume.

The concentration contour that defines the extent of the VOC plume being evaluated for cleanup is based on providing protection via the vapor intrusion pathway and, thus, is limited to onsite areas. Although the leading edge of the VOC plume extends into the CSX rail corridor, no residences will be located in the rail corridor and, therefore, no risks are posed by the off-site portion of the plume. The portion of the plume that has entered the rail corridor is not expected to impact the downgradient residential area because:

- The transport characteristics of the water-bearing zone have prevented groundwater contamination from migrating beyond the rail corridor over the past 50 years.
- The sheet pile wall installed in support of soil excavation interrupts groundwater flow to the southeast, and acts to retard further off-site migration of VOC contamination from the vicinity of monitoring well (MW) S32.
- The onsite soil removal action has eliminated the bulk of the onsite contamination, further reducing the potential for additional off-site migration, and any reductions achieved in onsite VOC concentrations will correspondingly reduce the potential for these compounds to migrate off-site at levels of significance.
- Previous residential indoor monitoring conducted by USACE did not identify any off-site indoor air quality concerns (URS, 2008).

The Upper Silt unit has also been impacted by historical releases of radiological constituents; however, these constituents have not been identified as COCs for groundwater, as there is no complete pathway for human exposure. A comparison of the 2003-2005 groundwater data to the RI data suggests that overall concentrations of radiological constituents are decreasing, with the exception of MW 32S (URS, 2008). The reason for the localized increase in MW 32S is believed to be related to the soil removal action in the eastern portion of the Site and associated installation of a sheet pile wall during the excavation activities, which disturbed radiological contamination in the fine particle size range.

F. Current and Potential Future Land and Water Uses

F.1 Current Land Use

The Site is situated in an urban area consisting of both residential and commercial properties, located in the Industrial F zoning district. The definition of the Industrial F district states that prohibited uses include "any use which produces radiation, light, smoke, fumes, or odors of a noxious or harmful nature carrying beyond the limits of the premises." Figure 8 shows the land use in the area immediately surrounding the Site.

Current land use is somewhat more residential, with population estimates indicating that there were approximately 80,000 people living in the Town of Colonie in 1998 and 292,006 persons living in Albany County in 1999 (U.S. Census Bureau, 2000).

F.2 Future Land Use

The most probable future land use at the Site is considered to be urban residential. In accordance with EPA guidance for selecting a site's potential future land use, current land use, site setting, zoning laws/maps, and comprehensive community master plans were examined. The Town's master plan indicating future commercial use for the Central Avenue strip, coupled with the fact that residential property currently borders the Site on two sides, supports the use of urban residential cleanup criteria. Future projected use will result in concentrated mixed use development with high population characteristic of an urban residential scheme.

F.3 Groundwater and Surface Water Uses

Homes and businesses in the area around the Site are provided with public water from the Latham Water District in the Town of Colonie. The water sources are the Mohawk River, several supply wells, and several reservoirs.

Groundwater at the Colonie Site is classified as Class III groundwater (EPA, 1986). The NYSDEC has previously stated that, in their view, all groundwaters in the state of New York are considered to be potential drinking water sources and not Class III. Class III groundwater is considered non-potable due to salinity or otherwise contaminated by naturally occurring conditions in excess of levels that would allow use for drinking or other beneficial purposes. In the case of the Colonie Site and adjacent areas, groundwater is non-potable due to high background concentrations of naturally occurring metals in excess of the corresponding New York State Groundwater Quality Standards (NYSGQSs). The non-potability of groundwater beneath and adjacent to the Colonie Site is a regional groundwater quality issue regarding the aesthetic and chemical characteristics of the waster, and is not site related. City water is provided and available to all properties in the vicinity of the Site. A well canvass conducted in 1992 located records for eight wells within a 2-mile radius of the Site, with two of the eight wells yielding water suitable for drinking. The radius for the well canvass was based on the EPA's Classification Review Area specifications (EPA, 1986). The two wells were used mainly for domestic/irrigation purposes or industrial use. A follow-up survey conducted as part of the 2003 RI indicated that the two wells were no longer active, and no other public water supply wells were found within the 2-mile radius review area (Shaw, 2003).

There is no residential use of surface water at the Colonie Site. Creeks and drainages have historically been used only to channel and divert storm water runoff and to convey treated effluent.

G. Summary of Site Risks

The baseline risk assessment estimates potential risks posed by the Site if no actions were taken. It provides the basis for taking action and identifies contaminants and exposure pathways that need to be addressed by the remedial action. This section summarizes the results of the baseline risk assessment for the Colonie Site groundwater.

G.1 Human Health Risk Assessment

The Human Health Risk Assessment (HHRA) (URS, 2004a) evaluated onsite and off-site groundwater, as well as off-site surface water and sediment associated with the unnamed tributary to Patroon Creek. The HHRA was performed in conjunction with ongoing soil removal activities and was based on the then current groundwater, surface water, and sediment data collected from 2001 and 2002.

G.1.1 Identification of Contaminants of Concern

The primary groundwater contaminants of concern identified in the HHRA are chlorinated solvents: PCE, TCE, and their degradation products DCE and VC.

G.1.2 Exposure Assessment

As discussed under the CSM, the HHRA identified and quantified two potential residential exposure pathways: groundwater consumption through domestic use and vapor intrusion of VOCs into buildings. The first of these pathways, domestic groundwater consumption, is a hypothetical pathway that does not exist currently either onsite or off-site. Given the Class III designation of the groundwater (i.e., non-potable), the domestic consumption pathway is extremely unlikely to become activated in the future and, therefore, was not evaluated in the FS.

The other potentially complete exposure pathway evaluated in the HHRA was that of inhalation of VOC vapors that could volatilize from the groundwater and migrate via vapor intrusion into residential buildings for both onsite and off-site receptors. The onsite pathway does not exist currently, but could exist in the future after completion of the soil removal action and the Site is declared suitable for residential use.

The potential for vapor intrusion of VOCs into off-site residences was evaluated, with multiple rounds of indoor air samples being collected to fully assess the off-site pathway at the potential receptor locations. The results of this indoor air sampling are further discussed in Section II.B of this ROD.

The HHRA also identified one off-site pathway related to direct recreational contact with surface water and sediment potentially contaminated by groundwater that is discharged to the surface along the unnamed tributary of Patroon Creek. Under this scenario, risk was driven by contact with polyaromatic hydrocarbons (PAHs) and arsenic in sediment. This exposure pathway was not considered in the FS due to the following considerations: 1) environmental conditions within the unnamed tributary were expected to improve over time as a result of the soil removal action that has been completed since the HHRA was conducted; 2) an onsite source of semi-volatile organic chemicals (i.e., fuel components) located near the point where the unnamed tributary emerges from the Site had already been cleaned up (Note: This source was likely a primary contributor to PAH concentrations in the sediment); and 3) the cleanup of soil that contains arsenic and PCE, as well as future remediation of groundwater containing PCE, were expected to have beneficial effects on the tributary's surface water and sediment quality (URS, 2008).

G.1.3 Risk Characterization

The HHRA (URS, 2004a) evaluated various exposure scenarios to on-site and off-site groundwater, and off-site surface water and sediment associated with the unnamed tributary to Patroon Creek, utilizing the 2001 and 2002 dataset.

The resulting assessment is considered highly conservative in nature, as contaminant concentrations in the groundwater have exhibited significant decreases since post-RI sampling began in 2003.

For the HHRA, most metals were screened out as Chemicals of Potential Concern (COPCs), as the background concentrations exceeded the corresponding NYSGQSs. Therefore, groundwater from the water table is considered non- potable based on background conditions. All exposure pathway risks related to the intrusion of volatile chemicals and resultant indoor air concentrations were estimated using EPA's spreadsheet version of the Johnson & Ettinger vapor intrusion model (EPA, 2002).

The risk assessment considers two types of risk: cancer risk and non-cancer risk. Typically, remedial action is considered at a CERCLA site when cumulative excess cancer risks exceed the EPA risk range of $1x10^{-6}$ to $1x10^{-4}$ (i.e., one in one million to one in ten thousand). For non-cancer effects, a hazard index (HI) is calculated which sums the non-cancer effects due to exposure to multiple COPCs for an exposure pathway. An HI greater than 1 indicates potential adverse non-cancer health effects.

The exposure scenarios and associated total risks evaluated under the HHRA are discussed below. Risks identified for each exposure scenario pathway, along the chemical constituents driving such risk, are presented in Table 2.

<u>Potential Future On-Site Groundwater-Consuming Residents</u>

This exposure scenario assumes future residential development of the Colonie Site; exposure to groundwater chemicals via use of the shallow groundwater as a domestic water source and inhalation of volatile chemicals that intrude the residence from the subsurface due to the presence of contaminated shallow groundwater.

Excess total risks were identified for both the child and adult receptor ($7.1x10^{-4}$ and $1.6x 10^{-3}$, respectively). As presented in Table 2, all risks were associated with exposure to tap water. No inhalation risks from intruded indoor air vapors were identified. The hazard index was greater than 1 for both receptors.

The carcinogenic risk drivers are VOCs (particularly PCE) and PAHs (particularly benzo(a)pyrene). PAHs were detected almost exclusively in MW 19S, which was the location of a petroleum release. This petroleum source area was remediated subsequent to the completion of the HHRA. The primary noncarcinogenic hazard driver is TCE.

<u>Potential Future On-Site Urban Residents</u>

Under this scenario, on-site residents are presumed to utilize public water for their domestic water supply needs rather than shallow groundwater. This scenario focuses on inhalation of volatile groundwater chemicals that intrude the residence from the subsurface due to the presence of contaminated shallow groundwater.

For this scenario, the risks and hazards do not exceed $1x10^{-6}$ and 1, respectively, for either the child or adult receptor.

<u>Current Off-Site Residents</u>

This scenario corresponds to the current residents located south (downgradient) of the Colonie Site, along Yardboro Avenue.

The residents obtain domestic water through the public water supply system; therefore, the only pathway of interest is the possibility of indoor air vapor intrusion via contaminated groundwater.

Excess total risks were identified for both the child and adult receptor (8.6×10^{-5} and 1.5×10^{-4}, respectively). The hazard index was greater than 1 for both receptors. Risk drivers were identified as benzene, PCE and TCE.

Subsequent indoor air sampling was conducted in the offsite residences between July 2002 and March 2005. A discussion of the air sampling and analytical results is presented in Section B.6 of this ROD. Based upon the results of this additional sampling, a finding of no further action was reached for all offsite residential locations.

Potential Future Off-Site Groundwater-Consuming Residents

This hypothetical scenario assumes that the shallow groundwater is utilized for domestic water needs, rather than the public water supply system. New domestic wells are unlikely to be installed due to the widely available public water supply, the low groundwater yield, and background levels of metals that would require point-of-use treatment.

Excess total risks were identified for both the child and adult receptor (4.7×10^{-3} and 9.0×10^{-3}, respectively). Risks were associated with exposure to both tap water and inhalation of intruded indoor air vapors. The hazard index was greater than 1 for both receptors.

The carcinogenic risk drivers are VOCs (particularly PCE, TCE and VC) and benzene. The primary noncarcinogenic hazard drivers are benzene and cis-1,2-DCE.

Current and Future Residents Contacting Off-Site Surface Water and Sediment in the Unnamed Tributary

This scenario corresponds to the existing residential children proximate to the Colonie Site and potential future on-site and off-site residents who have unrestricted access to the unnamed tributary downstream of the Site. A total excess risk of 1.6×10^{-4} was identified, with the risk coming from dermal contact via sediment. The HI was less than 1. The primary chemical drivers for incidental sediment exposure are PAHs, particularly benzo(a)pyrene and dibenz(a,h)anthracene. A potential contributing source of PAHs to the unnamed tributary is the petroleum release near MW 19S, which has since been remediated and removed this potential source of PAHs to the tributary.

As noted above, the HHRA utilized the then current 2001-2002 groundwater monitoring data in risk calculations even though the soil removal action at the Site was ongoing at the time. The migration of the plume associated with MW 32S (the location where the highest VOC detections were made) has since been retarded by the installation of a sheet pile wall, which will impede further migration of contamination into the residential area. In addition, the subsequent indoor air sampling of the offsite residences resulted in a finding of no further action. As MW 32S is situated on the property line, it was determined to be more indicative of onsite rather than offsite conditions, and the groundwater data from this well was incorporated into the onsite well data set. The focus of the Remedial Action Objective (RAO) development process was then to ensure protection from the onsite vapor intrusion pathway.

G.1.4 Uncertainties in Risk Estimates

The soil removal action at the Site was ongoing at the time risk assessment was conducted. Therefore, the full impact that the soil removal action would have on groundwater quality could not be predicted quantitatively with much certainty. Use of the most currently available data existing at the time provided a conservative approximation of future conditions, resulting in assumptions that tend to overestimate potential risk. However, overall groundwater quality at the Site has improved considerably since then and, thus, the risks calculated for most chemicals under the HHRA exposure scenarios are considered to be overstated for the conditions presently existing at the Site.

The exposure assessment for surface water and sediment presented in the HHRA is also considered to be conservative as no background data was available for comparing against the detected chemical concentrations. The assessment assumes that all chemicals detected in the surface water and sediment originated from the Colonie Site. However, if background data had been available, some chemicals or some proportion of the chemical concentrations detected might have been attributed to background conditions. Thus, the proportion of Site-related chemical exposure could have been determined, and Site-related risk could have been separated from total risk. Because background data was not available, all detected chemicals in surface water and sediment were conservatively considered to be Site-related for purposes of the risk assessment.

G.2 Ecological Risk Assessment

A Screening-Level Ecological Risk Assessment (SLERA) was performed on the unnamed tributary to Patroon Creek (URS, 2004b). The SLERA was based on surface water and sediment data collected from 2001 and 2002 for metals and chemicals. The resulting assessment did not take into account subsequent sediment removal actions conducted in the unnamed tributary in 2007 and, thus, is considered to be highly conservative in nature. The SLERA concluded that there was a lack of terrestrial habitat and that potential ecological risk would be associated with the potential discharges to the surface water and subsequent transport to sediments. Ecological screening levels for copper in the surface water, and several metals and PAHs in the sediment were exceeded; however, they were not at levels of concern which warranted further study or justified consideration of remedial alternatives (URS, 2004b). While historical Site operations may have been a source of metals and PAHs in sediment, the watershed is in an urban area that also contributes to the overall water and sediment quality in the tributary. Therefore, consideration of remedial alternatives for the sole purpose of addressing ecological concerns for sediment was not recommended.

G.3 Baseline Risk Assessment Summary

Results of the HHRA and subsequent modeling in support of the FS indicate that exposure to contaminants of concern in the Site groundwater under a hypothetical future onsite urban resident scenario may result in unacceptable risks (i.e., greater than the 10^{-4} and 10^{-6} risk range deemed protective in the NCP). The response action selected in this ROD is necessary to protect human health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

H. Remedial Action Objectives

The RAOs for the Colonie Site groundwater are as follows:

- Limit exposure of potential future onsite urban residents to VOC constituents that may migrate into homes via the vapor intrusion pathway.
- Reduce the concentrations of VOCs in onsite groundwater to levels that are protective of future onsite urban residents who may be exposed to these compounds via the vapor intrusion pathway.

The proposed action will reduce the excess cancer risk due to inhalation of vapors intruding into a hypothetical onsite residence to less than one in one million ($1x10^{-6}$). This risk reduction will be achieved by lowering the concentrations of groundwater contaminants to the following target cleanup goal concentrations:

Tetrachloroethylene (PCE)	5.5 µg/L
Trichloroethylene (TCE)	18 µg/L
cis-1,2-Dichloroethylene (DCE)	1,800 µg/L
Vinyl chloride (VC)	1.4 µg/L

As there are no Federal or State cleanup standards related to vapor intrusion, these target concentrations are based on the human health risk assessment results derived using the Johnson & Ettinger air model for subsurface vapor intrusion (EPA, 2002). As discussed above, the onsite pathway for vapor intrusion does not exist currently, but could become complete in the future. The Johnson & Ettinger model relates volatile groundwater concentrations to indoor vapor concentrations, which are further translated into risks and hazards based on toxicity and exposure. The target risk level and Site-specific values for various parameters related to VOC migration were loaded into the model, and the corresponding groundwater VOC constituent concentrations were calculated as the model output.

