FINAL

FEASIBILITY STUDY REPORT
for the
ONEIDA (SCONONDOA STREET) SITE
City of Oneida, New York

Prepared For:

Niagara Mohawk Power Corporation

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AUGUST 1998

FINAL
August 1998

This Feasibility Study has been prepared in accordance with the Order on Consent between Niagara Mohawk Power Corporation and the State of New York Department of Environmental Conservation (Index # DO-0001-9210).

6 August 1998

Date

David B. Babcock, P.E.
Parsons Engineering Science, Inc.
License No. 065209-1

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ACRONYMS

AGA - American Gas Association

AGC - Annual Guideline Concentration

AMSL - above mean sea level

ARAR - applicable or relevant and appropriate requirements

BDAT - Best Demonstrated Available Technology

BGS - below ground surface

BTEX - benzene, toluene, ethylene, and xylenes

BUTLs - background upper tolerance limits

CDIs - chronic daily intakes

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (federal)

CFR - Code of Federal Regulations

CT - central tendency

CWA - Clean Water Act

EEI - Edison Electric Institute

FEMA - Federal Emergency Management Agency

FS - feasibility study

HHRA - human health risk assessment

HI - hazard index

HWIR - Hazardous Waste Identification Rule

LADE - lifetime average daily exposure

LDR - land disposal restriction

MCL - maximum contaminant level

mg/kg - milligrams per kilgram

MGP - manufactured gas plant

NAPL - non-aqueous phase liquid

NCP - National Contingency Plan (abbreviation for USEPA National Oil and Hazardous Substances Pollution Contingency Plan under CERCLA of 1990)

NMPC - Niagara Mohawk Power Corporation

NYCRR - New York State Codes, Rules, and Regulations

NYSDEC - New York State Department of Environmental Conservation

NYSDOH- New York State Department of Health

O&M - operation and maintenance

OPRHRP - Office of Parks, Recreation, and Historic Preservation

PCBs - polychlorinated biphenyls

POTW - publicly-owned treatment works

ppm - parts per million

PRAP - Proposed Remedial Action Plan

PRGs - potential remediation goals

PSA/IRM - preliminary site assessment/interim remedial measures

RAOs - remedial action objectives

RCRA - Resource Conservation and Recovery Act (legislation signed in 1976 and amended by the Hazardous Solid Waste Amendments of 1984)

RfCs - reference concentrations

RfDs - reference doses

RI - remedial investigation

RME	- reasonable maximum exposure
ROD	- Record of Decision
SACM	- Superfund Accelerated Cleanup Model
SCGs	- standards, criteria, and guidelines
SGC	- short-term guideline concentration
SPDES	- State Pollutant Discharge Elimination System
SVOCs	- semi-volatile organic compounds
TAGM	- Technical and Guidance Memorandum (issued by NYSDEC)
TAL	- Target Analyte List
TBCs	- to be considered (guidelines or guidance values)
TC	- Toxicity Characteristic Rule (established by USEPA in 1990)
TCLP	- toxicity characteristic leach procedure defined in 40 CFR Part 261 for determining if a waste is characteristically hazardous
TI	- Technical Impracticability (from USEPA memorandum, "Guidance for Evaluating the Technical Impracticability of Groundwater Restoration")
TOC	- total organic carbon
TOGs	- Technical and Operational Guidance Series (issued by NYSDEC Division of Water)
USEPA	- United States Environmental Protection Agency
UST	- underground storage tank
UTSs	- universal treatment standard
VOCs	- volatile organic compounds

EXECUTIVE SUMMARY

SITE LOCATION AND DESCRIPTION

A 1.84-acre former manufactured gas plant (MGP) site, hereafter referred to as the Site, is located along Sconondoa Street near South Lake Street in the City of Oneida, Madison County, New York. The triangular-shaped site is bordered to the west and north by the Tailrace, an open stormwater ditch that discharges to Oneida Creek, which is approximately 1,000 feet east of the Site. An abandoned New York Central Railroad right-of-way is located north of the Tailrace. To the east of the Site is a gravel road that was the former route of the New York Ontario and Western Railroad while to the south is Sconondoa Street and business and residential buildings.

Niagara Mohawk Power Corporation (NMPC) presently owns the site and operates a natural gas regulator station and transmission line service center on the property. The site contains a service office, garage, above-grade petroleum storage tanks, and a storage yard for powerline spools, transformers, and utility poles. Operational utility lines run along the eastern and northern boundaries of the Site. Most of the site is paved, and the storage area is covered with gravel. NMPC intends to continue to use the site as a natural gas regulator station service center for the foreseeable future.

Soils beneath the pavement and gravel of the site consist of fill and construction debris commonly associated with MGP Sites: cinders, bricks, concrete, and ash fill. Deeper soils include peat, sand, silt, gravel, and clay. The Tailrace embankments consist of dredged spoils deposited as a result of the City of Oneida's regular storm sewer maintenance. Sediments within the Tailrace and on-site groundwater are also media of concern. Sediment and surface water within Oneida Creek are not impacted by the Site.

SITE HISTORY

This site history is condensed from the detailed site history presented in the Oneida (Sconondoa Street) Preliminary site Assessment/Interim Remedial Measure (PSA/IRM) Work Plan and Preliminary Historical Profile prepared by NMPC (ES, 1993; NMPC, 1992).

The Oneida Gas Light Company purchased the Sconondoa Street property from the G. Berry Tannery in 1896. By 1899, the Sconondoa Street gas works buildings replaced the tannery structures. Over the years, various power companies owned the Site, constructing such structures as a 25,000-cubic-foot gas holder, a 100,000-cubic-foot gas holder, purifiers, oil tanks, and a cistern. Decommissioning of these structures began in 1930 and was completed in 1964 to make room for the existing NMPC service center. The site has remained essentially unchanged since the construction of an addition in 1974.

CURRENT STATUS

Remedial Investigation Summary

Surface soils, subsurface soils, sediment, groundwater, and surface water samples were analyzed for the presence of semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), cyanide, PCBs and pesticides, total organic carbon (TOC), and metals. The extent of impacted media on-site and off-site has been defined.

Much of the impacted on-site soil appears to be associated with the former gas holders and purifiers. PAHs and BTEX were detected at their highest on-site concentrations in and around the former holder areas while cyanide was measured at its highest levels near the presumed former purifier slab area.

The Tailrace spoils (banks) and sediments contain PAH, BTEX, and cyanide. PAH and BTEX were most concentrated near the site and approximately 200 feet downstream from the northernmost property line. Cyanide was detected near the purifier slab area. Based on groundwater/sediment partitioning calculations presented in Appendix F of this FS, such partitioning of constituents from groundwater to the sediment as groundwater discharges to the Tailrace cannot be the primary source of Tailrace sediment constituent concentrations. Rather, Tailrace sediment appears to have been primarily impacted by past direct discharges to the Tailrace.

Sediments in Oneida Creek exhibit higher concentrations of PAHs upstream from where the Tailrace intersects the creek indicating the source of these PAHs is not associated with the MGP operations on-site. Benzene concentrations detected in Oneida Creek sediment were detected at two orders of magnitude lower than the TOC-adjusted screening concentration derived from USEPA threshold values for freshwater sediment.

In groundwater, PAHs were found downgradient of the former large (i.e., 100,000 cubic foot) gas holder and purifier areas. BTEX were found downgradient of the holder areas, and, cyanide was measured at its highest levels near the presumed former purifier area. Significant concentrations were not detected on the opposite side of the Tailrace from the Site. Groundwater downgradient of the holders and in a few side-gradient wells showed significant metal concentrations. Only arsenic, lead, mercury, and zinc are MGP-related metals. Non-MGP related metals in groundwater from off-site wells contamination are considered representative of background levels. Lead levels of off-site groundwater are also considered representative of background conditions, because lead is a common urban runoff constituent.

Risk Assessment Results

The risk assessment results indicate that there are potential health impacts, both carcinogenic and noncarcinogenic, to current and future receptors at the Site. The potential human health impacts are based primarily on potential exposure to PAHs and metals in soils; benzene, PAHs, other SVOCs, and metals in Tailrace sediment; and manganese in surface water located at and near the Site. There are no significant human health impacts associated with groundwater, because groundwater is not used at or near the Site nor is it likely to be used in the future based on the currently available public water supply. The risk assessment is based on a number of highly conservative (health protective) assumptions. The greatest potential health impact is to current and hypothetical future residents who have contact with soil from the Site or from Tailrace sediment or spoils. The actual health impact to receptors will likely be substantially lower than the predicted impact.