It is important to note that FUSRAP utilizes the administrative, procedural, and regulatory provisions of CERCLA and the NCP. As such, the determining factor to qualify for a response action is whether there is potential harm to human health or the environment. USACE has done a thorough analysis of the site-specific characteristics of the groundwater at the Colonie FUSRAP Site, which included the characteristics of the impacted water-bearing zone, the nature and extent of groundwater contamination, and potential routes of exposure, and has concluded that the only exposure pathway that is potentially complete, or may reasonably become complete in the future, is vapor intrusion of VOCs for future onsite urban residents. Accordingly, the target cleanup goal concentrations for groundwater are based on vapor intrusion COCs and not drinking water standards. Since there is no viable current or future exposure pathway for consumption of the groundwater, given the Class III designation of the groundwater, there is no potential harm to either human health or the environment through consumption of the groundwater. Therefore, it is not necessary to establish target cleanup goal concentrations based on drinking water standards.

I. Description of Alternatives

The Groundwater FS was prepared to develop and evaluate remedial alternatives for VOCs in groundwater, based on the RI sample analytical results, as well as the results of the HHRA. Five remedial alternatives were presented in the FS, as summarized below.

I.1 Description of Remedy Components

Alternative 1 – No Action: Under the no action alternative, no effort would be undertaken to contain, remove, treat, or monitor the VOC contamination. Although there are no current users of the affected groundwater, under the no action alternative it is assumed that no restrictions will be placed on current or future groundwater use.

This alternative would not achieve the RAOs, but is included to provide a baseline against which other alternatives can be measured.

- **Groundwater Extraction and Treatment Components**

  No groundwater extraction or treatment components are incorporated under the No Action Alternative.

- **Groundwater or Source Containment Components**

  No groundwater or source containment components are incorporated under the No Action Alternative.

- **Monitored Natural Attenuation**

  While natural attenuation processes may be occurring, the No Action Alternative does not provide physical monitoring or documentation to demonstrate that contaminant levels are decreasing over time.

- **Institutional Control Component**

  No institutional control components are incorporated under the No Action Alternative.

Alternative 2 – Land Use Controls (LUCs): Alternative 2 employs LUCs to limit exposure to Site-related VOC contamination. LUCs are administrative or legal mechanisms used to protect public health and the environment from residual contamination and are designed to limit land use, thereby restricting onsite activities and limiting potential future exposure.

- **Groundwater Extraction and Treatment Components**

  No groundwater extraction or treatment components are incorporated under Alternative 2.

- **Groundwater or Source Containment Components**

  No groundwater or source containment components are incorporated under Alternative 2

- **Monitored Natural Attenuation**

  No physical activities would be conducted to remediate groundwater contamination, nor would documentation of any natural attenuation processes be conducted to demonstrate that contaminant levels are decreasing over time under Alternative 2.

- **Institutional Control Component**

  LUCs would be implemented by burdening the property with an environmental easement describing the engineering controls and/or land use restrictions that would need to be employed to ensure that the property is safe for its intended future use. These controls would be designed to account for the potential future onsite residential land use by limiting potential exposure of hypothetical future onsite residents to contamination via the vapor intrusion pathway. LUCs considered for implementation at the Site include:

  - Prohibiting home construction with basements;
  - Mandating the installation of sub-slab ventilation systems; and
  - Requiring periodic monitoring of indoor air and/or sub-slab soil vapors.

  In addition, restrictions will be put in place at the Colonie Site regarding well drilling and/or groundwater pumping activities to insure that the shallow groundwater is not used for potable or irrigation purposes.

Alternative 3 – Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs): Natural attenuation is the combination of physical, chemical, and biological processes that result in reasonably predictable reductions in contaminant concentrations over time. For most chlorinated hydrocarbons (e.g., PCE, TCE, and DCE), anaerobic (i.e., without oxygen) biodegradation is the principal mechanism resulting in the reduction of these compounds. In contrast, biodegradation of VC is more efficient in aerobic (with oxygen) conditions. After the mass of contamination (PCE, TCE, and DCE) is degraded, the water-bearing zone is unlikely to remain anaerobic. As aerobic conditions become re-established, reductive dechlorination of VC will cease, and the much faster and productive aerobic degradation reaction will become the predominate mechanism. Under aerobic conditions, any VC present will be degraded within 1 to 2 years.

In addition to biodegradation, physical attenuation processes (e.g., mixing and dilution) will contribute toward the reduction of chlorinated hydrocarbon concentrations at the Colonie Site. At sites where contaminant concentrations are not high, these physical attenuation processes are often sufficient to achieve remediation goals (URS, 2008). MNA refers to the process of documenting the progress and effectiveness of natural attenuation through a defined monitoring program.

Groundwater monitoring data generated since the completion of Site excavation and dewatering activities (post-2007) may allow the enhanced data collection period to be shortened or revised. The June 2007 data shows only three wells where PCE exceeds its target cleanup goal concentration, with the highest reported concentration of PCE being 45 µg/L. TCE, DCE, and VC were below their target clean up goal concentrations in all wells. The subsequent data collected in October 2008 show similar trends; with the highest reported concentration of PCE being 31 µg/L. While two rounds of sampling is insufficient to demonstrate statistically significant long-term reductions, the apparent changes that have occurred recently in groundwater quality support the viability of MNA.

The primary line of evidence indicating that MNA would be a feasible means of reducing risk and improving groundwater quality at the site is that of its historical soil and groundwater sampling data that would directly demonstrate a clear and meaningful trend of declining mass and/or concentrations. Groundwater data collected subsequent to soil removal activities at the Colonie Site support this line of evidence. A secondary line of evidence is hydrogeologic and geochemical data that would indirectly demonstrate the types of natural attenuation present at the site and the rate at which such processes will reduce contaminant concentrations to required levels. Additional geochemical data is being collected to demonstrate the re-establishment of equilibrium condition, which would support this line of evidence.

The remedial action will be considered complete when compliance with the target goal concentrations has been achieved by all wells in the monitoring program. If, after four quarters of monitoring, measured concentrations in any well have stayed below the target goals, the well will be removed from the monitoring program. After eight quarters of sampling, data from the remaining wells will be statistically evaluated. Those wells demonstrating compliance with a statistically significant criterion that is below the target goal concentrations will be considered to have met the cleanup criteria and will be removed from the monitoring program.

Although no RAOs have been established for radiological parameters, they would be monitored under Alternative 3 in 13 wells (including MW 32S) to demonstrate that levels are stable or decreasing. Radiological data would be evaluated for trends over a two year timeframe to measure the effectiveness of the soil removal action.

- **Groundwater Extraction and Treatment Components**

  No groundwater extraction or treatment components are incorporated under Alternative 3.

- **Groundwater or Source Containment Components**

  No groundwater or source containment components are incorporated under Alternative 3

- **Monitored Natural Attenuation**

  Alternative 3 employs MNA to address the VOC plume, combined with an enhanced data collection period and subsequent long-term monitoring. The monitoring results would be used to verify that the target RAO concentrations have been achieved.

- **Institutional Control Component**

  Temporary LUCs (as described in Alternative 2) would be utilized as appropriate to limit potential future onsite residential exposure to groundwater contaminants via the vapor intrusion pathway until the RAOs are achieved. Well drilling restrictions would be implemented as a long-term LUC.

Alternative 4 – Enhanced Anaerobic Bioremediation (EAB): EAB is a technology that enhances the ability of naturally present microorganisms to degrade contaminants within a groundwater system through the introduction of organic substrates, nutrients, or other growth-enhancing ingredients.

Because the organic contaminants of concern at the Colonie Site are chlorinated hydrocarbons that are generally subject to anaerobic biodegradation, the EAB process would introduce an organic substrate that would lower the available oxygen in the subsurface, thereby creating an anaerobic state to facilitate biodegradation of the contaminants.

Similar to Alternative 3, radiological parameters would be monitored in 13 wells (including MW 32S) to demonstrate that levels are stable or decreasing and evaluate the effectiveness of the soil removal action.

- **Groundwater Extraction and Treatment Components**

  Alternative 4 combines the use of EAB and MNA**.** EAB would be used to remediate areas where PCE concentrations are higher than 55 µg/L. It is noted, however, that none of the wells exceeded the 55 µg/L PCE threshold in either the June 2007 or October 2008 data sets. If these decreased concentrations are substantiated through statistical analysis as downward trends, the active treatment area would be non-existent, and EAB would default to the MNA alternative. If, on the other hand, contaminant concentrations of chlorinated hydrocarbons increase to higher than 55 µg/L, the substrate would be injected to initiate the EAB process. One or more reapplications of the EAB substrate would be necessary if significant contaminant rebound occurs.

- **Groundwater or Source Containment Components**

  No groundwater or source containment components are incorporated under Alternative 4

- **Monitored Natural Attenuation**

  MNA would be relied upon to attain the target cleanup goal concentrations in those areas where PCE concentrations are less than 55 µg/L. The monitoring results would be used to verify that the RAOs have been achieved.

- **Institutional Control Component**

  Temporary LUCs (as described in Alternative 2) would be utilized as appropriate to limit potential future onsite residential exposure to groundwater contaminants via the vapor intrusion pathway until the RAOs are achieved. Pending completion of the two years of groundwater monitoring, a determination will be made as to the length of time that LUCs will be required. Well drilling restrictions would be implemented as a long-term LUC.

<u>Alternative 5 – Chemical Oxidation (CHEM OX):</u> CHEM OX is an *in situ* process proven to remediate soils and groundwater contaminated with chlorinated hydrocarbons. Powerful chemical oxidants are utilized to chemically degrade the organic constituents (via dechlorination reactions). The selected oxidizing agent is injected into an array of injection wells and allowed to naturally dissipate through the contaminated zone.

As in Alternatives 3 and 4, radiological parameters would be monitored in 13 wells (including MW 32S) to demonstrate that levels are stable or decreasing and evaluate the effectiveness of the soil removal action.

- **Groundwater Extraction and Treatment Components**

  Alternative 5 involves the combined use of CHEM OX and MNA**.** CHEM OX would be used to remediate areas where PCE concentrations are higher than 55 µg/L. It is noted, however, that none of the wells exceeded the 55 µg/L PCE threshold in either the June 2007 or October 2008 data sets. If these decreased concentrations are substantiated through statistical analysis as downward trends, the active treatment area would be non-existent and CHEM OX would default to the MNA alternative. If, on the other hand, contaminant concentrations of chlorinated hydrocarbons increase to higher than 55 µg/L, the substrate would be injected to initiate the CHEM OX process. One or more reapplications of the CHEM OX treatment would be necessary if significant contaminant rebound occurs.

- **Groundwater or Source Containment Components**

  No groundwater or source containment components are incorporated under Alternative 5.

- **Monitored Natural Attenuation**

  MNA would be relied upon to attain the target cleanup goal concentrations in those areas where PCE concentrations are less than 55 µg/L. The monitoring results would be used to verify that the RAOs have been achieved.

- **Institutional Control Component**

  Temporary LUCs (as described in Alternative 2) would be utilized as appropriate to limit potential future onsite residential exposure to groundwater contaminants via the vapor intrusion pathway until the RAOs are achieved. Well drilling restrictions would be implemented as a long-term LUC.

I.2 Common Elements and Distinguishing Features of Each Alternative

I.2.1 Applicable or Relevant and Appropriate Requirements (ARARs)

The remediation of groundwater at the Site is not ARAR-driven. There are no chemical-specific or location-specific ARARs identified for any of the alternatives with regard to the route of exposure. However, for Alternatives 4 and 5, compliance with the substantive technical requirements of the underground injection control (UIC) permit process (40 CFR Part 144-147), which is an action-specific ARAR, would be necessary.

I.2.2 Long-Term Reliability of Remedy

For Alternative 1, no efforts would be undertaken to remediate the groundwater contamination or mitigate the potential onsite risk posed by VOC vapors intruding into hypothetical future residences. Therefore, this alternative is not reliable in the long-term. Alternative 2 relies exclusively on LUCs to provide protection and, therefore, would not provide an effective means of addressing the groundwater contamination and documenting a reduction to cleanup goals. The long-term reliability of Alternative 3 is dependent on the performance of MNA. The remedy would result in permanent and irreversible reductions of groundwater constituent levels. Alternatives 4 and 5 are expected to provide a high degree of reliable, long-term protection, as both treatment technologies effectively degrade VOCs in groundwater.

I.2.3 Quantity of Untreated Waste and Treatment Residuals to be Disposed Off-Site or Managed Onsite in a Containment System, and Degree of Hazard Remaining in Such Material

Untreated wastes or treatment residuals would not be generated for off-site disposal or for containment and management onsite. Groundwater treatment under Alternatives 3, 4 and 5 would be performed *in situ*. Alternative 3 relies solely on naturally occurring processes and, thus, does not require additional substrate or chemical applications, as do Alternative 4 and 5. The materials used during implementation of Alternative 4 and 5 are expected to be consumed in the subsurface during the degradation process; therefore, there should be no treatment process residuals generated. Some purge water would be generated during routine groundwater monitoring well sampling; however, this material is not considered to be "treatment residuals" and would be managed and disposed of according to Standard Operating Procedures developed as part of the work plans. Residual VOC levels in groundwater upon completion of Alternatives 3, 4 and 5 would not pose a hazard, as the levels would be documented to be below the stated risk-based cleanup goal concentrations.

I.3 Expected Outcomes of Each Alternative

Alternative 1 would not achieve remedial goals and, thus, is unacceptable. Alternative 2 would provide a means to limit potential future exposure to VOC vapor intrusion; however, this alternative does not effectively document reductions in VOC levels in groundwater to levels that are protective. Therefore, the alternative does not achieve all RAOs and is not considered a permanent solution. In contrast, the expected outcome for Alternatives 3, 4, and 5 would be the attainment of all RAOs and the ability to release the property for beneficial reuse.

J. Comparative Analysis of Alternatives

The advantages and disadvantages of each alternative were compared against the nine CERCLA evaluation criteria established by EPA in Section 300.430(d)(9)(iii) of the NCP, as presented in this section. Table 3 presents a summary of the comparative analysis for each alternative.

J.1 Threshold Criteria

The two threshold criteria discussed below must be met for an alternative to be considered viable.

J.1.1 Overall Protection of Human Health and the Environment

Addresses whether an alternative provides adequate protection and describes how exposure risks are eliminated, reduced, or controlled through treatment or LUCs.

Alternative No. 1 would not be protective of human health or the environment because human exposure to VOC vapors at unacceptable levels could occur in the future. This alternative would not be able to achieve compliance with the RAOs, as it would not provide a means of demonstration that groundwater contamination levels have achieved the target cleanup goal concentrations. Achieving the cleanup goal concentrations is the only way to provide protection against the hypothetical future exposure route of vapor intrusion to onsite residents.

Alternatives 2, 3, 4 and 5 would be protective of human health and the environment. In each of these alternatives, potential future exposure to VOC vapor from groundwater would be controlled by implementation of LUCs. However, Alternative 2 does not directly address the RAO to reduce groundwater VOC concentrations at the Site to levels that allow unrestricted home construction and occupation (i.e., the alternative will not be able to demonstrate that target cleanup goal concentrations have been achieved). In addition, Alternative 2 does not meet the statutory preference for treatment versus reliance on administrative controls as a means to prevent exposure.

Alternative 3 includes implementation of both MNA and LUCs until the RAOs are achieved. Protectiveness will be provided through LUCs while the performance of MNA is being demonstrated. While Alternative 3 would not satisfy the preference for treatment as a principal element, the alternative does utilize a permanent solution and provides for the documented reduction in toxicity and volume of the groundwater contaminants. Mobility would not be reduced under any alternative.

Alternatives 4 and 5, which include active remediation, MNA, and applicable LUCs until the RAOs are achieved, are considered protective of human health and the environment. Both components of active treatment would be applied in areas with PCE concentrations above 55 µg/L (though this concentration was not exceeded in either the June 2007 or October 2008 data sets). Based on experience at other sites, VOCs would be readily degraded through either process, although two or more rounds of treatment may be required for full effectiveness. If the June 2007 concentrations are substantiated in future sampling rounds, then no active treatment would be performed and both alternatives would default to MNA.

J.1.2 Compliance With ARARs

Addresses whether a remedy will meet all of the ARARs related to hazardous substances released to the environment at the Site.

The remediation of groundwater at the Site is not ARAR-driven. There are no chemical-specific or location-specific ARARs identified for any of the alternatives with regard to the route of exposure. However, for Alternatives 4 and 5, compliance with the substantive technical requirements of the UIC permit process (40 CFR Part 144-147), which is an action-specific ARAR, would be necessary.

J.2 Primary Balancing Criteria

The five primary balancing criteria discussed below are used to identify major trade-offs among the alternatives.

J.2.1 Short-Term Effectiveness and Environmental Impacts

Addresses the impacts to the community and site workers during the time it takes to complete the remedial action and meet the RAOs.

None of the alternatives would have significant short-term effects (either negative or positive) on worker or community health. Appropriate health and safety precautions would be utilized during well installation or the installation of substrate injection points and associated sampling activities. Some short-term impacts to workers may occur during implementation of Alternative 5, due to the potential for handling chemicals. Appropriate health and safety precautions would be implemented during substrate injection

No environmental impacts are envisioned to be associated with the use of either EAB or CHEM OX (Alternatives 4 and 5), as neither the substrates nor their byproducts are toxic to the environment.

No monitoring is associated with Alternatives 1 and 2; therefore, no documentation would be provided that the target cleanup goal concentrations (and associated risk reduction) have been achieved. Also, the time required to meet RAOs is undefined. In addition, Alternative 1 does not provide controls to reduce potential future exposure.

For Alternatives 3, 4, and 5, the construction and implementation of the alternatives would not result in any short-term impacts on workers or the community. For Alternative 3, MNA of the source area is estimated to require about 15 years to achieve compliance with RAOs based on starting from the conditions documented in the 2003-2005 dataset. The MNA timeframe was estimated using a first order anaerobic decay model for the average values obtained from 2003-2005, and from the historic maximum concentration of VOCs. Additional detail on the modeling is located in Appendix C of the FS (URS, 2008). This estimate may be revised based upon an assessment of the data collected during the enhanced data collection period.

For Alternative 4, the active EAB remediation is expected to reduce existing dissolved phase contamination by half in the targeted areas within three years. For Alternative 5, the CHEM OX reactions from each application occur rapidly, and the outcome from the treatment would be apparent in a matter of months. Repeat applications may be required for both Alternatives 4 and 5. MNA would address the portion of the plume that is below 55 µg/L PCE for both Alternatives 4 and 5. LUCs and monitoring would continue until RAOs are achieved.

J.2.2 <u>Long-Term Effectiveness and Permanence</u>

Refers to the ability of the alternative to protect human health and the environment over time, once cleanup levels have been met.

For Alternative 1, no efforts would be undertaken to remediate the groundwater contamination or mitigate the potential onsite risk posed by VOC vapors intruding into hypothetical future residences. Although natural attenuation processes would reduce groundwater contamination concentrations over time and the excavation work has removed significant contaminant mass, no data would be collected to measure contaminant reductions or assess when potential risks have receded to threshold levels. Overall, this alternative would not provide an effective means of addressing the groundwater contamination or providing protection to future onsite residents against the potential risks from vapor intrusion.

Alternative 2 relies exclusively on LUCs to provide protection and, thus, is not considered a permanent solution. Although this alternative would protect human health if properly implemented, it would not provide an effective means of addressing the groundwater contamination and reaching the cleanup goals.

Alternatives 3, 4, and 5 reduce the magnitude of residual risk, and the reduction provided is permanent. Risk reduction under Alternative 3 would be dependent on the performance of MNA. Because the post-excavation groundwater monitoring data set is insufficient to statistically demonstrate the rate at which natural attenuation processes are occurring at the Colonie Site, an enhanced data collection period would be necessary to expand the data set.

With the completion of the soil removal action, monitoring would provide a means to evaluate the equilibrium of geochemical conditions and assess the rate of biodegradation. The goal of the MNA enhanced data collection would be to document that MNA would achieve the RAOs within a reasonable period of time. The remedy would result in permanent and irreversible reductions of groundwater constituent levels.

Alternatives 4 and 5 are expected to provide a high degree of reliable, long-term protection of human health and the environment. Both EAB and CHEM OX treatments have been shown to effectively degrade chlorinated hydrocarbons (i.e., PCE and TCE) in groundwater, although repeat applications for either type of treatment may be required to achieve target cleanup goal concentrations. The degradations that occur are irreversible and provide a long-term solution.

J.2.3 <u>Reduction in Toxicity, Mobility, or Volume Through Treatment</u>

Refers to anticipated ability of the remedy to reduce the toxicity, mobility, or volume of the hazardous components present at the site through treatment.

Neither Alternative 1 nor 2 provides any documented reduction of toxicity, mobility or volume of the groundwater contaminants as an element of remediation. For Alternative 3, natural attenuation processes are expected to gradually reduce the toxicity of the groundwater and the volume of contaminants over time. As VOC constituents are degraded, the toxicity would be reduced, as TCE and DCE have higher target cleanup goal concentrations than PCE. In addition, as concentrations are reduced and cleanup goal concentrations are achieved across the onsite plume, the plume area designated as impacted would decrease.

Alternatives 4 and 5 also reduce VOC concentrations in groundwater, thereby reducing the toxicity of the contaminant plumes and volume of contaminants present. Mobility of contaminants would not be reduced under any alternative. Both forms of treatment may increase the solubility and mobility of certain metals; however, their mobility should return to normal beyond the treatment area of influence. There are varying degrees of uncertainty regarding performance of these alternatives based on the 2003 to 2005 geochemical conditions at the Site. As noted previously, additional geochemical data is being collected and evaluated to determine more current geochemical conditions, subsequent to soil removal activities.

J.2.4 <u>Implementability</u>

Addresses the technical and administrative feasibility of an alternative, including the availability of material and services required for cleanup.

All the alternatives are administratively feasible, and the required services and materials, where applicable, are available. Therefore, technical feasibility comprises the focus of the implementability analysis. There are no construction, equipment, storage, or disposal-related considerations associated with Alternatives 1 and 2. These alternatives are both technically feasible to implement.

Alternative 3 is simple to implement, since infrastructure requirements are limited to the installation of monitoring wells. Operating and maintenance requirements would include groundwater sampling, well inspections and associated periodic repairs or replacement (if required). This alternative does not impact future actions.

For most areas, drilling into the subsurface should not be difficult because there are few utility constraints. The LUCs will have the same implementability considerations as described for Alternative 2.

Alternatives 4 and 5 are more complex in that they both require a pilot test to optimize design, and injection of the materials would need to be performed by specially trained subcontractors using mobile equipment. In addition, repeat injections may be required if contaminant rebound occurs. The portion of the Site treated by the MNA component common to Alternatives 4 and 5, as well as the implementation of LUCs, would have the same considerations as described above.

J.2.5 Cost

Evaluates the estimated capital, and operation and maintenance costs.

The total costs for each alternative (present worth with an accuracy of +50% to -30%) are estimated as follows:

Alternative No. 1: $0

Alternative No. 2: $29,000

Alternative No. 3: $430,000

Alternative No. 4: $980,000

Alternative No. 5: $2,100,000

Alternatives 1 and 2 provide the lowest overall costs; however, neither alternative achieves the same level of protectiveness as Alternatives 3, 4 and 5, nor are they permanent solutions. Alternative 3 provides similar levels of protectiveness and long-term permanence as Alternatives 4 and 5, and is more cost effective. Under Alternatives 4 and 5, if the technology does not perform adequately, the cost to implement another alternative remedy might be higher than if the technology had not been attempted in the first place. Additional information regarding the development of cost estimates for each alternative is provided in the FS (URS, 2008).

J.3 Modifying Criteria

These criteria are formally evaluated after the public comment period.

J.3.1 State Acceptance

The NYSDEC concurred with the selection of Alternative 3 as the Selected Remedy for groundwater. The agency noted that when combined with an appropriate monitoring plan and land use controls, monitored natural attenuation is a sufficiently protective groundwater remedy for the environment.

The NYSDOH also concurred with the selection of Alternative 3; however, the agency did provide comments regarding the strengthening of LUCs and the development of RAOs. These comments and USACE responses are provided in Section III of this ROD.

J.3.2 Community Acceptance

Opposition to the selection of Alternative 3 was presented by one community group. The community group supports the selection of Alternative 4: EAB as a viable means to permanently address groundwater contamination and prevent further migration.

As discussed within this ROD, EAB is more effective in treating higher concentrations of VOCs. As the concentrations of contamination decrease, so does the effectiveness of EAB, and thus the cost effectiveness of the remedy decreases as well. A component of the EAB alternative is to combine the active treatment (for areas with PCE greater than 55 µg/L PCE) with the use of MNA for areas with lesser levels of contamination. The most current groundwater data does not indicate the presence of PCE concentrations above 55 µg/L, therefore, had Alternative 4 been initially selected at completion of the Proposed Plan and response to public comments, the active treatment portion of the remedy would default to the use of MNA based upon existing groundwater conditions. It should be further noted that MNA is a passive, not an active, treatment. The use of MNA, a passive remedial method, tracks the changes in VOC concentrations in groundwater and imposes a strict groundwater monitoring program designed to demonstrate the progress and effectiveness of natural attenuation. The additional implementation of land use controls provides added protection against future exposure to VOC vapors for potential onsite residents.

K. Principal Threat Wastes

Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained. Low-level threat wastes are source materials that generally can be reliably contained and would present only a low level of risk in the event of release. The EPA expects that treatment will be the preferred means to address the principal threats posed by sites in general wherever practicable. The groundwater contamination at the Site is neither a principal threat waste nor a low-level threat waste. Groundwater is not considered a source material, nor is the VOC contamination present in the groundwater considered a source material (i.e., such as a Dense Nonaqeous Phase Liquid [DNAPL] would be).

L. Selected Remedy

Alternative 3, Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs), is the Selected Remedy for groundwater remediation being proposed for implementation at the Colonie FUSRAP Site.

L.1 Summary of the Rationale for the Selected Remedy

Alternative 3 is preferred over other alternatives because:

- The Alternative is expected to achieve substantial risk reduction by providing permanent and irreversible reductions in concentrations of groundwater COCs to acceptable levels in the most cost effective and easily implemented manner.
- The Alternative provides measures to prevent potential future onsite residential exposure to VOC vapors from contaminated groundwater through the implementation of LUCs until RAOs have been met.

Based on currently available information, USACE believes that the Selected Remedy meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing criteria. The Selected Remedy has State acceptance. While there are community concerns regarding Alternative 3, the remedy was chosen based on the relative merits of the alternatives to address the types and levels of contamination currently present at the site, in accordance with CERCLA criteria.

L.2 Detailed Description of the Selected Remedy

Reductions in contaminant concentrations will be documented and evaluated statistically through a groundwater monitoring program. An MNA work plan will be developed that will outline the wells to be sampled, sample analysis, and sample frequency. Groundwater monitoring associated with the MNA program initially will consist of sampling all 15 of the existing Upper Silt wells. Four new wells are also included for cost-estimating purposes, assuming they are needed. Figure 9 shows all of the existing monitoring wells present on and adjacent to the Colonie Site.

Because the current data set is insufficient to demonstrate the rate at which *in situ* biodegradation processes are active, a two- to five- year enhanced data collection period is proposed to evaluate these rates, as to document that geochemical conditions have returned to equilibrium. Monitoring data generated since the completion of Site excavation and dewatering work may allow the data collection period to be shortened or revised. While the monitoring program for the enhanced data collection project will be established in the MNA Work Plan, it is assumed that groundwater monitoring will be conducted on a quarterly basis. during the first year. During the next two years, monitoring will be conducted semi-annually. Annual groundwater monitoring will be conducted thereafter.

The quarterly and semi-annual samples collected in the first three years of this program will be analyzed for VOC compounds and MNA geochemical assessment parameters. The samples collected after the third year will be analyzed for VOCs only. The goal during the enhanced data collection period will be to generate a robust data set that will allow the primary and secondary lines of evidence requested by EPA guidance to be documented (i.e., decreasing concentration trends of primary contaminants and groundwater geochemical evidence of biodegradation).

At the end of the two –to-five year data collection period or sooner, the progress of MNA will be assessed and the estimated timeframe to achieve target cleanup goal concentrations will be re-evaluated using site-specific data. Monitoring will continue until compliance with the target cleanup goal concentrations has been achieved.

The remedial action will be considered complete and monitoring will be discontinued when compliance with the cleanup goal concentrations have been achieved for all onsite monitoring wells included in the monitoring program. If during the monitoring period, measured concentrations in any well reach, and are maintained below, the target cleanup goal concentrations for four consecutive quarters, the well will be dropped from the monitoring program. After eight quarters of monitoring, data from any wells remaining in the monitoring program will be evaluated statistically using the data collected post-excavation and any subsequently collected rounds of data.

Wells achieving compliance with a statistically significant criterion that is below the target cleanup goal concentrations will have met the cleanup criteria, and further monitoring of these wells will be discontinued.

While the estimated timeframe to achieve RAOs is currently projected at 15 years, the progress of MNA will be assessed and the estimated timeframe to achieve RAOs will be re-evaluated at the end of the two- or five-year enhanced data collection period. Lines of evidence (both groundwater concentrations of VOCs and geochemical conditions) will be used to evaluate the progress of MNA. Site data currently indicates that VOC reduction is already occurring based on source material removal, and that MNA is a viable and cost-effective means of achieving additional risk reduction within a reasonable timeframe. USACE has initiated a two year monitoring program beginning in 2008 to better refine timeframes and estimates.

L.3 Cost Estimate for the Selected Remedy

Total costs for the selected remedy (Alternative 3) are estimated to be $430,000. The costs are based on well installation, long term monitoring and other indirect capital costs, as presented in the FS. The estimate includes costs for legal and administrative activities associated with obtaining/revising land use restrictions and development of the monitoring program work plan. Table 4 presents a detailed breakdown of the overall cost estimate for Alternative 3.

Total capital costs are estimated to be $60,000. This includes both direct costs, such as implementation of LUCs and installation of monitoring wells; and indirect costs, such as management and administrative costs. The number of monitoring wells has been estimated for cost purposes only. USACE will devise a long-term monitoring program that may differ from the conceptual monitoring plan outlined in the FS.

Four new monitoring wells are currently proposed, for a total network of 19 monitoring wells. Each well will be 4-inch diameter polyvinyl chloride (PVC), installed to a depth of approximately 20 ft below ground surface (bgs). Cost for well installation includes labor, materials, and equipment necessary for the installation of wells. Well sampling labor costs include labor, materials, equipment, and waste disposal necessary for collecting groundwater samples.