No significant impacts have been observed at Oneida Creek downstream from the Tailrace. In addition, on-site groundwater does not intersect with the ground surface on-site. Groundwater also does not significantly affect biota within Oneida Creek based on the groundwater to surface water flux estimates and the surface water quality monitoring results. Both the flux estimates and the monitoring results show that surface water standards are not exceeded from groundwater leaving the Site.

REMEDIAL ACTION OBJECTIVES

The remedial action objectives (RAOs) for this site are:

1. Maintain the current commercial-industrial use of the NMPC property for the foreseeable future.
2. Maintain use of the Tailrace to transmit stormwater to Oneida Creek by maintaining existing Tailrace invert elevations at its upstream and downstream ends (according to the City's request based on drainage needs).
3. Eliminate human contact with sediments in the Tailrace exceeding PRGs.
4. Eliminate contact with surface soils exceeding PRGs.
5. Remove or control identified sources of significant impacts.
6. Monitor groundwater as needed to evaluate groundwater quality following site remediation.

DESCRIPTION OF ALTERNATIVES

The remedial alternatives that are considered in this feasibility study fall into two categories:

Tailrace Alternatives

1. Limited sediment removal and placement of culvert
2. Sediment removal and restoration of Tailrace
3. Sediment and dredge spoils removal and restoration of Tailrace and its banks

On-site Soil/Groundwater Alternatives

1. Limited action

2. Containment/treatment
3. Source removal

RECOMMENDED ALTERNATIVES

The recommended alternatives are:

- Tailrace - Alternative 3: Excavation of sediment and dredge spoils exceeding preliminary remediation goals (PRGs) and restoration of the Tailrace and its banks.
- Soil/Groundwater - Alternative 3: Source material removal, groundwater use restrictions as needed, and short-term groundwater monitoring off-site to the northeast for five years.

The recommended alternatives would mitigate exposure pathways and corresponding risks of the Oneida site to human health and the environment in the following ways:

- Eliminating identified sources of impacts through excavation and appropriate management off-site.
- Removing on-site soils containing PRG exceedances.
- Installing an asphalt cover over the entire Site, consistent with continuing use of the site by NMPC.
- Removing Tailrace sediments and spoils containing PRG exceedances.
- Monitoring groundwater to confirm the long-term effectiveness of eliminating on-site sources and assess on-site/off-site groundwater quality.

Although groundwater is not considered a complete human health exposure pathway, short-term groundwater monitoring for five years northeast of the site and south of the Tailrace would also be a part of the recommended alternatives. The purpose of this monitoring would be to assess the effect of source removal and intrinsic bioremediation on groundwater quality south of the Tailrace.

A range of SCGs apply to the soil and sediment in and around the Site. All of these SCGs could be met with the recommended alternatives. Excavation of soil and sediment, placement of an asphalt cover over the Site, and proper management of the excavated soil and sediment would almost completely remove the toxicity, and mobility, and volume of constituents from the Site.

Removal of impacted soil and sediment that exceeds PRGs and placement of an asphalt cover on the Site would provide a long-term solution in that source materials would be removed, and Tailrace sediments would be protected from site impacts. Implementation of these recommended alternatives would also effectively decrease any residual risk, specifically through the proper management of excavated material.

Adequate and reliable controls would be used to manage residuals that remain at the Site following remediation. Groundwater monitoring for five years at selected monitoring wells would assess groundwater quality and the long-term effect of the remediation on groundwater quality. Groundwater remediation in the form of a pump and treat system is not considered practicable based on the ineffectiveness of pump and treat systems in meeting groundwater PRGs, the lack of an estimated end time for operation and maintenance of such a system, and the current City of Oneida restriction of drinking water well installation downgradient of the Site. Thus, on-site source material removal with groundwater monitoring is considered the preferred remedy for its long-term cost effectiveness.

This recommended alternative would be effective in the short term in that engineering controls and air monitoring would protect the local community during construction. Remedial construction activities should be straightforward and would not require any unusual or difficult operations for construction workers as long as proper precautions, such as effective erosion control, are carefully implemented. Engineering controls would be implemented, as needed, including various dust suppression techniques, and simultaneous excavation and backfilling could be performed. In addition, to minimize odor generation, excavation work could be conducted during cold weather. Air quality and odor monitoring would also be conducted during construction to monitor particulate emissions, soluble airborne constituents, and odors. If necessary, air quality and odor can be controlled during construction.

The City of Oneida has requested that improvement to the Tailrace be made to accommodate flood events more effectively. Restoration of the Tailrace to a size and shape that would improve its hydraulics is included in the recommended alternatives.

The total present worth (PW) for the recommended alternatives is approximately $2,432,000. The total present worth is the sum of capital costs and the present worth of operation and maintenance costs. Operation and maintenance following remediation would be limited to groundwater monitoring.

SECTION 1

INTRODUCTION

1.1 REPORT OBJECTIVES, SCOPE, AND ORGANIZATION

This report documents the feasibility study (FS) conducted for Niagara Mohawk Power Corporation (NMPC) to address the former manufactured gas plant (MGP) at the Scononda Street site in Oneida, New York (hereafter referred to as the Site). NMPC retained Parsons Engineering Science, Inc., (Parsons ES) to complete the FS in accordance with a New York Department of Environmental Conservation (NYSDEC) Order on Consent (Index No. DO-0001-9210). The FS was prepared following United States Environmental Protection Agency (USEPA) and State of New York guidance documents for evaluating remediation alternatives under statutes, including the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (USEPA, 1988, 1993b; NYSDEC, 1990). The Draft Feasibility Study Guidance Document for Former Manufactured Gas Plant (MGP) Sites was also used to develop this FS (Parsons ES, 1996) as were results from the Remedial Investigation (Parsons ES, 1997).

This document is organized into five sections. Section 1, the introduction, summarizes the information important to the evaluation of remediation alternatives. Section 2 presents the goals and requirements that affect the extent of remediation that is needed and the types of remediation alternatives to be evaluated. Section 2 also includes New York standards, criteria, and guidelines (SCGs) and a discussion of preliminary remediation goals (PRGs) and remedial action objectives (RAOs). Section 3 identifies and describes the technologies that are applicable to remediation of the Site. These technologies are categorized into general response actions, including no action, institutional controls, capping, containment, removal, preparation, treatment, and disposal. Section 4 combines the applicable technologies evaluated in Section 3 into remediation alternatives and screens and evaluates each of these alternatives against selection criteria. Section 5 presents the recommended alternatives and provides the basis for their recommendation.

This document includes six appendices. Appendix A contains the list of references and acronyms. Appendix B consists of cost estimate tables. Appendix C shows the feasibility calculations. Appendix D presents the preliminary remediation goals for groundwater and on-site soil. Appendix E is an evaluation of the hydraulic barrier options, and Appendix F contains flux, partitioning, and NAPL mobility calculations.

1.2 SITE LOCATION AND DESCRIPTION

The 1.84-acre site is located along Sconondoa Street near South Lake Street in the City of Oneida, Madison County, New York (Figure 1.1). The triangular-shaped site is bordered to the west by the Tailrace, an open storm sewer that originates in the City of Oneida, flows to the northeast, and discharges to Oneida Creek. An abandoned New York Central Railroad right-of-way is located north of the Tailrace. To the east of the Site is a gravel road that was the former route of the New York Ontario and Western Railroad while to the south are Sconondoa Street and business and residential buildings (Figure 1.2).

The Site is presently owned by Niagara Mohawk Power Corporation, which operates a natural gas regulator station and electrical transmission line service center on the property. The Site contains a natural gas regulator station, an office, garage, above-grade petroleum storage tanks, and a storage yard for powerline spools, transformers, and utility poles. Operational utility lines run along the eastern and northern boundaries of the Site. Most of the Site is paved, and the storage yard is covered with gravel. The Site is secured by a perimeter fence, which is locked after working hours. A small lawn is located just outside the fenced area on the south side of the Site (Figure 1.3).