Total annual operating and maintenance costs (O&M) are estimated to be $290,200 over a 16-year period. These O&M costs include the MNA performance monitoring period and subsequent annual monitoring. The MNA performance monitoring for VOCs and geochemical parameters encompasses a three-year period (for estimating purposes only), with Year 1 being baseline and quarterly sampling; and Years 2 and 3 being semiannual performance monitoring. As noted previously, the performance monitoring period may be between two (2) and five (5) years, dependent on analytical results of the groundwater sampling. Annual groundwater monitoring for VOCs will be conducted through Year 15, with one final year (Year 16) of quarterly VOC sampling designed to document attainment of target RAO concentrations in all monitoring wells.

Costs are included for routine sample analysis of detected radiological parameters during each groundwater sampling event to demonstrate that levels are stable or decreasing.

Reporting costs include labor and materials necessary for data evaluation, evaluation of site conditions, and recommendation for continuation of groundwater monitoring.

A contingency factor of 20% ($70,040) has been applied to the subtotal cost of Alternative 3 to cover the potential for unanticipated conditions or unforeseen circumstances that were not possible to evaluate at the time the estimate was prepared.

The information in the cost estimate summary is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the *Administrative Record* file, an *Explanation of Significant Difference* (ESD) or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

L.4 Estimated Outcomes of the Selected Remedy

The Selected Remedy is considered a permanent solution, will attain all RAOs to be protective of human health and the environment, and provide for the ability to release the property for beneficial reuse.

M. Statutory Determinations

The selected remedy satisfies the statutory requirements of CERCLA §121 and the NCP, as described below.

M.1 Protection of Human Health and the Environment

The selected remedy, Alternative 3, will protect human health and the environment by use of MNA to reduce VOC concentrations in groundwater to acceptable levels. It is anticipated that MNA will achieve satisfactory risk reduction within a 15-year timeframe. The alternative provides for the control of potential future exposure to VOC vapor from groundwater through the implementation of LUCs until such time as the target cleanup goals concentrations are attained and RAOs have been achieved.

M.2 Compliance with ARARs

There are no action-specific, chemical-specific, or location-specific ARARs identified for the selected remedy. Alternative 3 is expected to achieve all RAOs.

M.3 Cost-Effectiveness

USACE has determined that the selected remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: *A remedy shall be cost-effective if its costs are proportional to its overall effectiveness* (NCP §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., deciding whether they were protective of human health and the environment, as well as being ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; and short-term effectiveness).

Overall effectiveness was then compared to costs to determine effectiveness. The relationship of the overall effectiveness of Alternative 3 was determined to be proportional to its costs and, thus, this alternative represents a reasonable value for the money to be spent.

M.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The Selected Remedy, which relies on naturally occurring processes, will achieve significant reductions in VOC concentrations in groundwater. The Selected Remedy satisfies the criteria for long-term effectiveness by reducing VOC contamination. For Alternative 3, natural attenuation processes are expected to gradually reduce the toxicity of the groundwater and the volume of contaminants over time. As concentrations are reduced and target concentrations are achieved across the Site, the plume area designated as impacted will recede. The Selected Remedy does not present short-term risks different from the treatment alternatives. There are no special implementability issues related to the Selected Remedy.

M.5 Preference for Treatment as a Principal Element

While Alternative 3 would not satisfy the preference for treatment as a principal element, the alternative does utilize a permanent solution and provides for the documented reduction in toxicity and volume of the groundwater contaminants. Mobility will not be reduced under any alternative.

M.6 Five-Year Review Requirements

The Selected Remedy will achieve all RAOs. Once those RAOs are achieved, no hazardous substances, pollutants, or contaminants will remain above levels that would not allow for unlimited use and unrestricted exposure; however, until those RAOs are achieved, there are statutory requirements for five-year reviews to determine the protectiveness of the adopted remedy for the Site groundwater. USACE will discontinue the five-year reviews only after documenting that concentrations of the contaminants of concern have met cleanup criteria in all wells, as described in Section L.2.

III. RESPONSIVENESS SUMMARY

The public comment period for the Colonie Site Groundwater Proposed Plan extended from July 30 to August 31, 2009. Letters were received from the public, the NYSDOH and the NYSDEC during this time and are attached to this Responsiveness Summary. Verbal comments were received from one commenter during the public meeting held July 30, 2009. These comments are documented in the public meeting transcript, which is also attached to this Responsiveness Summary. All comments received have been grouped by commentor and are presented below.

Mr. Bob Reilly, State Assembly (verbal comments)

Comment #1:

How does the groundwater move or not move? What is the nature of the groundwater? Because it seems to me that groundwater would, in fact, move off the site over time.

Response:

Groundwater migration rates are slow due to the low hydraulic conductivity of the silts and clays and the modest hydraulic gradients. Groundwater velocities in the plume areas in the southern portion of the Colonie Site range approximately from 4 to 40 feet/year. The Upper Silt unit is composed primarily of lake silt and sand and sits atop a layer of clay and silt. In general, permeability is ranked from higher to lower rates as follows: Gravel > Sand > Silt> Clay.

Comment #2

The other one, not by way of criticism, but the number of people here is quite small. So what was the nature of your publicity in this? What elected officials -- I was contacted by letter, but I didn't see any other advertisement. The mayor of the village, when I had a conversation with him a day or two ago, he was unaware of this meeting. So what elected officials did you contact and what was the nature of the notice in the newspaper? Was it a legal notice or an ad or what?

Response:

Public meeting announcements were published in two local newspapers, the Colonie Spotlight and the Albany Times Union. The announcements were published for two consecutive Wednesdays (July 15 and July 22, 2009) prior to the meeting. A copy of the Proposed Plan and Fact Sheet were sent to a mailing list of officials from state representatives to local committeemen. Approximately 200 postcards were mailed to local residents announcing the public meeting as well as the availability of the Proposed Plan in the public library.

Comment #3:

Was the notice that's in the newspaper, not to belabor, by way of ad or legal notice? The reason I ask that question is very few people read the legal notices.

Response:

The notice is a public notice, but it is specifically not placed in the legal section of newspapers. The notice was placed in the local Colonie news section of both the Colonie Spotlight and the Albany Times Union. The notice was placed as a four-by-six inch advertisement. This size and placement is consistent with how public notices have been advertised in the past.

Comment #4

As an elected official, I've been aware of and kept somewhat up to breast on this subject, on this issue. And as an elected official, and I believe for many residents, it's a very frustrating process, because many people are extremely concerned about health issues related to this. So my question is, can we see an end to this some time? Can we see an end to this? Can you predict some time when an end to this may occur, and the state government, whoever, Department of Health, DEC and the Corps of Engineers, declare this process over with?

Response:

The public comment period for the Colonie Site Groundwater Proposed Plan extends through August 31, 2009. All comments received will be formally addressed in a Responsiveness Summary. Subsequent to the Responsiveness Summary, the Record of Decision will be finalized and will document what action will be taken in the future in terms of groundwater remediation. The Record of Decision is the point in the overall process where USACE documents the path forward to completion.

If that action is the proposed preferred remedy (monitored natural attenuation), USACE will continue to collect groundwater samples over time to ensure that the attenuation process will be completed according to our analysis. The current timeframe for remediation is estimated at 15 years or less.

Regarding the soil remediation, the removal action was completed in 2007 with the excavation and offsite disposal of contaminated soil from the main site and three vicinity properties, however, some documentation issues require follow-up. Completion of the soil removal has addressed the main concerns of the community.

Comment #5:

So there's another process for soil?

Response:

The CERCLA process is the same for both soil and groundwater. The soil documentation process is moving slightly behind the documentation process for the groundwater. The soil removal was conducted as part of an interim removal measure and the associated documents are still being finalized.

Similar to the groundwater process, there will be a public meeting for the soil, where the Proposed Plan will be presented for public review and comment. The Plan will present an analysis of all the soil removal work completed by USACE, as well as the earlier soil remediation activities conducted by DOE. The removal actions will be evaluated to ensure that they are consistent and effective in terms of being protective for human health and the environment.

Comment #6:

The question of depleted uranium is not a question being addressed today. There's no trace amounts of depleted uranium in the groundwater of levels that would be of concern; is that accurate?

Response

Uranium has been detected in one well (MW 32S) at the Site at levels exceeding the EPA's Maximum Contaminant Level (MCL) of 30 µg/L. Based upon the HHRA, no complete pathway (current or future) exists for ingestion of drinking water; therefore, no potential risks were identified for radiological constituents under that scenario. In addition, no potential future risks from radionuclides were identified based on the vapor intrusion pathway. Radionuclides (including uranium) will be monitored under Alternative 3 in 13 wells (including MW 32S) to demonstrate that levels are stable or decreasing. Radiological data would be evaluated for trends over a two year timeframe to measure the effectiveness of the soil removal action.

Comment #7:

Somewhat for the record, the site is now usable in a number of ways, such as a highway that they talk about, some leaning over to the highway or a playground or a warehouse. I'll leave out residence. Is that correct?

Response:

DOE is the owner of record for this property. USACE would not be directly involved in site re-use. USACE is conducting a two-year groundwater monitoring program. At the completion of the groundwater monitoring program, compliance with the cleanup goals will be evaluated. Proposed periodic monitoring will be based on modeling results (i.e., Mann Whitney). The government would continue the long term monitoring program until such time as the cleanup goals have been achieved (for the proposed remedy of monitored natural attenuation, this would be approximately 15 years). DOE would work with the General Services Administration (GSA) to determine the appropriate method to excess the property, based upon the GSA real property screening process. This process evaluates potential interest from other federal or state agencies. If not, the property would then be auctioned for the highest bid.

With respect to groundwater, the cleanup goals are consistent with residential (unrestricted) use.

Comment #8:

In fact, it's years off before the site?

Response:

Yes. As presented in the response to Comment # 7, DOE would complete a screening to determine other uses for the property.

Comment #9:

Now, I assume that you know there are -- you're aware of the various what I'll call activists -- wanting testing and litigation relative to the site and in depleting uranium. What we're doing here tonight really is irrelevant as far as that's concerned.

Response:

The public meeting is not related to other issues being pursued by interested parties. Public meetings are held as a regulatory requirement under CERCLA.

Comment #10:

How will your results be publicized? You did a good job publicizing this even though many people didn't come, but now, will there be --what will be the steps in informing the public of what happens as far as your determination for remediation?

Response:

After public comment period ends on August 31, 2009, a formal response will be prepared for all comments received (in writing or verbally). The comment responses will be incorporated into the Record of Decision. If there is a change to the proposed remedy, based upon comments received, all interested stakeholders, such as the NYSDEC and the NYDOH, would be notified. If there are no substantial changes, the ROD will be finalized. It is planned to finalize the ROD for the Colonie Site Groundwater by the end of 2010.

The availability of the finalized ROD will be published in both the Albany Times Union and Colonie Spotlight newspapers. The ROD will be available for public inspection and copying at the William K. Sanford Town Library, 629 Albany Shaker Road, Loudonville, NY 12211 (518) 458-9274.

Work plans will then be developed to determine the appropriate locations for long term monitoring wells. A long term groundwater monitoring plan will also be prepared. A report will be issued after each round of sampling (i.e., quarterly, semi-annual, annual). The reports will contain analytical data, maps and a narrative summary of the groundwater results in comparison to the cleanup goals. These reports will be provided to the NYSDEC and NYDOH, as well as any other stakeholders that have expressed interest. The groundwater monitoring reports will also be placed in the public library repository.

In addition, newsletters and community meetings may be used to communicate on-going site progress. Stakeholders can always call and ask direct questions or submit letters.

Comment #11:

Finally, I'll say I haven't heard anything that I object to this evening.

Response:

Comment noted.

<u>Community Concerned About NL Industries (CCNL) (letter dated August 27, 2009)</u>

Comment #1:

While the polluted groundwater at the site is not currently being used for drinking water, it can intersect with nearby streams spreading contaminants. There are streams in the area where people fish and they should not be subjected to ongoing contamination from the polluted groundwater.

Response:

There are no indications that the Colonie Site groundwater is "polluting local streams", and based upon current data, it is reasonable to expect that any potential contaminant migration issues would decrease with time. Potential contamination in surface water and associated risks were evaluated in the RI and Risk Assessment reports. The primary contaminants detected in the unnamed tributary to Patroon Creek during the RI were arsenic, PAHs and VOCs. The only VOC constituent elevated above the water quality criteria was PCE, with a maximum detection of 6.0 µg/L (compared to the water quality criteria of 5.0 µg/L). These samples were obtained during the 2001-2002 timeframe, a period in which PCE concentrations in Site groundwater were detected at levels up to 1,200 µg/L. In 2008, Site PCE levels were reported as 31 µg/L or less. While this level does exceed the NYSDEC surface water standard of 5.0 µg/L, the intent of showing this value was not to imply that current levels are below surface water standards, but to demonstrate the overall decrease of PCE levels in groundwater since 2001

The HHRA evaluated direct recreational contact for surface water in the unnamed tributary to Patroon Creek, based upon the 2001-2002 data (including VOCs). The primary constituent contributing to elevated risk was identified as PAHs. It was noted that the watershed is in an urban area, which contributes to the occurrences of PAHs; thus the potential exposure risk was not necessarily site-related.

Comment #2:

Another major concern is the past toxic air vapors in the basements of Yardboro Avenue homes which could occur again if the groundwater is not fully remediated. Toxic air vapors from VOCs are a significant public health risk which was not fully addressed in the Groundwater Proposed Plan. On page 9 and 10 of the plan the Army Corps downplays the toxic vapor problem that was found in some Yardboro Avenue homes. In our meetings with the state agencies, they agreed that were no clear standards determining what levels are “safe” and the exposures to people in their basements was a risk. We were informed that when the source of contamination was exhumed on the site property, the toxic vapor levels went down for awhile. However, the contaminants that have leached into the groundwater can ebb and flow and if the groundwater is not remediated, the vapors could occur again at some point in the future.

Response:

Groundwater will be fully remediated under the MNA alternative. In addition, the MNA monitoring program ensures that no potential changes in the configuration of the plume go undetected. Although all indications are that the plume is diminishing since the source material has been removed, the “monitored” part of MNA ensures that the plume is closely observed until such time as the remedial action objectives have been achieved. Wells are monitored within and at the edges of the plume to observe changes in the plume, and sentinel wells are monitored downgradient of the plume to assess any movement of the plume.

The intent of the Proposed Plan was not to downplay the indoor air assessments that took place between 2002 and 2005. The Proposed Plan provides a summary of the residential sampling information which is presented in greater detail within the FS. The results of the indoor air investigation are also presented in the *Final Indoor Air Assessment Report* (Shaw, 2005). The indoor air, outdoor air, and sub-slab sampling results obtained during this investigation were compared to a variety of guideline values, including NYSDOH Study Background Levels, NYSDOH Air Guideline Values, and EPA PRGs. All final recommendations of ’No Further Action” were made with concurrence of the NYSDOH.

As presented in the Proposed Plan, the extent of the VOC plume being evaluated for cleanup is based on providing protection via the vapor intrusion pathway and, thus, is limited to onsite areas. The plume was identified as the extent of groundwater exceeding the RAOs, and was plotted based upon 2003-2005 data (during soil removal activities). Both the June 2007 and October 2008 data (obtained after source removal was complete) indicated that only three of 19 wells have concentrations of VOCs (PCE) exceeding the RAOs. While it is agreed that these concentrations may fluctuate somewhat over time, the source of contamination has been removed, thus the VOC levels would not rebound to concentrations detected prior to soil removal. For example, PCE levels fluctuated in one well from June 2007 to October 2008 at concentrations between 9.4 and 21 µg/L, however, the PCE concentration in this well prior to source removal was 1,200 µg/L.

In addition to the fact that the soil removal action has reduced the potential for additional off-site VOC migration, no potential impacts to downgradient residential area are expected as the transport characteristics of the water-bearing zone have prevented groundwater contamination from migrating beyond the rail corridor over the past 50 years and the sheet pile wall installed in support of soil excavation interrupts groundwater flow to the southeast, and acts to retard further off-site migration of the VOC plume.