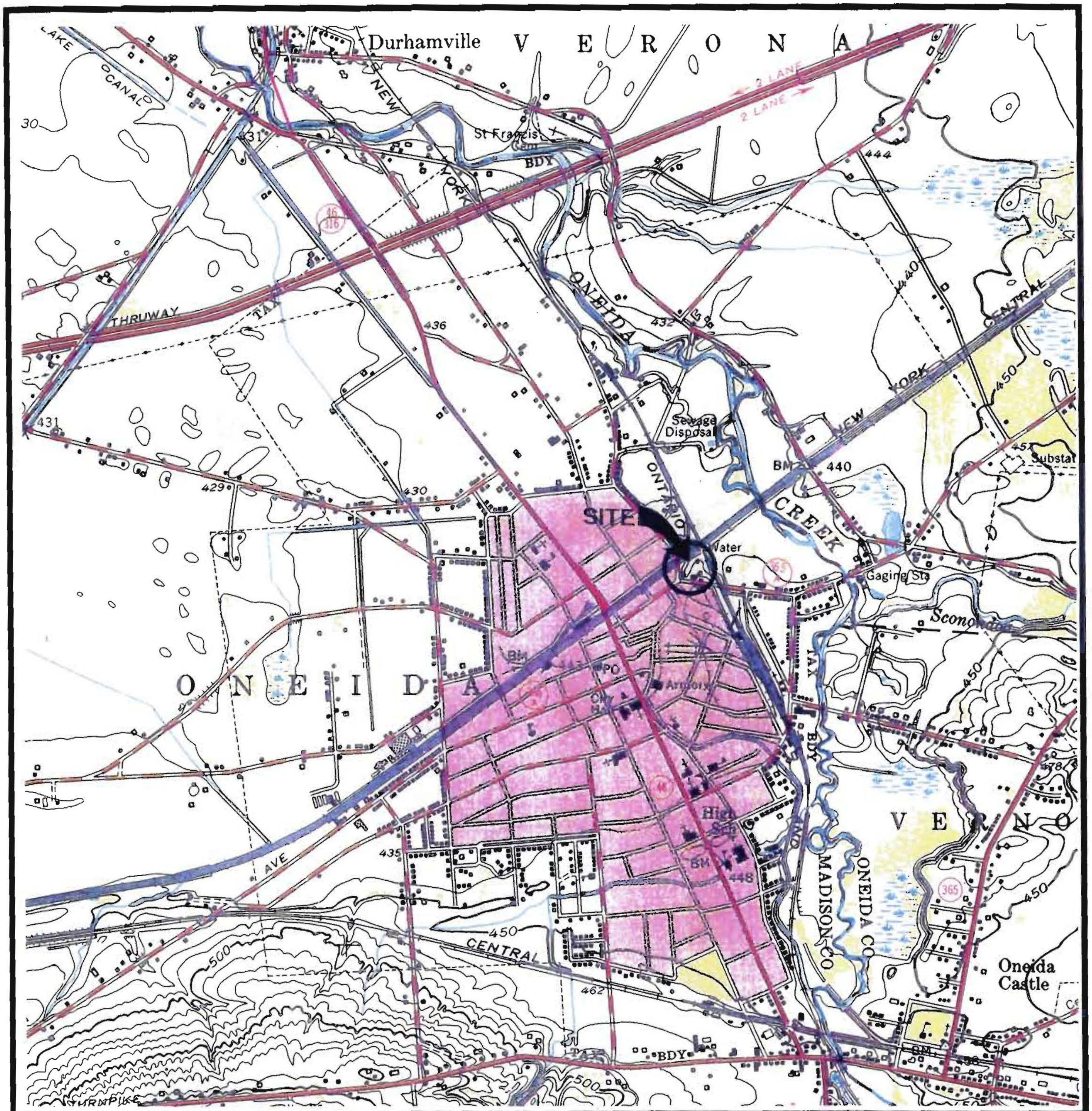
Soils beneath the Site consist of fill and construction debris commonly associated with MGP Sites: cinders, bricks, concrete, and ash fill. Deeper soils include peat, sand, silt, gravel, and clay. The Tailrace banks consist of dredge spoils deposited as a result of the City of Oneida's regular maintenance of the open stormwater sewer. Tailrace water discharges through a floodgate into Oneida Creek at a point about 1,000 feet northeast of the Site.

1.2.1 Geology

The geology encountered at the Site during the Remedial Investigation (RI) is consistent with the regional geology and findings from previous soil borings and wells. Unconsolidated media beneath the Site are characterized as fill covering organic peat with interbedded silt and clay, over layered silt, sand, and fine to coarse gravel, overlying a continuous layer of silty-clay.

The Site is covered with up to 15 feet of fill. The fill is highly variable in composition. The major component of the fill ranges from silt to fine to coarse sand and gravel. In some of the borings, debris consisting of wood, stone, brick, glass, or cinders was also encountered.

A peat unit lies below the fill across most of the investigation area. At several locations, the upper portion of the peat appears to have been reworked or mixed with the overlying fill. The peat unit consists of loose, dark brown silt, fine sand, and organic material. Scattered, soft, gray silty clay lenses are also within the peat. The total thickness of the peat layer is generally less than five feet, but was observed to be up to 12 feet thick in some borings.



NEW YORK
QUADRANGLE LOCATION

LATITUDE: N 43° 06' 27"
LONGITUDE: W 75° 39' 08"

N

**SOURCE: U.S.G.S. 7.5 MINUTE SERIES
TOPOGRAPHIC MAP,
ONEIDA, NEW YORK (1955)
SW/4 ONEIDA 15' QUADRANGLE**

2000' 0 2000'

Approximate Scale in Feet

FIGURE 1.1

NIAGARA MOHAWK

**NIAGARA MOHAWK POWER
CORPORATION
SYRACUSE, NEW YORK**

SITE LOCATION MAP

ONEIDA SCONONDOA STREET

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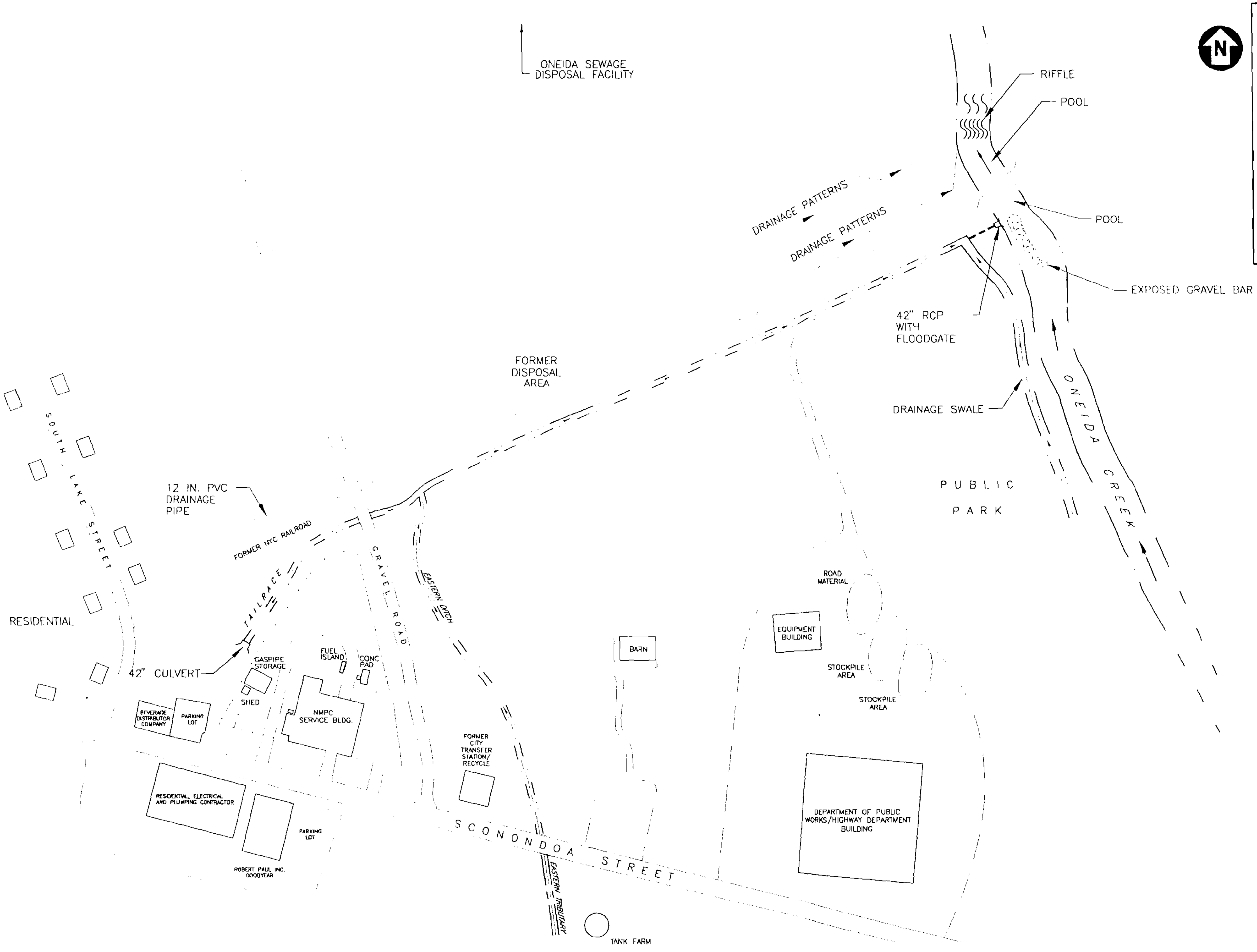

LEGEND:

—x——x—	FENCE
	GRAVEL ROAD

NOTES:

1. THIS DRAWING IS BASED UPON NMPC'S ONEIDA SERVICE CENTER TOPOGRAPHIC MAP, DRAWING NUMBER D-51348-C DATED MAY 28, 1993. OFFSITE FEATURES DERIVED FROM AERIAL PHOTOGRAPHY, USGS 7.5 MINUTE ONEIDA QUADRANGLE AND FIELD OBSERVATIONS.
2. WETLAND LOCATIONS FROM USFWS NWI MAPS (1991) AND NYSDEC ARTICLE 24 WETLANDS MAP. BOUNDARIES DRAWN DO NOT DEPICT JURISTICTIONAL DELINEATION.