Comment #3:

We strongly support the selection of Alternative 4: Enhanced Anaerobic Bioremediation (EAB) to fully address the polluted groundwater. We strongly oppose the Army's preferred Alternative 3: Monitored Natural Attenuation (MNA) and Land Use Controls. This is merely the cheapest method and it is basically a "no cleanup" or "do nothing" approach. It allows VOC toxic contaminants to be spread and diluted in groundwater which can flow into surface water and through vapors go into people's basements. EAB technology is an innovative approach that can effectively remediate the polluted groundwater for an additional $550,000. This is a wise use of the taxpayer's money as it can permanently address the pollution and stop any further spreading of the contaminants.

Response:

Rather than being a "no cleanup" or "do nothing" approach, Alternative 3, MNA is a passive treatment option compared to Alternative 4, EAB, an active treatment option. The use of MNA does not allow for the spread of VOC contamination, rather, it imposes a strict groundwater monitoring program designed to demonstrate the progress and effectiveness of natural attenuation. The additional implementation of land use controls (including restrictions on construction of homes with basements) provides added protection against future exposure to VOC vapors for potential onsite residents. As presented in the FS and Proposed Plan, there is no current or future risk to off-site residents from vapor intrusion related to Site groundwater.

As discussed in the Proposed Plan, EAB is more effective in treating higher concentrations of VOCs (for purposes of the FS evaluation, the effectiveness level was determined to be 55 µg/L PCE). As the concentrations of contamination decrease, so does the effectiveness of EAB, and thus the cost effectiveness of the remedy decreases as well. A component of the EAB alternative is to combine the active treatment (for areas with PCE greater than 55 µg/L PCE) with the use of MNA for areas with lesser levels of contamination. As previously discussed, the most current groundwater data does not indicate the presence of PCE concentrations above 55 µg/L (the maximum detected concentration in October 2008 was 31 µg/L); therefore, had Alternative 4 been initially selected at the completion of the Proposed Plan and response to public comments, the active treatment portion of the remedy would default to the use of MNA based upon existing groundwater conditions.

Comment #4:

If limited funding is driving the selection of the cheaper Alternative 3, we note that U.S. Senators in New York have successfully sought additional funding for this site in the past, helping to obtain the $5 million needed to finish the soil remediation. Our group would like to advocate for more funding to achieve a cleanup with Alternative 4. We urge the Army Corps to select Alternative 4 for the Groundwater Cleanup Plan.

Response:

The potential of limited funding was not considered during the remedy selection process. Alternative 3 was chosen based on the relative merits of the alternatives to address the types and levels of contamination currently present at the site, in accordance with the nine criteria used by CERCLA Alternative 3 was determined to provide substantial risk reduction in the most cost effective and easily implemented approach.

<u>State of New York Department of Health (letter dated September 14, 2009)</u>

Comment #1

The plan indicates that USACE's preferred remedy for groundwater is the monitored natural attenuation of VOCs. While we have no objection to this remedy for the groundwater, there does not appear to be any safeguards in place to prevent future landowners from drilling a well for any purpose. We understand that the proposed land use controls will include a deed restriction in the form of an environmental easement to prevent the installation of groundwater wells for drinking, irrigation or for process water; however, the proposed plan does not state this as being the case. Therefore, we request that the Record of Decision clearly state that the land use controls also include restrictions on the use of on-site groundwater.

Response:

Agree. The ROD for the Colonie Site Groundwater will include restrictions on the drilling or pumping of groundwater as a component of the selected remedy.

Comment #2:

The risk derived remedial cleanup objectives (RCOs) set forth in the proposed plan are to protect occupants of any future on-site buildings from contaminants in the indoor air as a result of soil vapor intrusion. However, the RCOs proposed here are based on the concentration of VOCs in the groundwater alone. Based on our experience, we cannot predicate the indoor air concentrations of volatile organic compounds in any building based upon a known concentration of VOCs in the groundwater and/or soil vapor. Instead of applying these RCOs as intended, we recommend that appropriate indoor air samples with concurrent sub-slab vapor samples be collected after buildings are constructed in the future to determine if the potential for exposures remain.

Alternatively, an active sub-slab depressurization system which depressurizes the entire building slab could be installed at the time of construction as a proactive measure aimed at preventing potential future exposures related to soil vapor intrusion.

Response:

The numerical remedial action objectives presented in the Proposed Plan are applied to concentrations of VOCs in groundwater to determine the level of remediation required for groundwater to be protective of human health and the environment. These proposed groundwater concentrations were calculated based upon modeling performed using EPA's Johnson and Ettinger Model for Subsurface Vapor Intrusion.

The Johnson and Ettinger model is widely used in assessing vapor intrusion risk into buildings. Site-specific model parameters include: depth to water table, soil types (both above the water table and within the vadose zone), and average vapor flow rates into a building (based upon soil type). Modeling results and RAOs were initially presented in the *Final Groundwater Feasibility Study* (URS, May 2008).

Until such time as concentrations of VOCs in groundwater attain the numerical RAOs, land use controls would be implemented for any potential future buildings constructed on the site. As specified in the Proposed Plan, periodic indoor air and sub-slab sampling would be conducted to assess potential exposure risks during the remediation timeframe. The installation of sub-slab ventilation systems for any future construction is also specified in the Proposed Plan as a control measure for reducing potential future exposures related to soil vapor intrusion.

Comment #3:

Another concern with the RCOs is that they do not take into account the possibility of exposures to site related contamination (both VOCs and radiological) in groundwater, via ingestion of future drinking water. Therefore, we recommend that the appropriate New York State Drinking Water standards be applied towards this potential exposure pathway.

Response:

Based upon the HHRA, no complete pathway (current or future) exists for ingestion of drinking water; therefore, no potential risks were identified for either VOC or radiological constituents under that scenario. In addition, no potential future risks from radionuclides were identified based on the vapor intrusion pathway. As there is no viable pathway for consumption of groundwater, and thus no potential risk to human health and the environment, we do not feel it is appropriate to establish RAOs based on drinking water standards. As noted on the Proposed Plan, in some cases the vapor intrusion RAO is more stringent than the MCL (e.g., the RAO of vinyl chloride is 1.4 micrograms per liter; the MCL is 2.0 micrograms per liter.

Comment #4:

Based on the groundwater monitoring to date, the radiological contamination detected in monitoring well 32S does not appear to be decreasing over time. Therefore, we recommend that the preferred remedy also include a contingency plan for this well. If radiological contaminants do not decrease after a designated amount of time, then alternative remedial options need to be explored to address the contamination in this area.

Response:

A component of the long term monitoring to be conducted for the MNA remedy includes the assessment of radiological conditions in all wells (including MW 32S) to evaluate the effectveness of the soil removal action. As the radiological constituents present in the Colonie Site groundwater do not pose a potential human health risk via the vapor intrusion pathway, no remedial options are required to be evaluated under CERCLA. Potential contingency plans related to radiological constituents may be developed under the long term groundwater monitoring work plans; however, it is not appropriate to include such contingencies within the scope of the proposed remedy for VOCs.

Comment #5:

The statement that the groundwater is non-potable due to high background concentrations of naturally occurring metals may be misinterpreted by the public. Please provide a clarification to indicate that this designation is strictly due to the aesthetic quality of the groundwater and not based on health implications.

Response:

Text has been revised to state: " … naturally occurring metals in excess of the corresponding New York State Groundwater Quality Standards (NYSGQSs). The non-potability of groundwater beneath and adjacent to the Colonie Site is a regional groundwater quality issue regarding the aesthetic and chemical characteristics of the water, and is not site related."

Comment #6:

Based on the proposed remedy of monitored natural attenuation for groundwater, USACE are proposing that the site be used for residential use. However, we believe that at this time it is premature to discuss which future uses are deemed protective of the environment and public health until a final soil cleanup goal is presented and approved by both the NYS DEC and the NYS DOH.

Response:

Under CERCLA, reasonable future land use is identified during the Baseline Risk Assessment and Remedial Investigation/Feasibility Study process in order to determine the appropriate extent of remediation. RAOs are also determined to assist in the development of alternatives that would achieve cleanup levels associated with the reasonably anticipated future land use over as much of the site as possible.

The proposed future land use of urban residential for groundwater is consistent with the proposed future land use presented in the *Action Memo for Soil Removal at the Colonie Site* (USACE, 2001).

Comment #7:

Based on the concern for soil vapor intrusion in the future we agree with the proposal to assign land use controls to the site mandating the installation of sub-slab ventilation systems and requiring periodic monitoring of indoor air/and or sub slab vapors. However, we do not agree with the proposed land use control of limiting buildings without basements as a measure to prevent soil vapor intrusion from occurring in that structure nor do we believe that this control alone would prevent soil vapor intrusion from occurring.

Response:

It is intended that the land use controls presented in the Proposed Plan be used in tandem in order to provide a layered approach to limiting potential future exposures to VOC vapors until such time as the groundwater RAOs have been attained. No one land use control would be used individually. The restriction on basement construction would not, in itself, prevent soil vapor intrusion from occurring, however, used in conjunction with other controls, would provide added protection from potential vapor intrusion into the structure by increasing the distance of the foundation from the vadose zone.

<u>State of New York Department of Environmental Conservation (letter dated August 31, 2009)</u>

Comment #1:

The Department concurs with the selection of Alt 3 as the preferred remedial approach for groundwater. The selection is supported by the dramatic reduction in maximum groundwater VOC concentrations (from 2,583 ug/l to 49.6 ug/l); the presence of tetrachloroethene degradation products (indicating natural reductive dechlorination) and the limited migration of groundwater contamination from source areas. When combined with an appropriate monitoring plan and land use controls, monitored natural attenuation is a sufficiently protective groundwater remedy for the environment.

Response:

Comment noted.

Comment #2:

A long-term monitoring plan for site groundwater has been submitted to and commented on by the Department. As part of the program, site groundwater will continue to be tested and evaluated for contamination until remedial standards are achieved and maintained.

Response:

Agree. The implementation of a long-term monitoring plan and subsequent sampling of groundwater until such time as it is demonstrated that the remedial action objectives have been achieved, are integral components of the Preferred Alternative.

Comment #3:

With respect to land use controls, the Department is aware of restrictions currently in place associated with soils contamination at the facility. The restrictions must be modified to prohibit the use of site groundwater, prohibit home construction with basements, mandating the installation of sub-slab ventilation systems on constructed structures. The land use controls must remain in effect until such time all New York State standards are met.

Response:

Upon implementation of the Preferred Alternative, existing land use controls will be modified to incorporate the additional controls specified for groundwater: prohibiting the use of site groundwater, prohibiting home construction with basements, and mandating the installation of sub-slab ventilation systems on all future construction. The implementation of a long-term monitoring plan and subsequent sampling of groundwater, until such a time as it is demonstrated that the remedial action objectives have been achieved, are integral components of the Preferred Alternative.

IV. REFERENCES

Dineen, 1982. *The Geology of the Pine Bush Aquifer, North-Central Albany County, NY.* By R.J. Dineen. Bulletin No. 449 New York State Museum. The University of the State of New York, New York. August 1982.

EPA. 1986. *Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy*. *Final Draft.* U.S. Environmental Protection Agency, Washington. D.C. December 1986.

EPA, 2002. *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance).* EPA530-D-02-004. U.S. Environmental Protection Agency, Washington. D.C. November 2002.

IT (International Technology), 1999. *October 1999 Geoprobe Groundwater Sampling Report, Colonie FUSRAP Site*. December, 1999.

IT, 2001 *Phase II Geoprobe Groundwater Sampling Report, Colonie FUSRAP Site*. 2001

Shaw, 2003. *Final Groundwater Remedial Investigation Report, Colonie FUSRAP Site.* Shaw Corporation for the U.S. Army Corps of Engineers – New York District. July 2003.

Shaw, 2004. *Site Investigation Report for the Unnamed Tributary of Patroon Creek, Patroon Creek, and Three Mile Reservoir.* U.S. Army Corps of Engineers – New York District. September 2004.

Shaw, 2005. *Final Indoor Air Assessment Report, Colonie FUSRAP Site.* Shaw Corporation for the U.S. Army Corps of Engineers – New York District. August, 2005.

Shaw, 2010. *Final Post Remedial Action Report, Colonie FUSRAP Site.* Shaw Corporation for the U.S. Army Corps of Engineers – New York District. January, 2010.

URS, 2004a. *Part A, Human Health Risk Assessment, Colonie FUSRAP Site.* URS Corporation for the U.S. Army Corps of Engineers – New York District. September 2004.

URS, 2004b. *Part B, Screening Level Ecological Risk Assessment, Colonie FUSRAP Site.* URS Corporation for the U.S. Army Corps of Engineers – New York District. September 2004.

URS, 2008. *Final Groundwater Feasibility Study, Colonie FUSRAP Site.* URS Corporation for the U.S. Army Corps of Engineers – New York District. May 2008.

USACE, 2001. *Final Action Memorandum – Revising DOE Action Memorandum dated February 14, 1997: Soil Removal at the Colonie Site.* U.S. Army Corps of Engineers – New York District. October 2001.

USACE, 2006. C*SX Vicinity Property Action Memorandum*. U.S. Army Corps of Engineers – New York District. MONTH, 2006.

USACE, 2008. *Final* C*SX Vicinity Property Report, Colonie FUSRAP Site*. U.S. Army Corps of Engineers – New York District. September, 2008.

U.S. Census Bureau, 2000. U.S. Census Bureau, Population Estimates Program, Washington, DC, Internet Release Date: March 9, 2000.