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Approximate Scale in Feet

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DRAWN BY: SEH	08/04/97
CHECKED BY:	

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REGISTRATION NUMBER NA DATE NA

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CITY OF ONEIDA
MADISON COUNTY, NEW YORK STATE

CURRENT LAND USAGE

SCALE
1" = 180'
DRAWING NUMBER
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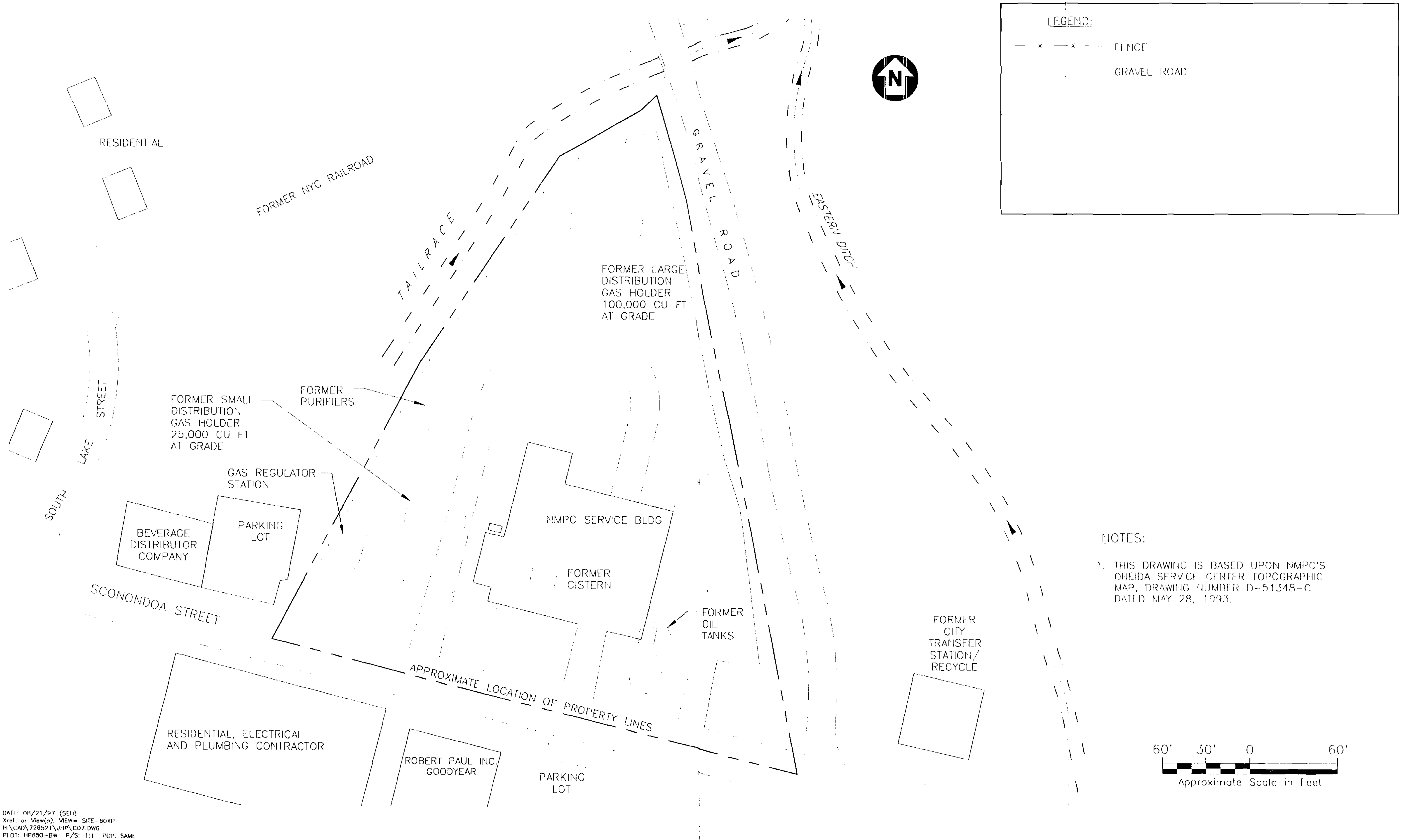

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ONEIDA SERVICE CENTER
CITY OF ONEIDA
MADISON COUNTY, NEW YORK STATE

SITE PLAN

SCALE 1" = 60'
DRAWING NUMBER 1.3

1-5

An alternating glacial lacustrine sediment sequence is found below the fill and peat or where they are not present. The primary units are silt and fine sand, alternating with sand and gravel. Layers of sand and gravel up to 9 feet thick were observed in the Preliminary site Assessment (PSA) and RI borings. The silt and fine sand is a gray, compact unit with layers up to 24 feet thick containing some finer seams or partings. The sand and gravel is a loose brown-gray, fine to coarse sand mixed with fine gravel and pebbles.

The deepest unit observed during the investigation is a stiff, brown-red clay containing little silt and occasional fine sand partings. The clay has low permeability (ES, 1994) and was observed at the base of every boring drilled with the objective of reaching it. The clay dips sharply to the south-southwest across the Site. The difference in the top-of-clay elevation between boring B-7 and monitoring well ES-6 was 24.5 feet. The maximum penetration of the clay was eight feet. The site stratigraphy, shown in Figures 1.4 and 1.5, clearly illustrates the dip of the clay layer.