TABLES

Table 1 Summary of VOC Concentrations in Upper Silt, 2002 to 2008

	First Half 2002 (Jan-Feb)					Average of 4 Sample Rounds (2003-2005)					June, 2007					October, 2008				
WELL ID	DCE12C µg/L	PCE µg/L	TCE µg/L	VC µg/L	Total VOCs	DCE12C µg/L	PCE µg/L	TCE µg/L	VC µg/L	Total VOCs	DCE12C µg/L	PCE µg/L	TCE µg/L	VC µg/L	Total VOCs	DCE12C µg/L	PCE µg/L	TCE µg/L	VC µg/L	Total VOCs
05S[a]	22	69	14	ND	105	27	66	16	1.5	110	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
07S[b]	2	16	9	ND	27	24	19	17	ND	60	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
08S	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10S	ND	ND	ND	ND	ND	ND	ND	0.05	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
14S	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
21S	ND	240	23	ND	263.0	ND	2.17	ND	ND	2.2	0.15	2	0.12	ND	1.9	ND	ND	ND	ND	ND
30S	1	23	8	0	32	1.3	24	6.6	ND	32	0.94	9.7	3.1	ND	13.7	2.70	12.0	5.4	ND	20.1
31S	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
32S	940	1200	420	23	2583	217	355	188	1.9	762	18	9.4	4.1	0.53	32.0	20	21.0	7.7	0.91	49.6
33S	ND	180	ND	ND	180	ND	0.17	ND	ND	0.2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
34S	2	250	ND	2	254.0	1.2	1.3	0.12	1.4	4	0.75	0.41	0.16	1.3	2.6	1.30	ND	ND	1.8	3.1
35S	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
36S	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
37S	ND	ND	ND	ND	ND	1.4	0.25	0.21	0.51	2.4	2.1	0.3	ND	ND	2.4	2.3	0.2	0	1	4.0
38S	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
39S	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
40S[c]	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
41S[d]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	8.30	45	10	0.60	63.9	4.60	31	7	0.77	43.1
42S[d]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	2.20	ND	ND	ND	2	2.30	0.34	1.00	ND	3.6
43S[d]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PZ12[c]	NS	NS	NS	NS	NS	1.2	24	4.6	ND	30	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

ND = Non-Detect
NS = Not Sampled
Shaded values exceed the respective
Reference: *Final Goundwater Feasibity Study (URS,2008)*

DCE12C = cis-1,2-Dichloroethene
PCE = Tetrachloroethene
TCE - Trichloroethene
VC = Vinyl Chloride

NOTES:
(a) Well abandoned 2005
(b) Well abandoned 2004
(c) Wells installed 2004
(d) Wells installed December 2006

CLEANUP GOALS:
PCE = 5.5 µg/L
TCE = 18 µg/L
DCE = 1,800 µg/L
VC = 1.4 µg/L

Table 2. Human Health Risk Assessment Summary

Receptor	Pathway	Risk	Hazard	Risk/HI Drivers
Future Onsite Groundwater-Consuming Resident – Adult	Ingestion of COPCs-Tap Water	**$3.9x10^{-4}$**	**2**	Cis-1,2-DCE; PCE; TCE VC; PAHs
	Dermal Absorption of COPCS -Tap Water	**$1.2x10^{-3}$**	>1	PCE; TCE; PAHs
	Inhalation of COPCs-Showering	$4.0x10^{-5}$	>1	PCE; TCE
	Inhalation of COPCs-Indoor Air	$4.0x10^{-7}$	>1	None
	ALL PATHWAYS	**$1.6x10^{-3}$**	**2**	
Future Onsite Groundwater-Consuming Resident – Child	Ingestion of COPCs-Tap Water	**$2.3x10^{-4}$**	**4**	Cis-1,2-DCE; PCE; TCE VC; PAHs
	Dermal Absorption of COPCS -Tap Water	**$4.9x10^{-4}$**	>1	PCE; TCE; PAHs
	Inhalation of COPCs-Indoor Air	$2.3x10^{-7}$	>1	None
	ALL PATHWAYS	**$7.1x10^{-4}$**	**5**	
Future Onsite Urban Resident – Adult	Inhalation of COPCs-Indoor Air	$4.0x10^{-7}$	>1	None
	ALL PATHWAYS	$4.0x10^{-7}$	>1	
Future Onsite Urban Resident – Child	Inhalation of COPCs-Indoor Air	$2.3x10^{-7}$	>1	None
	ALL PATHWAYS	$2.3x10^{-7}$	>1	
Current/Future Offsite Urban Resident – Adult	Inhalation of COPCs-Indoor Air	**$1.5x10^{-4}$**	**2**	Benzene; PCE; TCE; Toluene; Xylene (total)
	ALL PATHWAYS	**$1.5x10^{-4}$**	**2**	
Current/Future Offsite Urban Resident – Child	Inhalation of COPCs-Indoor Air	**$8.6x10^{-5}$**	**6**	Benzene; PCE; TCE; Toluene; Xylene (total)
	ALL PATHWAYS	**$8.6x10^{-5}$**	**6**	
Future Offsite Groundwater Consuming Resident – Adult	Ingestion of COPCs-Tap Water	**$6.2x10^{-3}$**	**12**	Cis-1,2-DCE; PCE; TCE VC; PAHs
	Dermal Absorption of COPCS-Tap Water	**$2.4x10^{-3}$**	**2**	PCE; TCE; VC; PAHs
	Inhalation of COPCs-Showering	**$4.0x10^{-4}$**	>1	PCE; TCE; VC
	Inhalation of COPCs-Indoor Air	**$1.5x10^{-4}$**	**2**	Benzene; PCE; TCE; Toluene; Xylene (total)

Table 2. Human Health Risk Assessment Summary (Continued)

Receptor	**Pathway**	**Risk**	**Hazard**	**Risk/HI Drivers**
	ALL PATHWAYS	**$9.1x10^{-3}$**	**17**	
Future Offsite Groundwater Consuming Resident – Child	Ingestion of COPCs-Tap Water	**$3.6x10^{-3}$**	**28**	Cis-1,2-DCE; PCE; TCE VC; PAHs
	Dermal Absorption of COPCS -Tap Water	**$9.7x10^{-4}$**	**4**	PCE; TCE; PAHs
	Inhalation of COPCs-Indoor Air	**$8.6x10^{-5}$**	**6**	Benzene; PCE; TCE; Toluene; Xylene (total)
	ALL PATHWAYS	**$4.7x10^{-3}$**	**38**	
Current/Future Residents Contacting Offsite Surface Water and Sediment	Ingestion of COPCs-Surface Water	$5.9x10^{-8}$	>1	None
	Dermal Absorption of COPCs-Surface Water	$1.6x10^{-6}$	>1	PCE
	Ingestion of COPCs-Sediment	$1.6x10^{-5}$	>1	PAHs; Arsenic
	Dermal Absorption of COPCs-Sediment	**$1.4x10^{-4}$**	>1	PAHs; Arsenic
	ALL PATHWAYS	**$1.6x10^{-4}$**	>1	

Note:
COPCs = Chemicals of Potential Concern
Cis-1,2-DCE= Cis-1,2-Dichloroethene
PCE = Tetrachloroethene
TCE = Trichloroethene
VC = Vinyl Chloride
PAHs = Polyaromatic Hydrocarbons

Risk and hazard values that represent excess risk are shaded in **bold.**

Table 3
Comparative Analysis of Alternatives

Criteria	Alternative 1 No Action	Alternative 2 Land Use Controls	Alternative 3 Monitored Natural Attenuation/Land Use Controls	Alternative 4 Enhanced Bioremediation	Alternative 5 Chemical Oxidation
OVERALL PROTECTIVENESS					
Human Health Protection	No documented reduction in risk. No protection against potential future exposure route of vapor intrusion.	Provides control of potential future exposure from vapor intrusion by implementation of LUCS. Does not demonstrate that target RAO concentrations in groundwater have been achieved.	Includes implementation of both MNA and LUCs until the RAOs are achieved. Protectiveness will be provided through LUCs while the performance of MNA is being demonstrated.	Iinclude active remediation, MNA, and applicable LUCs until the RAOs are achieved.	Same as Alternative 4.
Environmental Protection	No documented reduction in groundwater contamination.	Same as Alternative 1.	Documented reduction in groundwater contamination over time.	Same as Alternative 3.	Same as Alternative 3.
COMPLIANCE WITH ARARs					
Chemical Specific ARARs	No chemical specific ARARs.	No chemical specific ARARs.	No chemical specific ARARs.	No chemical specific ARARs.	No chemical specific ARARs.
Location Specific ARARs	No location specific ARARs.	No location specific ARARs.	No location specific ARARs.	No location specific ARARs.	No location specific ARARs.
Action Specific ARARs	No action specific ARARs.	No action specific ARARs.	No action specific ARARs.	Compliance with the Underground Injection Control (UIC) permit process (40 CFR Part 144-147) will be required.	Compliance with the Underground Injection Control (UIC) permit process (40 CFR Part 144-147) will be required.

Table 3
Comparative Analysis of Alternatives

Criteria	Alternative 1 No Action	Alternative 2 Land Use Controls	Alternative 3 Monitored Natural Attenuation/Land Use Controls	Alternative 4 Enhanced Bioremediation	Alternative 5 Chemical Oxidation
LONG-TERM EFFECTIVENESS AND PERMANENCE					
Magnitude of Residual Risk	Residual risks are high, as no documented remediation or risk mitigation efforts will be implemented.	While risks may be mitigated by implementation of LUCs, no documented reduction of risk would be available,	Residual risks low, as residual VOC concentrations would be documented to be below target RAO concentrations.	Same as Alternative 3.	Same as Alternative 3.
Adequacy and Reliability of Controls	This alternative is not reliable, as no efforts will be undertaken to remediate the groundwater contamination or mitigate the potential onsite VOC vapor intrusion risks.	This alternative is not reliable. The alternative relies exclusively on LUCs to provide protection and does not provide documentation that RAO have been achieved.	Degree of reliability will be dependent on the rate of MNA processes. The enhanced data collection period will establish the ability of MNA to meet the RAOs within a reasonable period of time.	High degree of reliability. Technology has been shown to effectively degrade VOCs in groundwater, although repeat applications for either type of treatment may be required to achieve target cleanup concentrations.	Same as Alternative 4.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT					
Treatment Processes Used and Materials Treated	None. Naturally occurring biodegradation in combination with physical attenuation processes will reduce VOC constituents over time. However, there will be no monitoring to measure the extent of attenuation.	None. Naturally occurring biodegradation in combination with physical attenuation processes will reduce VOC constituents over time. However, there will be no monitoring to measure the extent of attenuation.	Naturally occurring biodegradation in combination with physical attenuation processes will be monitored to document that VOC constituents are reduced over time.	Organic substrates would be utilized to create an anaerobic state to facilitate biodegradation of VOC contaminants.	Chemical oxidants are utilized to chemically degrade VOC constituents.
Amount of Hazardous Materials Destroyed or Treated	No documentation that VOC mass is destroyed.	No documentation that VOC mass is destroyed.	The dissolved phase mass of VOCs is estimated at approximately 24 pounds.	Same as Alternative 3.	Same as Alternative 3.

Table 3
Comparative Analysis of Alternatives

Criteria	Alternative 1 No Action	Alternative 2 Land Use Controls	Alternative 3 Monitored Natural Attenuation/Land Use Controls	Alternative 4 Enhanced Bioremediation	Alternative 5 Chemical Oxidation
Degree of Expected Reduction in Toxicity, Mobility and Volume	Natural attenuation processes are expected to reduce the toxicity of groundwater and volume of contaminants over time. VOC contaminant mobility will not be reduced. However, there will be no monitoring to measure the extent of attenuation.	Natural attenuation processes are expected to reduce the toxicity of groundwater and volume of contaminants over time. VOC contaminant mobility will not be reduced. However, there will be no monitoring to measure the extent of attenuation.	Documented natural attenuation processes are expected to reduce the toxicity of groundwater and volume of contaminants over time. VOC contaminant mobility will not be reduced.	Technology has been shown to degrade VOC constituents; thus reducing toxicity and volume. Contaminant mobility will not be reduced. May increase the mobility of certain metals; however, mobility should return to normal beyond the treatment area of influence.	Same as Alternative 4
Degree to Which Treatment is Irreversible	No treatment of contamination is proposed.	No treatment of contamination is proposed.	Irreversible	Irreversible	Irreversible
Type and Quantity of Residuals Remaining After Treatment	Unknown, as no groundwater quality assessment will be made.	Same as Alternative 1.	Residual VOCs below cleanup goals.	Same as Alternative 3.	Same as Alternative 3.
SHORT-TERM EFFECTIVENESS					
Community Protection During Remedial Action	No short-term impacts.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Worker Protection During Remedial Action	No short-term impacts.	Same as Alternative 1.	Appropriate health and safety precautions will be utilized during well installation and associated sampling activities.	Appropriate health and safety precautions will be utilized during installation of substrate injection points and associated sampling activities.	Same as Alternative 4.
Environmental Impacts	No environmental impacts are envisioned.	Same as Alternative 1.	No environmental impacts are envisioned. MNA utilitizes naturally occurring processes to	No environmental impacts are envisioned, as neither the substrate used nor the	Same as Alternative 4.

Table 3
Comparative Analysis of Alternatives

Criteria	Alternative 1 No Action	Alternative 2 Land Use Controls	Alternative 3 Monitored Natural Attenuation/Land Use Controls	Alternative 4 Enhanced Bioremediation	Alternative 5 Chemical Oxidation
			degrade VOCs.	byproducts are toxic to the environment.	
Time Until Remedial Action Objectives Are Achieved	15 years (based upon 2007 data set). However, there will be no monitoring to measure the extent of attenuation, thus confirmation of this estimate of time would not be possible.	The RAO for limiting exposure of potential future residents to VOC constituents via vapor intrusion pathway will be achieved upon implementation of LUCs. No timeframe associated with achieving clean up goals, as no monitoring is performed.	15 years (based upon 2007 data set)	3 years to achieve RAOs within active treatment area (greater than 55 µg/L PCE). Remaining areas assumed to achieve RAOs within 15 years, based on use of MNA.	RAOs should be achieved within months in active treatment area (greater than 55 µg/L PCE). Remaining areas assumed to achieve RAOs within 15 years, based on use of MNA.
IMPLEMENTABILITY					
Ability to Construct and Operate	No construction or operation.	No construction or operation.	Easily constructed and operated.	Easily constructed and operated.	Easily constructed and operated.
Reliability of Technology	None.	None.	Enhanced data collection period will be implemented in order to better assess equilibrium conditions and refine estimated timeframes.	Highly reliable.	Same as Alternative 4.
Ease of Undertaking Additional Actions If Needed	Does not impact addition actions.	Does not impact addition actions.	Does not impact addition actions.	Does not impact additional actions.	Does not impact additional actions.
Ability to Monitor Effectiveness of Remedy	None.	None.	Groundwater monitoring component provides ability to monitor effectiveness.	Same as Alternative 3.	Same as Alternative 3.
Ability to Obtain Approvals and Coordinate with Other	No approval necessary.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Table 3
Comparative Analysis of Alternatives

Criteria	Alternative 1 No Action	Alternative 2 Land Use Controls	Alternative 3 Monitored Natural Attenuation/Land Use Controls	Alternative 4 Enhanced Bioremediation	Alternative 5 Chemical Oxidation
Agencies					
Available of Equipment, Specialists and Materials	None required.	Same as Alternative 1.	Uses easily available standard equipment and materials. No specialists required.	Alternative is more complex in that it requires a pilot test to optimize design, and injection of the materials will need to be performed by specially trained subcontractors using mobile equipment. In addition, repeat injections may be required if contaminant rebound occurs.	Same as Alternative 4.
Availability of Technologies	None required.	None required	Easily available.	Same as Alternative 3.	Same as Alternative 3.
COST					
Capital Cost	$0	$23,000	$60,000	$310,000	$1,630,000
Operating and Maintenance Cost	$0	$0	$290,000	$503,000	$119,100
Present Worth Cost	$0	$29,000	$430,000	$980,000	$2,100,000

Table 4
Estimated Remediation Costs - Groundwater
Alternative 3 - Monitored Natural Attenuation and Land Use Controls

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Institutional Controls				
- Land Use Controls and Agreements	1	ls	20,000	20,000
Subtotal Institutional Controls				**20,000**
Groundwater monitoring wells				
- Mobilization	1	ls	2,000	2,000
- Monitoring Wells: 4" dia. PVC	4	ls	5,000	20,000
Subtotal Groundwater Monitoring Well Installation				**22,000**
Subtotal Direct Capital Costs				**42,000**
Indirect Capital Costs				
Engineering and Construction Management (15% of direct costs)				7,000
Health and Safety Equipment & Training (5% of direct costs)				3,000
Legal and Administrative (2% of direct costs)				1,000
Project Management (10% of direct costs)				5,000
Subtotal Indirect Capital Costs				**16,000**
Total Capital Costs				**60,000**
Annual O&M Costs				
MNA Performance Monitoring (Year 1 - Baseline and 3 Quarterly Sampling Events)				
- Well Sampling-Labor (76 samples)	220	hr	52	11,500
- Well Sampling-Analytical (VOCs and MNA)	76	sample	420	32,000
- Well Sampling-Analytical (radiological)	1	sample	235	300
- Water disposal, sampling equipment	4	ls	2250	9,000
- Data Analysis & Report Preparation	4	ea	3000	12,000
Subtotal MNA Performance Monitoring (Year 1)				**64,800**
Project Management and Adminstrative (15% of O&M costs)				9,800
Present Worth MNA Monitoring Costs (occurs during first year, no discount rate)				**74,600**
Semi-Annual MNA Performance Monitoring (Years 2 and 3)				
- Sampling-Labor (38 samples)	110	hr	52	5,800
- Sampling-Analytical (VOCs and MNA)	38	sample	420	16,000
- Well Sampling-Analytical (radiological)	1	sample	235	300
- Water disposal, sampling equipment	2	ls	2250	4,500
- Data Analysis & Report Preparation	2	ea	3000	6,000
Subtotal Semi-Annual MNA Performance Monitoring (Years 2, and 3) Costs				32,600
Project Management and Adminstrative (15% of O&M costs)				4,900
Total Semi-Annual MNA Performance Monitoring (Years 2 and 3) Costs				**37,500**
Present Worth Semi-Annual Monitoring Costs (Years 2 and 3 @ 2.5% Discount Rate) 1				**70,600**