1.2.2 Groundwater Flows and Pathways

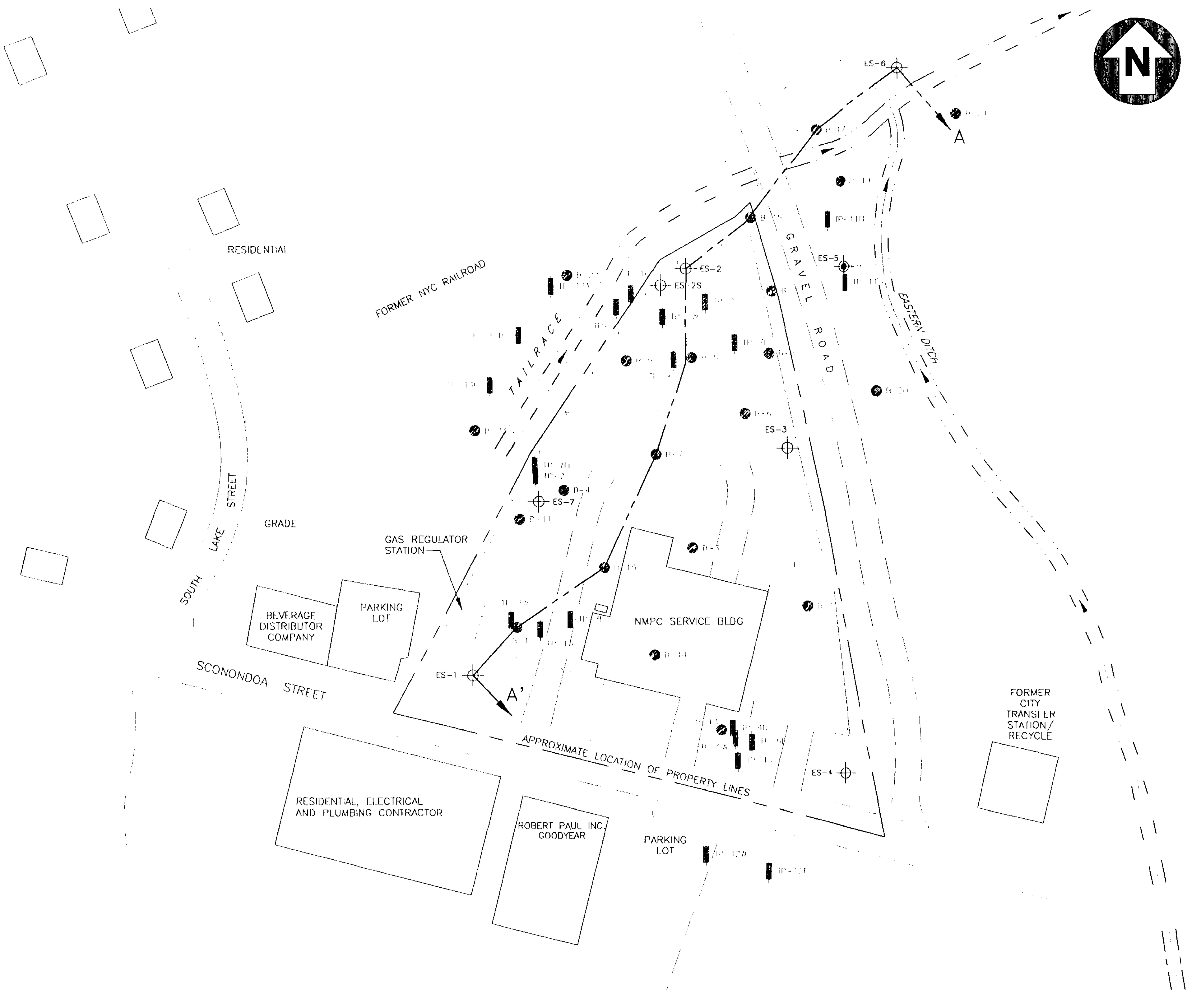
The glacial lacustrine deposits of silt, sand, and gravel form the main water-bearing unit at the Site. Lower portions of the fill material are saturated as well. In the site vicinity, groundwater flow is toward the northeast. On-site, groundwater flows radically toward the Tailrace and the Eastern Ditch (Figure 1.6). Hydraulic gradients are relatively flat at the Site, on the order of 0.006 to 0.008 feet per foot (ft/ft). Near the Tailrace and Eastern Ditch, the hydraulic gradients increase to 0.04 ft/ft to 0.05 ft/ft. The average hydraulic gradient between the Site and Oneida Creek is 0.003 ft/ft.

Groundwater is found at depths ranging from 5 feet below ground surface (BGS) northeast of the site to 11 feet BGS at the southwestern corner of the Site. Seasonal water level variations between July 1995 and January 1996 were generally on the order of 2 to 3 feet, but in some wells, water levels varied by as much as 4 feet. Water levels varied fairly uniformly, so groundwater flow directions did not vary appreciably. Water levels were measured four times: in July, August, and December of 1995 and in January 1996 (Parsons ES, 1997).

Hydraulic conductivity results from slug tests conducted in the lacustrine unit ranged from 0.02 ft/day to 58.32 ft/day, with a mean of 3.57 ft/day and a median of 4.45 ft/day (Parsons ES, 1997).

1.2.3 Surface Water Classifications and Use

The major surface water features in the area are seasonal wetlands, the Tailrace, the Eastern Ditch, the drainage swale located adjacent to Oneida Creek, and Oneida Creek, which is located northeast of the NMPC property. The off-site wetlands are described in Section 1.2.4, and the Tailrace, the Eastern Ditch, the drainage swale, and Oneida Creek are described below.



LEGEND:

— x — x —	FENCE
	GRAVEL ROAD
⌖ ES-2	MONITORING WELL LOCATION FOR SHORT TERM GROUNDWATER MONITORING
▮	TEST PIT LOCATION
●	BORING LOCATION
— — —	PROPERTY LINE
A — — A'	CROSS SECTION LOCATION AND ORIENTATION

NOTES:

1. THIS DRAWING IS BASED UPON NMPC'S ONEIDA SERVICE CENTER TOPOGRAPHIC MAP, DRAWING NUMBER D-51348-C DATED MAY 28, 1993.

80' 40' 0 80'
Approximate Scale in Feet

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CROSS SECTION LOCATION MAP

SCALE 1" = 80'
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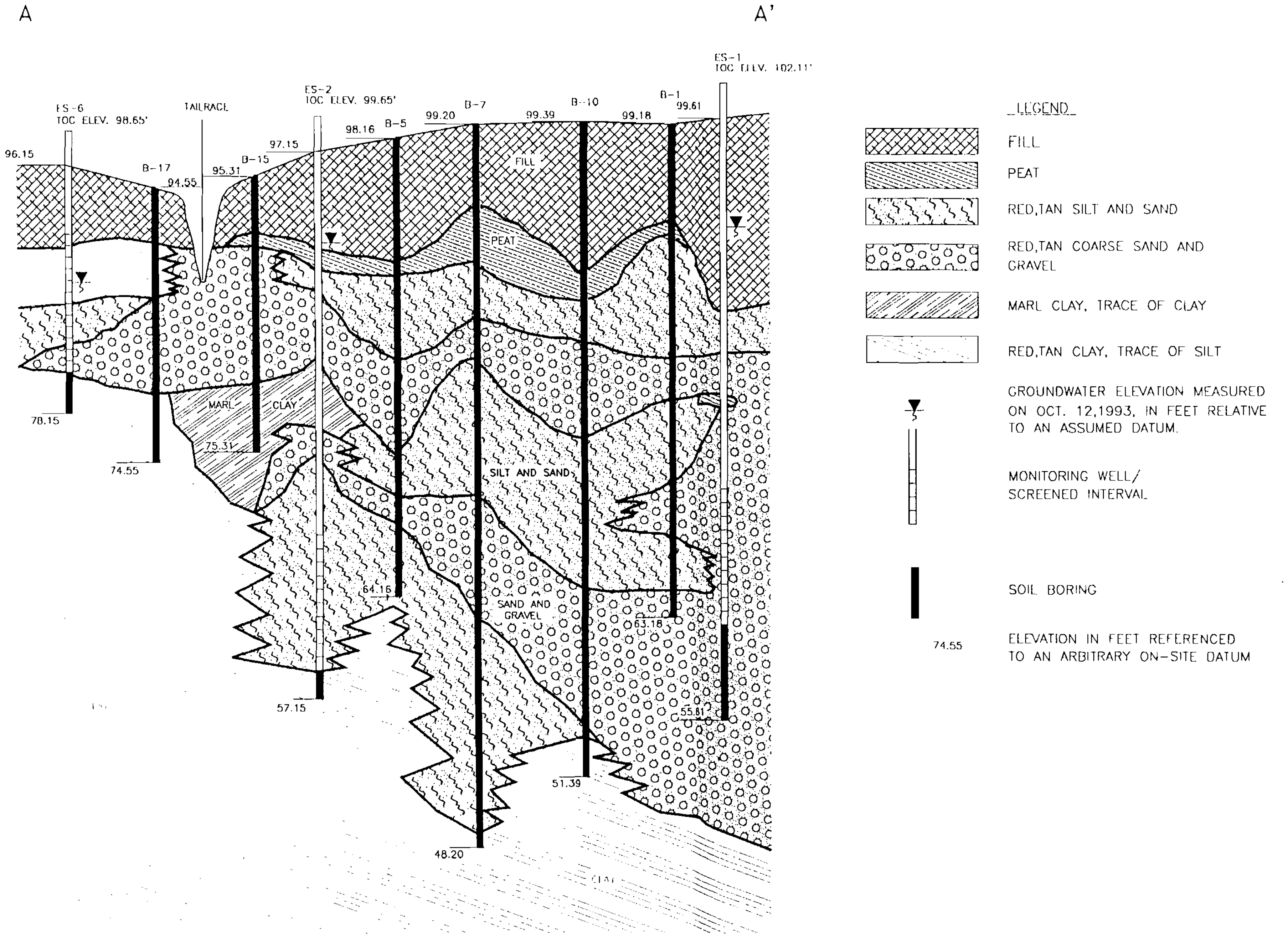