Table 4 (continued)
Estimated Remediation Costs - Groundwater
Alternative 3 - Monitored Natural Attenuation and Land Use Controls

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Annual Groundwater Monitoring (GM) (Year 4 - Year 15) Costs				
- Sampling-Labor (19 samples)	60	hr	52	3,200
- Sampling-Analytical (VOCs)	19	sample	120	2,300
- Well Sampling-Analytical (radiological)	1	sample	235	300
- Water disposal, sampling equipment	1	ls	2250	2,300
- Data Analysis & Report Preparation	1	ea	3000	3,000
Subtotal Annual Groundwater Monitoring (Year 4 - Year 15) Costs				11,100
Project Management and Adminstrative (15% of O&M costs)				1,700
Total Annual Groundwater Monitoring (Year 4 - Year 15) Costs				**12,800**
Present Worth GM Costs (Year 4 - Year 15 @ 3% Discount Rate) (1)				**116,300**
Quartertly Groundwater Monitoring (GM) (Year 16)				
- Sampling-Labor (76 samples)	220	hr	52	11,500
- Sampling-Analytical (VOCs)	76	sample	120	9,200
- Well Sampling-Analytical (radiological)	1	sample	235	300
- Water disposal, sampling equipment	4	ls	2250	9,000
- Data Analysis & Report Preparation	4	ea	2500	10,000
Subtotal Quarterly Groundwater Monitoring (Year 16) and SI Costs				40,000
Project Management and Adminstrative (15% of O&M costs)				6,000
Total Quarterly Groundwater Monitoring (Year 16) Costs				**46,000**
Present Worth GM Costs (Year 16 @ 3% Discount Rate) (1)				**28,700**
Total Present Worth Annual O&M Costs				**290,200**
Subtotal Cost of Alternative				**350,200**
Contingency (@ 20%)				70,040
Total Estimated Cost of Alternative				**430,000**

Key to unit abbreviations	
ea	each
hr	hour
ls	lump sum
sample	per sample

(1) Real Discount Rates based on U.S. Office of Management and Budget Circular No. A-94, Appendix C-January 2006

FIGURES

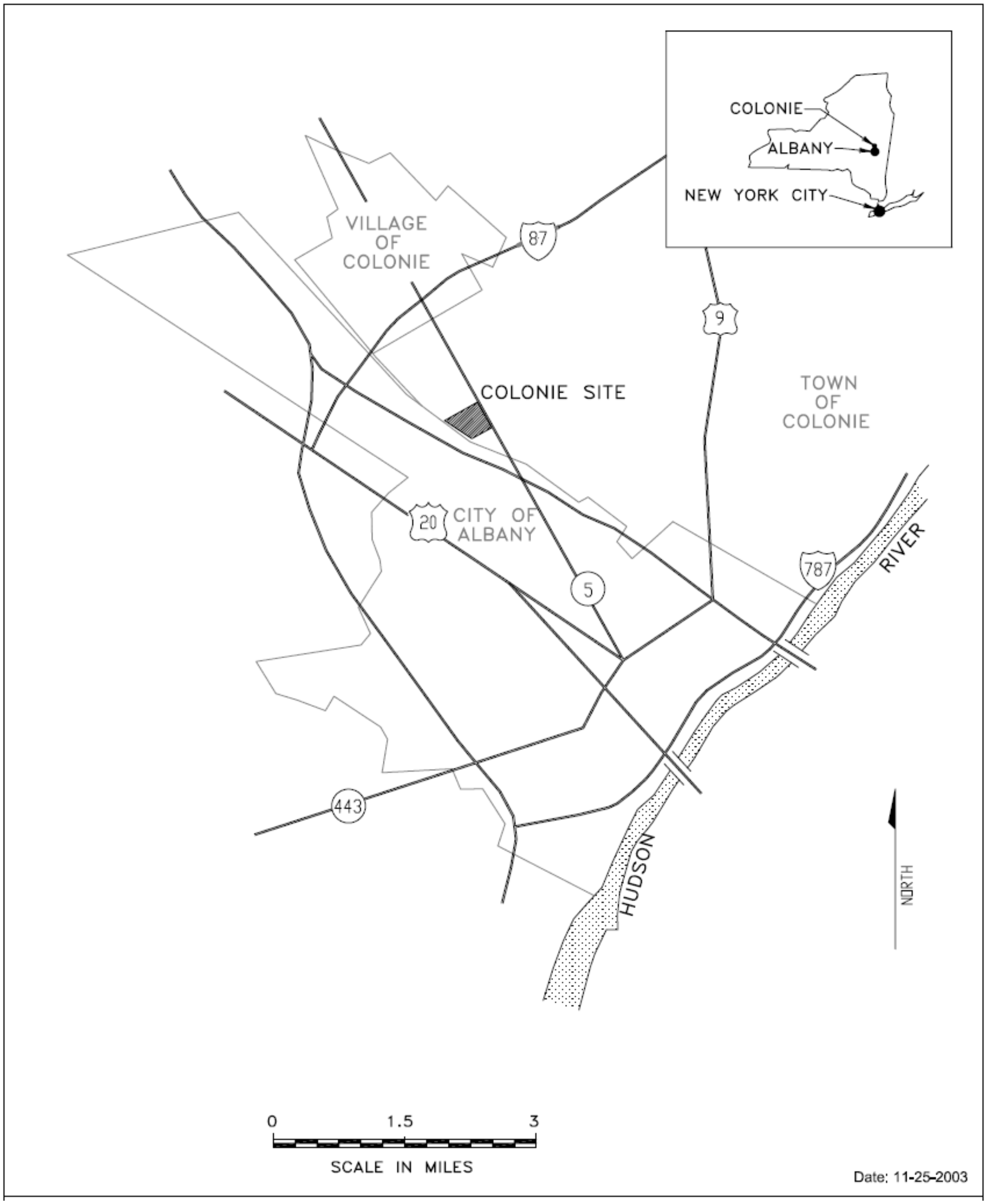

FIGURE 1: LOCATION MAP – COLONIE FUSRAP SITE

LEGEND

STORM MH	STORMWATER MANHOLE
SMH	SANITARY MANHOLE
CB	CATCH BASIN
	POWER POLE
	FENCE LINE
	MAIN SITE OUTLINE
	VICINITY PROPERTY OUTLINE

REFERENCE:

BASE MAP SOURCES: EDWARD W. BOUTELLE & SON CIVIL ENGINEERS AND SURVEYORS
BECHTEL NATIONAL INC.

GENERAL NOTES:

1. THIS SURVEY IS BASED ON PHOTOGRAMMETRIC MAPPING PREPARED BY LOCKWOOD MAPPING, INC., PHOTOS DATED MAY 13, 1998.
2. SITE ELEVATIONS AND COORDINATE GRID ARE BASED ON SITE MONUMENTATION AND INFORMATION PROVIDED BY ICF KAISER ENGINEERS, INC.

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DRAWING NUMBER 837935D85 | OFFICE ALB | X-REF X | IMAGE ---

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Plot Date/Time: 05/15/08 11:48am
Plotted by: Samuil.Shkolnik
Xref: .
Image: .

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REMEDIAL ACTION PROGRAM

FIGURE 2
SITE MAP WITH VICINITY PROPERTIES

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COLONIE FUSRAP SITE
1130 CENTRAL AVENUE, ALBANY, NY 12205

SCALE:	DRAWING NO.	SHEET NO.	REVISION NO.
1" = 60'	837935D92	1 OF 1	

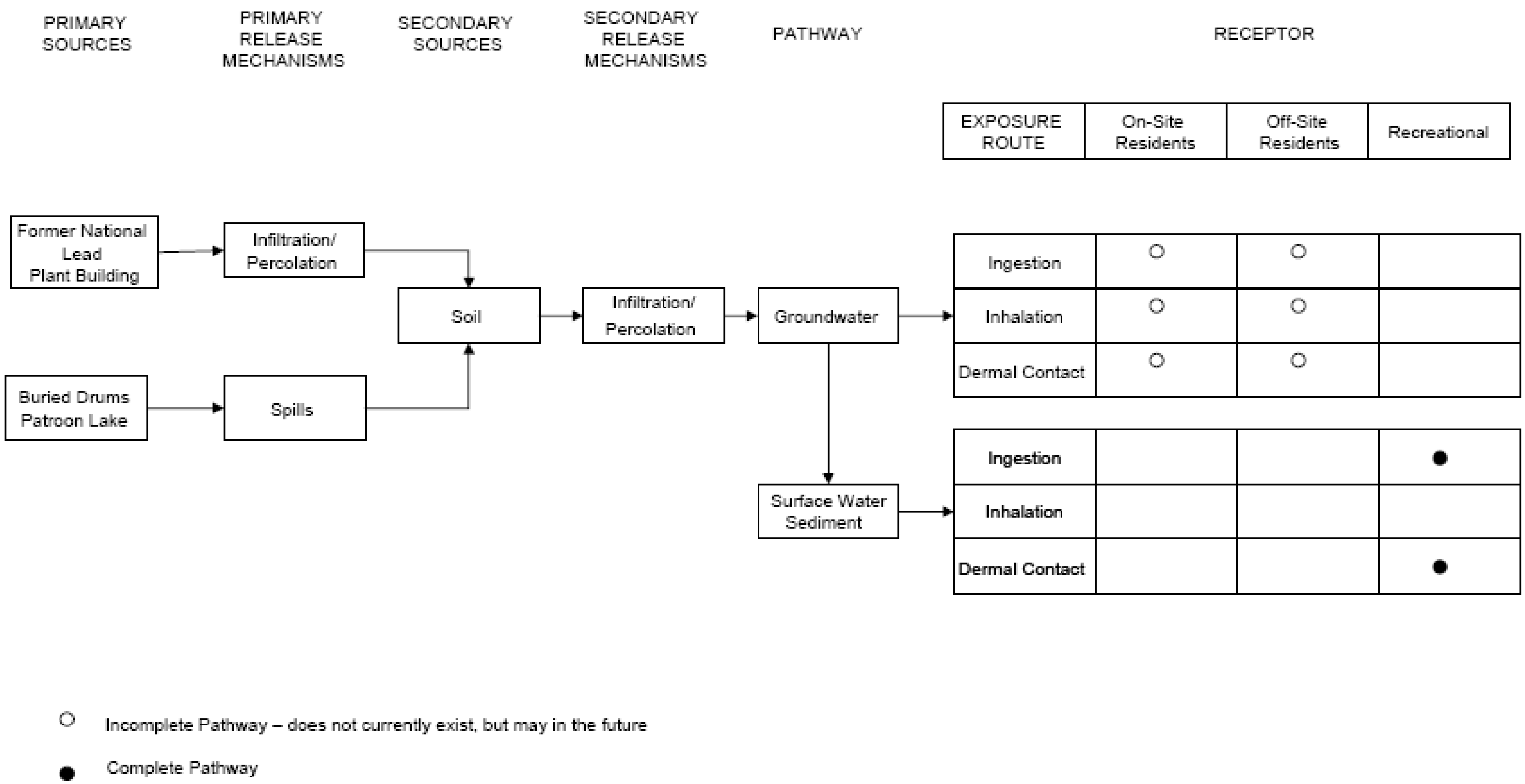
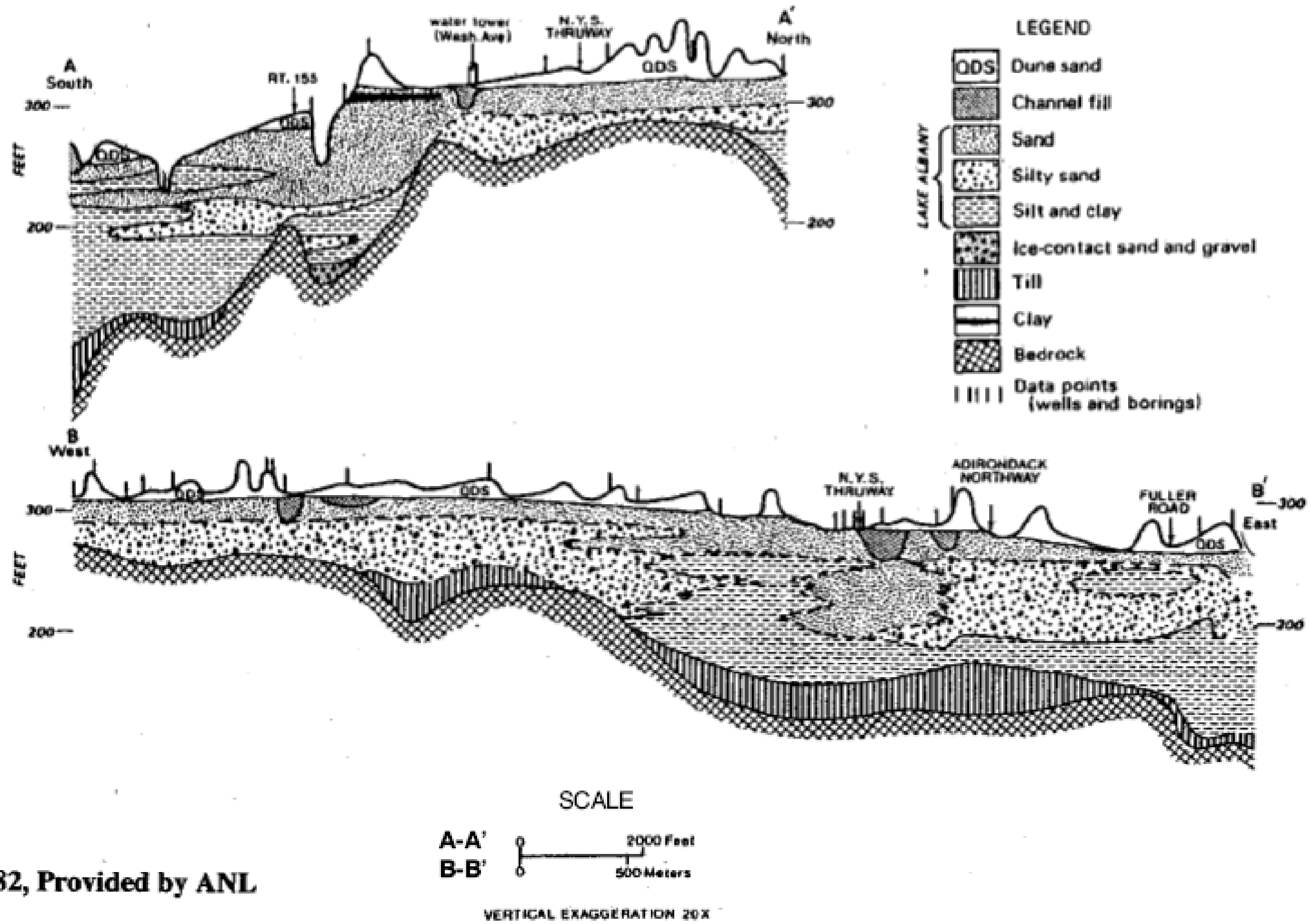
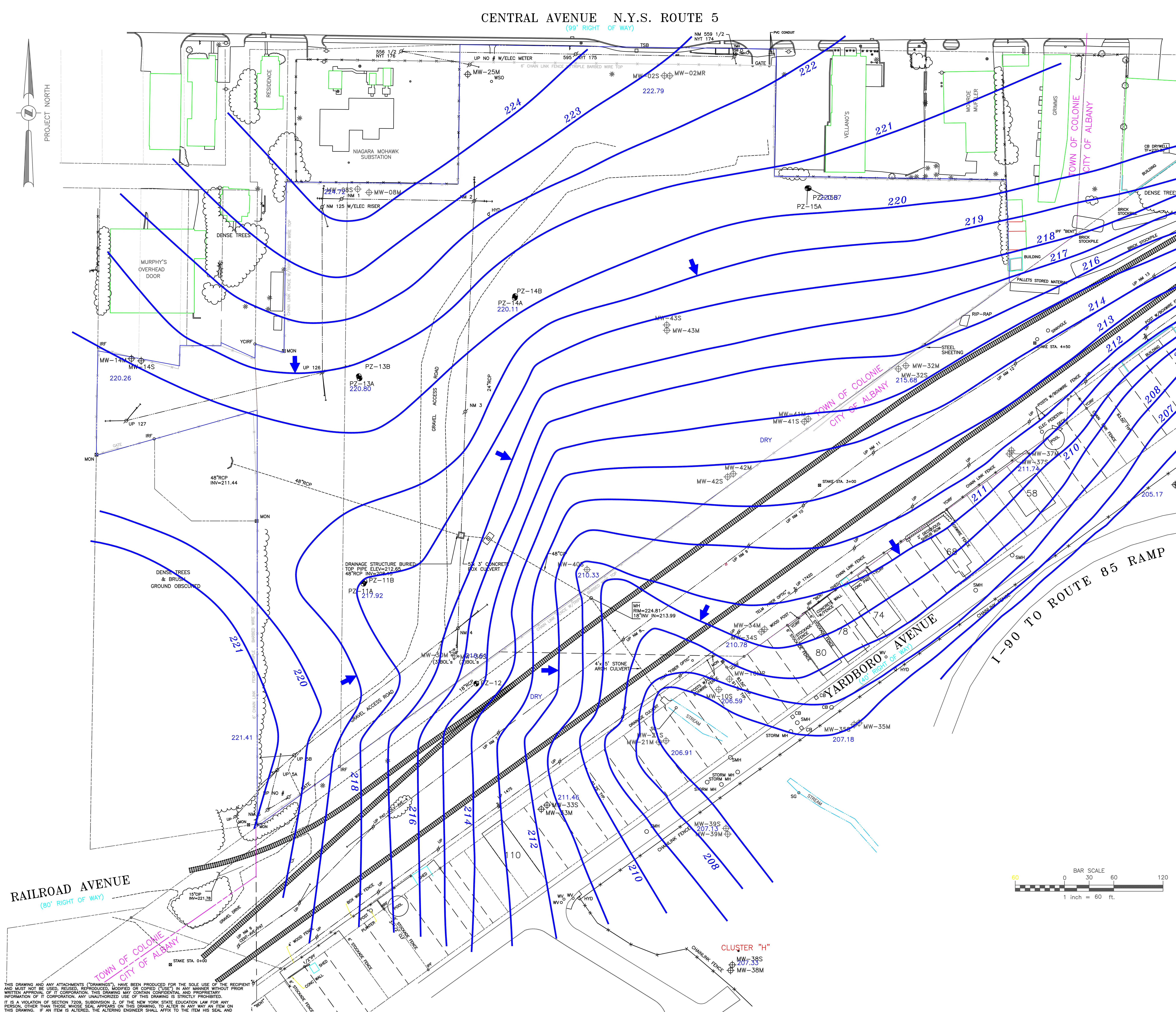