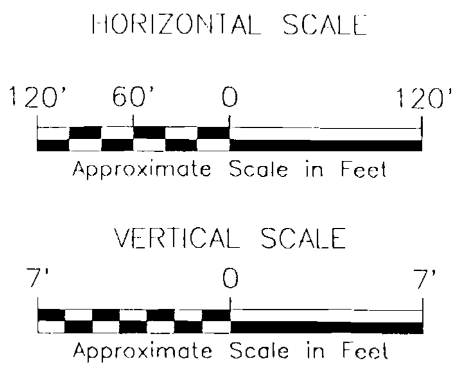

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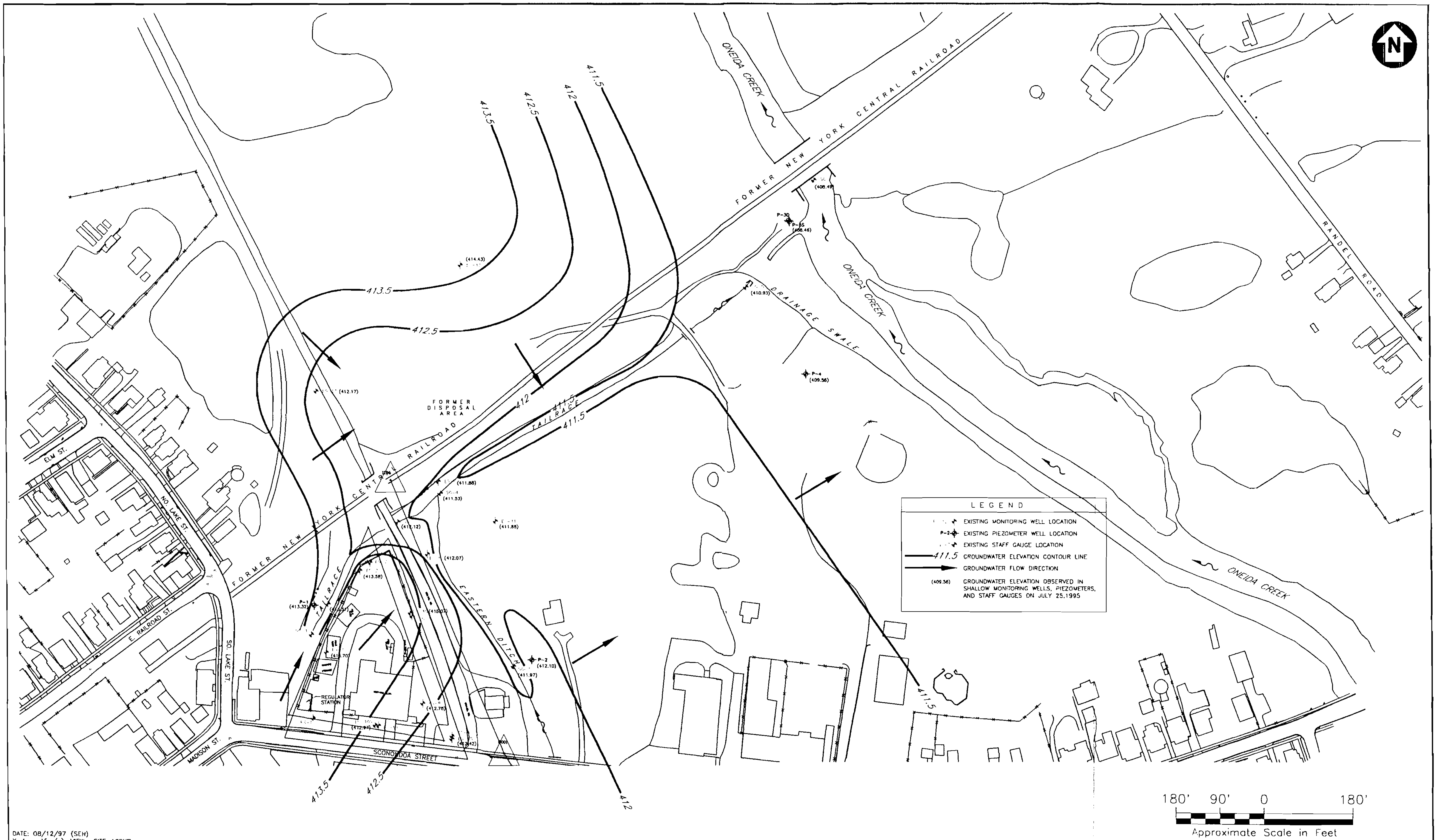
CROSS SECTION A-A'

SCALE AS NOTED
DRAWING NUMBER 1.5



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REGISTRATION NUMBER NA DATE NA

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OFFICES IN PRINCIPAL CITIES

NIAGARA MOHAWK

ONEIDA SERVICE CENTER
CITY OF ONEIDA
MADISON COUNTY, NEW YORK STATE

GROUNDWATER ELEVATION CONTOUR MAP

SCALE 1" = 180'
DRAWING NUMBER 1.6

The Tailrace, located adjacent to the west and northwest boundary of the Site, is the closest surface water body. The Tailrace is a storm sewer that originates within the City of Oneida and does not have a NYSDEC surface water classification. It flows through culverts upstream of the Site, emerges from a culvert along the west edge of the Site, and flows approximately 1,200 feet northeast to Oneida Creek. A culverted storm sewer enters the Tailrace from the north adjacent to the northwest side of the Site. An open stormwater ditch, the Eastern Ditch, joins the Tailrace downstream and east of the Site.

Both the Eastern Ditch and the drainage swale, approximately 50 feet and 1000 feet, respectively, east of the Site, are open stormwater ditches. The Eastern Ditch carries water from the Wilson Street and Sconondoa Street sewers. Like the Tailrace, both the Eastern Ditch and the drainage swale have no NYSDEC surface water classification.

Oneida Creek is a Class C(t) water body, suitable for fishing and fish propagation. The surface water elevation of Oneida Creek is approximately 408 feet above mean sea level (AMSL). There are no known water intakes in Oneida Creek (NYSDOH, 1982). Sconondoa Creek is westerly flowing and joins Oneida Creek at a point about 2,000 feet southeast (upstream) of the Site.

Oneida Creek flows northwest and enters Oneida Lake at South Bay, approximately 10 miles northwest of the Site. Oneida Lake discharges into the Oneida River approximately 20 miles west of South Bay. The Oneida River flows west approximately eight miles and joins the Oswego River. The Oswego River flows north approximately 21 miles and discharges into Lake Ontario.

1.2.4 Floodplains and Wetlands

A floodplain is composed of a floodway and a flood fringe. The floodway is that part of the floodplain considered to be the zone of highest hazard due to the passage of larger floods. The flood fringe is a zone of floodwater storage outside the floodway where water moves slowly or is ponded during a 100-year flood event. According to the Federal Emergency Management Agency (FEMA) Flood Boundary and Floodway Map for the City of Oneida, the Site is located within the 100-year flood fringe of the regulated floodway of Oneida Creek (Figure 1.7) (FEMA, 1995).

No wetlands exist on-site. Potential wetland areas have been observed off-site at the base of the elevated railroad tracks north of the Site. The railroad berm interrupts local drainage patterns and probably contributes to the persistence of local wetlands. Some of these wetland areas serve as stormwater retention basins for the City of Oneida storm water outfalls; water inputs into these wetlands include stormwater discharge from a 12-inch PVC discharge pipe, located on the north side of the abandoned New York Central Railroad.

LEGEND:

- - x - - x - - FENCE
GRAVEL ROAD
▥ 100-YEAR FLOOD FRINGE
☐ 500-YEAR FLOOD FRINGE
— — — APPROXIMATE 100-YEAR FLOOD BOUNDARY
——— 500-YEAR FLOOD BOUNDARY

NOTES:

1. THIS DRAWING IS BASED UPON NMPC'S ONEIDA SERVICE CENTER TOPOGRAPHIC MAP, DRAWING NUMBER D-51348-C DATED MAY 28, 1993.
2. BOUNDARIES ARE BASED UPON FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD BOUNDARY AND FLOODWAY MAP EFFECTIVE DATE: AUGUST 5, 1985

NOT TO SCALE

DATE: 08/21/97 (SEH)
Xref. or View(s): VIEW= SITE-200XP
H.\CAD\726521\JHP\C11.DWG
PLOT: HP650-BW P/S: 1:1 PCP: SAME

NO.	DATE	REVISION	BY

	DATE
PROJECT NUMBER: 72652104000	
DESIGNED BY: JHP	
DRAWN BY: SEH	08/04/97
CHECKED BY:	

ENGINEER NA
REGISTRATION NUMBER NA DATE NA

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FLOOD BOUNDARY AND
FLOODWAY MAP

SCALE NOT TO SCALE
DRAWING NUMBER 1.7

Extensive areas north of the abandoned railroad bed exhibited saturated soil conditions, typical wetland vegetation, and standing water at the time of the June and October 1993 inspections by Parsons ES. Trees within the low areas exhibited high water marks two feet above ground surface, indicating significant accumulation of water during flood periods. The surface drainage from these low areas is apparently to the north with no direct connection into the Tailrace. The terraced railroad appears to act as a surface water drainage divide, separating wetlands to the north from the Tailrace. There were no observed culverts or channels that connect the two drainage areas. Significant flooding may cause some water from the Tailrace to flow overland through the railroad tunnel or overpass (Parsons ES, 1997).

1.2.5 Future Land Use

The site will continue to include an active electrical transmission line service center and a natural gas regulator station in accordance with NMPC's current plans for the Site.

1.3 SITE HISTORY

This site history is condensed from the detailed site history presented in the Oneida (Sconondoa Street) Preliminary site Assessment/Interim Remedial Measure (PSA/IRM) Work Plan and Preliminary Historical Profile prepared by NMPC (ES, 1993; NMPC, 1992).

The Oneida Gas Light Company purchased the Sconondoa Street property from the G. Berry Tannery in 1896. By 1899, the Sconondoa Street gas works buildings replaced the tannery structures. The following is a summary of industrial ownership of the Sconondoa Street property:

G. Berry Tannery	1857 - 1896
Oneida Gas Light Company	1896 - 1902
Oneida Light and Power Company	1897 - 1901
Madison County Gas and Electric Company (acquired both Oneida companies)	1901 - 1911
Adirondack Electric and Power Corporation	1911 - 1927
New York Power and Light Corporation	1927 - 1950
Niagara Mohawk Power Corporation	1950 - Current

The early Oneida Gas Light Company gas works consisted of coal retorts, a scrubber room, a purifier room, a lime storage room, a coal house, and an at-grade, 25,000-cubic-foot gas holder. The Oneida Light and Power Company, formed separately, constructed a building, which housed six dynamos, on the eastern portion of the gas works property. Various modifications to the site operations and layout took place over time. The electric plant was decommissioned by 1914, and an at-grade, 100,000-cubic-foot gas distribution holder was added to the north end of the Site. Between 1909 and 1914, purification operations were converted from lime sludge to wood shavings. The 25,000-cubic-foot gas holder may have been converted to a relief holder, but this has not been confirmed.

The Adirondack Electric Power and Light Corporation converted operations to water (carbureted) gas in 1920. Two superheaters and a separator were installed in the former electric room, and the former coal gas building was converted for storage. Two oil tanks, a cistern, and three purifiers were installed to support the water gas operations.

The New York Power and Light Corporation phased out gas manufacturing operations between 1928 and 1930. The 25,000- and 100,000-cubic-foot former gas holders were used to store purified gas piped in from a MGP in Utica. In 1930, the 25,000-cubic-foot gas holder, cistern, oil tanks, and purifiers were removed. The carbureted gas production room was demolished in 1942. Final demolition of MGP structures, including the 100,000-cubic-foot distribution holder, took place between 1963 and 1964 to make way for the Niagara Mohawk Power Corporation service center. The site has remained essentially unchanged since the construction of a service center addition in 1974. Figure 1.3 shows the approximate locations of the former holders and other structures.

1.4 SCOPES OF PRELIMARY SITE ASSESSMENT AND REMEDIAL INVESTIGATION

1.4.1 Preliminary site Assessment (PSA)

A PSA study was performed at the site between June 24, 1993, and February 24, 1994 (ES, 1994). An Interim Remedial Measure (IRM) was determined to be unnecessary based on the nature and extent of MGP-related waste materials on-site. Distinct, highly concentrated wastes were not encountered during the PSA. Furthermore, MGP-related constituents were mostly limited to the site property, and no known users of groundwater exist. The objectives of PSA study were to:

1) characterize the nature and extent of residuals on and off-site,
2) determine whether the residuals constituted a significant threat to public health or the environment, and
3) determine whether one or more IRMs would be appropriate due to the nature and extent of residuals at the Site.

The conclusions and recommendations of the PSA report were:

- Residuals were present on-site and to a lesser extent downgradient of the Site. However, the nature and extent of residuals did not lend themselves to an IRM because distinct, concentrated residuals were not encountered.

- Additional subsurface soil sampling was recommended to characterize more quantitatively the nature and extent of residuals in subsurface soils and soils/dredge materials along the Tailrace.
- The installation of additional monitoring wells was recommended to characterize more fully the background and downgradient quality, the vertical distribution of residuals in groundwater, and the relationship between groundwater and surface water in the Tailrace.
- Additional surface water sampling in Oneida Creek was recommended to assess the potential impacts of sediment on surface water quality.
- A baseline human health risk evaluation was recommended to quantify any risk to local inhabitants, site workers, and transient visitors.
- A criteria-specific analysis (Fish and Wildlife Impact Analysis (FWIA), Step IIB) was recommended to compare the concentrations of residuals with numerical criteria associated with specific media and biota.

1.4.2 Remedial Investigation

A remedial investigation (RI) report was issued in June 1997 (Parsons ES, 1997). The objectives of that investigation were to:

1) evaluate the nature and extent of impacts, including delineation and characterization of sources, residuals, and potential migration pathways,
2) evaluate potential human health and environmental risks and preliminary remediation goals (PRGs), and
3) provide data to support the FS.

The RI objectives were met through the initial and supplemental data collection efforts and subsequent integration of the analytical results with site geology and hydrogeology. The first objective was met primarily through the subsurface drilling program and by sampling and laboratory analysis of soil and groundwater samples. The second objective was met by conducting a human health risk assessment and a fish and wildlife impact assessment. The final objective was met through the sampling and laboratory analysis of surface soils, subsurface soils, sediments, surface water, and groundwater samples and data evaluation and interpretation. Results of these analyses are summarized in Section 1.6.

1.5 SUMMARY OF CULTURAL RESOURCE INVESTIGATIONS

In 1995, Niagara Mohawk submitted a Phase I Cultural Resource Investigation for the Site to the State of New York. This investigation was subsequently reviewed by the New York State Office of Parks, Recreation and Historic Preservation (OPRHP) in 1996 in accordance with the New York State Parks, Recreation and Historic Preservation Law, Section 14.09 (OPRHP Project Review No. 93PR0876). The OPRHP concurred with the conclusion of that investigation that there was "No Impact" on cultural resources currently listed in or eligible for listing in the State and National Registers of Historic Places. Although several Sites of cultural importance have been identified near the Oneida Site, continuous development and construction within the project area since the mid-1800's has limited the potential for recovering evidence of prehistoric occupation. Furthermore, NMPC has kept detailed records of the development of the project area. Thus, according to the revised Phase 1 Cultural Resource Investigation, it is unlikely that new information would be acquired through archaeological investigations of the remains (Collamer and Associates, 1996).

1.6 NATURE AND EXTENT OF IMPACTS

The nature and extent of impacts is discussed by media and by constituent groups. Surface soils, subsurface soils, sediment, groundwater, and surface water samples were analyzed for the presence of polynuclear aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene, and xylenes (BTEX), PCBs and pesticides, total organic carbon (TOC), cyanide, and/or metals. The significant findings, discussed in detail in the RI report, are summarized below. Figures 4.1 through 4.5 in the RI Report present these findings.

1.6.1 Analytes Detected in Soils and Sediments

1.6.1.1 PAHs

PAH concentrations in subsurface soils ranged from non-detect (in eight samples) to 2,017 milligrams per kilogram (mg/kg) or parts per million. The highest PAH concentrations were generally found in the northern corner of the NMPC property and along the west side of the service center building.

PAHs were detected in all nine subsurface dredge spoil samples collected along the Tailrace from areas where dredge spoils had been deposited. Detected concentrations ranged from 0.096 mg/kg to 22,996 mg/kg. The two highest concentrations of PAHs (22,996 mg/kg and 7,159 mg/kg) were detected approximately 150 to 250 feet east of the intersection of the Tailrace and the Eastern Ditch.

PAHs were detected in surface soils collected in the site vicinity, including all five background samples. PAH concentrations ranged from 1 mg/kg to 2,030 mg/kg. Background PAH concentrations ranged from 3 mg/kg to 253 mg/kg. The highest concentration of PAHs was at location SS-2, near the Tailrace along the northwest side of the Site.

PAHs were detected in all 30 Tailrace sediment samples. Total PAH concentrations in the Tailrace sediments ranged between 2 mg/kg and 46,694 mg/kg. The sediment sample location situated in the Tailrace approximately 150 feet east of the intersection with the Eastern Ditch had the highest total PAH concentrations, ranging from 16,208 mg/kg (0 to 0.5 feet deep) to 46,694 mg/kg (0.5 to 1.0 feet deep). PAH concentrations ranged from 8 mg/kg to 33 mg/kg in the Eastern Ditch and from 2 mg/kg to 11 mg/kg in the drainage swale. A PAH concentration of 118 mg/kg was also observed south of Sconondoa Street and upstream of the Site.