FIGURE 3: CONCEPTUAL SITE MODEL FOR GROUNDWATER



Source: Dineen, 1982, Provided by ANL

FIGURE 4: GEOLOGICAL CROSS-SECTION



LEGEND

⌖	MONITORING WELL USED FOR LONG-TERM MONITORING
□ CB	CATCH BASIN
←──	GUY WIRE
○ IRF	IRON ROD FOUND
⌖	MONITORING WELL
◐ PZ-14B	PIEZOMETER
○ SMH	SANITARY MANHOLE
⊠ MON	SQUARE CONCRETE MONUMENT
○ STORM MH	STORMWATER MANHOLE
○ TMH	TELEPHONE MANHOLE
□ TSB	TRAFFIC SIGNAL BOX
	UTILITY POLE
○ WMTR	WATER METER
○ WSO	WATER SHUT-OFF
○ YCIRF	YELLOW CAPPED IRON ROD FOUND
	OVERHEAD ELECTRIC
	UNDERGROUND PIPE
	FENCE LINE
HDPE	HIGH DENSITY POLYETHYLENE PIPE
RCP	REINFORCED CONCRETE PIPE
	GROUNDWATER CONTOUR CONTOUR INTERVAL = 1.0 FEET

GENERAL NOTES:

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2. FIELD EDIT BASED ON SITE WORK CONDUCTED THROUGH JULY 2005

3. MONITORING WELLS REMOVED DUE TO EXCAVATION: WELL 19S/NOV 2002, WELL 7S/NOV 2004, WELL 1F/JUN 2005, WELL 5S/M/F/JUL 2005.

4. EXCAVATION LIMIT CONTOURS PROVIDED BY CT MALE ASSOCIATES JULY 2005, ELEVATIONS SHOWN IN COMPLETED UNITS ARE BOTTOM OF EXCAVATION.

5. TOPOGRAPHIC INFORMATION TO THE SOUTH OF YARDBORO AVENUE SURVEYED BY CT MALE, INC. 2002.

6. ONLY AVERAGE VOC VALUES ARE SHOWN FOR WELLS.

7. GEOPROBE CONCENTRATIONS REPRESENT HISTORICAL RI DATA.

8. ALL UTILITIES ARE NOT SHOWN.

9. CONTAMINANT CONTOURS BASED ON GEOPROBE AND MONITORING WELL DATA SHOWN ON THE FIGURE. GEOPROBE DATA INCLUDES PHASE I, II, AND III RESULTS (OCT 1999 TO DEC 2001). ONLY GEOPROBE DETECTIONS ARE SHOWN.

10. WELL DATA IS AVERAGE OF FOUR 2003 TO 2005 SEMIANNUAL SAMPLE EVENTS (SECOND HALF 2003 TO FIRST HALF 2005) EXCEPT;
DATA FOR WELL 05S IS AVE. OF THREE SAMPLE EVENTS; AND
DATA FOR WELL 36S AND PZ12 IS AVE. OF TWO SAMPLE EVENTS; AND
DATA FOR WELLS 07S AND 40S IS BASED ON ONE SAMPLE EVENT.

11. VOC CONCENTRATIONS SHOWN FOR THE GEOPROBES ARE THE MAXIMUM OF THE SHALLOW UPPER SILT LAYER (0' -15') AND THE DEEP UPPER SILT LAYER (15' -30').

12. VOC WAS NOT DETECTED AT LOCATIONS WHERE NO CONCENTRATION DATA IS PROVIDED.

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FIGURE 5
GROUNDWATER CONTOURS

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COLONIE FUSRAP SITE
1130 CENTRAL AVENUE, ALBANY, NY 12205

SCALE:	DRAWING NO.	SHEET NO.	REVISION NO.
1" = 60'	837935D92	1 OF 1	

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FIGURE 6
ESTIMATED EXTENT OF ONSITE VOCs IN EXCESS OF RAO CONCENTRATION (2003–2005)

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COLONIE FUSRAP SITE
1130 CENTRAL AVENUE, ALBANY, NY 12205

SCALE:	DRAWING NO.	SHEET NO.	REVISION NO.
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LEGEND

	MONITORING WELL USED FOR LONG-TERM MONITORING
CB	CATCH BASIN
	GUY WIRE
IRF	IRON ROD FOUND
	MONITORING WELL
PZ-14B	PIEZOMETER
SMH	SANITARY MANHOLE
MON	SQUARE CONCRETE MONUMENT
STORM MH	STORMWATER MANHOLE
TMH	TELEPHONE MANHOLE
TSB	TRAFFIC SIGNAL BOX
	UTILITY POLE
WMTR	WATER METER
WSO	WATER SHUT-OFF
YCIRF	YELLOW CAPPED IRON ROD FOUND
	OVERHEAD ELECTRIC
	UNDERGROUND PIPE
	FENCE LINE
HDPE	HIGH DENSITY POLYETHYLENE PIPE
RCP	REINFORCED CONCRETE PIPE
	SOIL UNITS WHERE VOC CONTAMINATED SOILS EXCAVATED
	VOC CONCENTRATION IN GROUNDWATER (UG/L)

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FIGURE 7
SOIL EXCAVATION AREAS AND
ESTIMATED VOC PLUME IN GROUNDWATER
(2003–2005)

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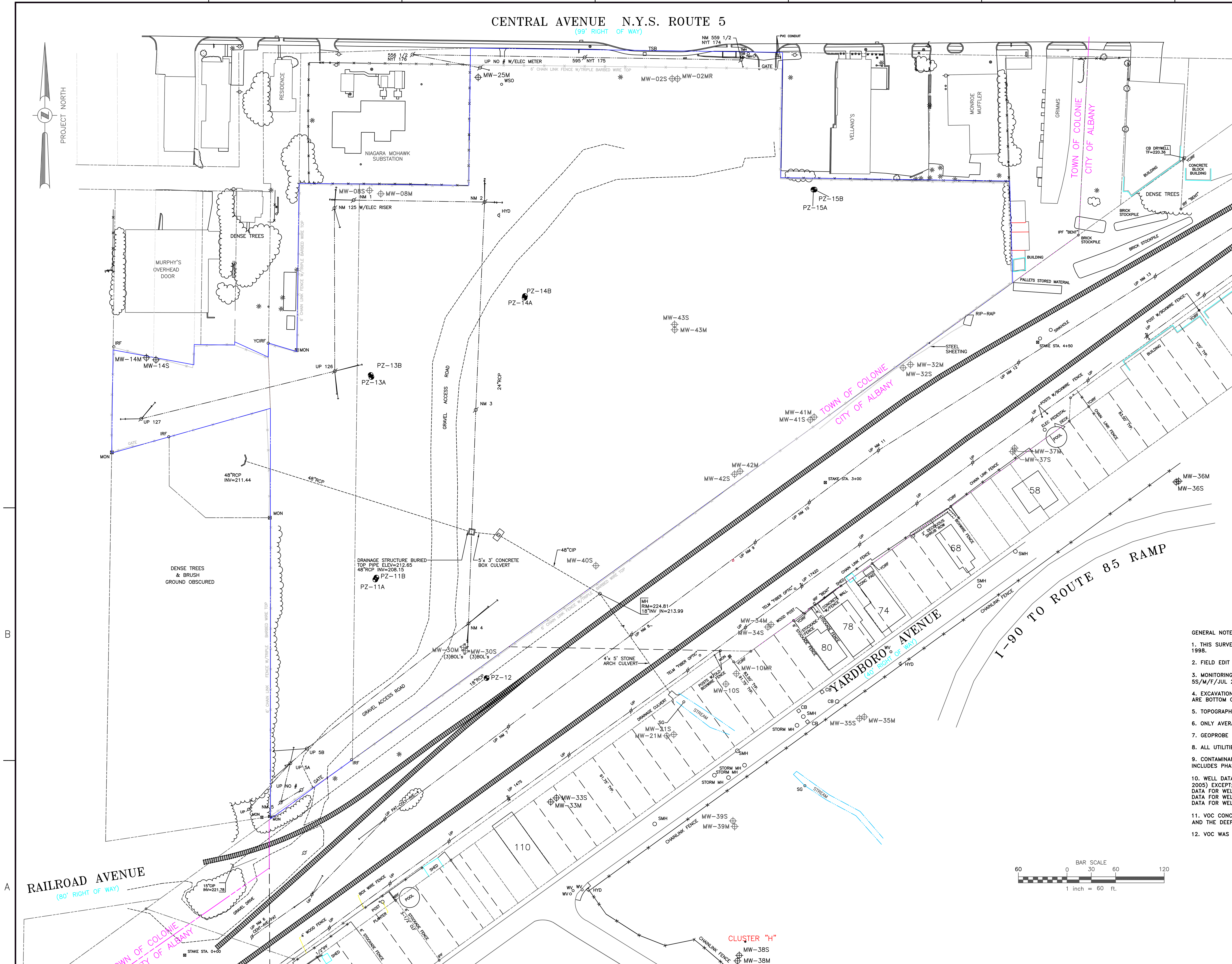
	U.S. ARMY CORPS OF ENGINEERS FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM
	FIGURE 8 LAND USE MAP
Cabrera Services	COLONIE FUSRAP SITE 1130 CENTRAL AVENUE, ALBANY, NY 12205

DRAWING NO.	SHEET NO.	REVISION NO.
837935D92	1 OF 1	



LEGEND

	MONITORING WELL USED FOR LONG-TERM MONITORING
CB	CATCH BASIN
	GUY WIRE
IRF	IRON ROD FOUND
	MONITORING WELL
PZ-14B	PIEZOMETER
SMH	SANITARY MANHOLE
MON	SQUARE CONCRETE MONUMENT
STORM MH	STORMWATER MANHOLE
TMH	TELEPHONE MANHOLE
TSB	TRAFFIC SIGNAL BOX
	UTILITY POLE
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2. FIELD EDIT BASED ON SITE WORK CONDUCTED THROUGH JULY 2005

3. MONITORING WELLS REMOVED DUE TO EXCAVATION: WELL 19S/NOV 2002, WELL 7S/NOV 2004, WELL 1F/JUN 2005, WELL 5S/M/F/JUL 2005.

4. EXCAVATION LIMIT CONTOURS PROVIDED BY CT MALE ASSOCIATES JULY 2005, ELEVATIONS SHOWN IN COMPLETED UNITS ARE BOTTOM OF EXCAVATION.

5. TOPOGRAPHIC INFORMATION TO THE SOUTH OF YARDBORO AVENUE SURVEYED BY CT MALE, INC. 2002.

6. ONLY AVERAGE VOC VALUES ARE SHOWN FOR WELLS.

7. GEOPROBE CONCENTRATIONS REPRESENT HISTORICAL RI DATA.

8. ALL UTILITIES ARE NOT SHOWN.

9. CONTAMINANT CONTOURS BASED ON GEOPROBE AND MONITORING WELL DATA SHOWN ON THE FIGURE. GEOPROBE DATA INCLUDES PHASE I, II, AND III RESULTS (OCT 1999 TO DEC 2001). ONLY GEOPROBE DETECTIONS ARE SHOWN.

10. WELL DATA IS AVERAGE OF FOUR 2003 TO 2005 SEMIANNUAL SAMPLE EVENTS (SECOND HALF 2003 TO FIRST HALF 2005) EXCEPT;
DATA FOR WELL 05S IS AVE. OF THREE SAMPLE EVENTS; AND
DATA FOR WELL 36S AND PZ12 IS AVE. OF TWO SAMPLE EVENTS; AND
DATA FOR WELLS 07S AND 40S IS BASED ON ONE SAMPLE EVENT.

11. VOC CONCENTRATIONS SHOWN FOR THE GEOPROBES ARE THE MAXIMUM OF THE SHALLOW UPPER SILT LAYER (0' -15') AND THE DEEP UPPER SILT LAYER (15' -30').

12. VOC WAS NOT DETECTED AT LOCATIONS WHERE NO CONCENTRATION DATA IS PROVIDED.

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U.S. ARMY CORPS OF ENGINEERS
FORMERLY UTILIZED SITES
REMEDIAL ACTION PROGRAM

FIGURE 9
LONG TERM MONITORING WELLS

Cabrera Services

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SCALE:	DRAWING NO.	SHEET NO.	REVISION NO.
1" = 60'	837935D92	1 OF 1	