Total PAH concentrations in the Oneida Creek sediments ranged between non-detect and 17 mg/kg, but were below 2 mg/kg in seven of the eight samples. The sample with the highest total PAH concentration was an upstream sample. A sediment sample collected near the mouth of the Tailrace had a total PAH concentration of 1 mg/kg.

1.6.1.2 BTEX

BTEX concentrations in subsurface soils ranged from non-detect (in 19 samples) to 789 mg/kg. The three highest concentrations of BTEX (789 mg/kg, 189 mg/kg, and 170 mg/kg) were detected near the northern corner of the NMPC property. BTEX concentrations of up to 82 mg/kg were noted along the west side of the service center building. BTEX concentrations were comparatively low over the other areas sampled.

BTEX concentrations in the dredge spoils along the Tailrace ranged from non-detect (in five samples) to 278 mg/kg. The pattern of BTEX distribution is similar to PAHs; the highest concentrations were found approximately 150 to 250 feet east of the intersection of the Tailrace and the Eastern Ditch, and the lower concentrations were found along the Service Center property line. No BTEX compounds were detected along the eastern portion of the Tailrace or the drainage swale.

BTEX compounds were detected in four surface soil samples with a maximum concentration of 0.054 mg/kg. BTEX was not detected in 16 samples. Three of the surface soil samples containing BTEX were collected along the Tailrace. The fourth sample was located in the center of the NMPC Service Center yard west of the fuel island. BTEX was not detected in any of the background surface soil samples.

BTEX was detected in the Tailrace sediment samples at concentrations ranging from non-detect (6 locations) to 172 mg/kg. The area containing the highest BTEX concentrations extended from west of the center of the NMPC property to approximately 150 feet east of the intersection of the Tailrace and the Eastern Ditch. BTEX compounds were not detected in any of the upstream Tailrace, Eastern Ditch, or drainage swale samples.

BTEX was detected in two of the eight Oneida Creek sediment samples. The highest BTEX concentrations (1 mg/kg) were detected in an upstream sample and the lowest concentrations (0.01 mg/kg) were in a downstream sample.

1.6.1.3 Cyanide

Total cyanide concentrations in subsurface soils ranged from non-detect (in 34 samples) to 5 mg/kg. Three of the locations where cyanide was detected are located east of the Site; the fourth is located near the former purifier area.

Cyanide was detected in only one dredge spoil area sample, at a concentration of 117 mg/kg. The sample was located between the Tailrace and the northwest corner of the Service Center fence.

Cyanide was detected in four surface soil samples, two of which were background samples. Concentrations ranged from non-detect to 2 mg/kg along the Tailrace. The background locations contained 1 mg/kg cyanide along the elevated former railroad bed and 2 mg/kg cyanide on the Oneida Department of Public Works property, which is about 600 feet east of the NMPC Site.

Cyanide was detected in the Tailrace sediment samples at concentrations ranging from non-detect (in 27 samples) to 2 mg/kg. The samples containing cyanide were located west of the Site, within approximately 100 feet of the outlet of the culverted section of the Tailrace. Cyanide was detected only in surficial sediment samples. Cyanide was not detected in any of the Oneida Creek sediment samples.

1.6.1.4 PCBs/Pesticides and Other Organic Compounds

No PCBs were detected in subsurface soils at the Site. Low concentrations of pesticides were detected in two test pit samples and one soil boring sample along the site perimeter. Neither PCBs nor pesticides are MGP-related compounds. However, spraying of vegetation along the gravel road north of the abandoned railroad tracks was observed during the PSA/IRM study and as recently as June 1995.

Other non-Site related VOCs and SVOCs were detected in trace amounts in limited samples. Some of the compounds (acetone, methylene chloride, and bis(2-ethylhexyl)phthalate) are common laboratory by-products. The other compounds detected were styrene, carbazole, and dibenzofuran.

Analysis of PCBs and pesticides in the dredge spoil materials located along the Tailrace was limited to one location along the northwest corner of the site property fence. No PCBs or pesticides were detected in the sample, SB-17. Three nonsite-related VOCs and SVOCs were also detected in the sample: acetone (a common laboratory by-product), tetrachloroethene, and dibenzofuran.

PCBs were not detected in the Tailrace sediment samples. However, six pesticides were detected in the samples, including four pesticides in an upstream sediment sample. Three nonsite-related VOCs and seven nonsite-related SVOCs were detected in the sediment samples. The VOCs (acetone, 2-butanone, and methylene chloride) and four of the SVOCs (phthalates) are common laboratory contaminants. The other SVOCs are phenol, carbazole, and dibenzofuran. Six of the nonsite-related SVOCs were detected in an upstream sediment sample.

Aroclor 1248 was detected in one of the Oneida Creek sediment samples collected near the mouth of the Tailrace. The compound is not believed to have originated on-site because it was not detected in the Tailrace sediment samples or dredge spoils samples.

Pesticides were not detected in the Oneida Creek sediment samples. One nonsite-related VOC, methylene chloride, was detected in the sediment samples. The compound is a common laboratory contaminant. No nonsite-related SVOCs were detected in the Oneida Creek sediment samples.

1.6.1.5 Metals

Up to 21 metals were detected in the subsurface soil, surface soil, and sediment samples. Metals are naturally-occurring in both soils and groundwater. Only arsenic, lead, mercury, and zinc are potentially MGP-related. Metals concentrations in the various media were compared to statistical background levels based on background upper tolerance limits (BUTLs) using results from five surface soil samples (USEPA, 1989). BUTLs, as defined in Section 2.2.1, were also used for the risk assessment, which is summarized in Section 1.8. BUTLs were used to focus the discussion of metals to those of most significance based on human health risk criteria. The calculation of BUTLs and the determination of which metals are considered significant are also discussed in Section 1.8 of this report and in Section 6 of the RI report.

In order of frequency of detection, the metals detected in subsurface soil samples above BUTLs were magnesium (5 samples), barium (4 samples), sodium (4 samples), and silver (3 samples). Up to eight metals were detected in two surface samples above BUTLs: aluminum, barium, chromium, cobalt, nickel, potassium, silver, and sodium. None of these metals are associated with former MGP-related operations.

In order of frequency of detections, the metals detected in sediment above BUTLs were: lead (four samples), silver (three samples), antimony (two samples), arsenic (one sample), and zinc (one sample). Of these metals, silver and antimony are not associated with former MGP-related operations. In addition, lead and zinc can originate from many different sources commonly present in an urban environment.

1.6.2 Analytes Detected in Groundwater

Two rounds of groundwater sampling were conducted during the RI: Round 1 in July 1995 and Round 2 in December 1995. All new and existing groundwater monitoring wells at the site were sampled during each round. See Figure 1.4 for monitoring well locations.

1.6.2.1 PAHs

PAH concentrations, primarily naphthalene and 2-methylnaphthalene, ranged from non-detect (11 samples) to 144,621 micrograms per liter (µg/l) or parts per billion. The highest concentrations were detected in ES-2S, located at the northern corner of the site downgradient of the former 100,000-cubic-foot gas distribution holder. ES-2S is closest to the area with the highest PAH concentrations in the soil. PAHs were also found in ES-2 (1,508 µg/l), the deeper well paired with ES-2S, and in ES-7 (782 µg/l), located in the former purifier area. PAHs were also detected in ES-5 (390 µg/l), located off-site and northeast (downgradient) of the former 100,000 cubic foot distribution gas holder, and in ES-3 (242 µg/l), located on-site northeast of the former 25,00-cubic-foot relief holder.

1.6.2.2 BTEX

BTEX compounds, primarily ethylbenzene and xylene, were detected in groundwater samples at concentrations ranging from non-detect to 13,400 µg/l. BTEX detections generally correlated with PAH detections. The highest concentrations were detected in ES-2S (13,400 µg/l) and ES-7 (903 µg/l). The extent of BTEX to the north and northeast of the NMPC property is most likely limited to the area south of the Tailrace and west of the Eastern Ditch based on no BTEX being observed at ES-6, ES-11, or ES-13.

1.6.2.3 Cyanide

Total cyanide was detected at concentrations ranging from non-detect to 470 µg/l. The highest cyanide concentrations were observed at monitoring wells ES-7 and ES-2S, both located in the former purifier area.

1.6.2.4 PCBs/Pesticides

PCBs were not detected in any of the groundwater samples. Three pesticides were detected: endosulfan I was found in ES-2S, ES-3, and ES-7, and heptachlor and alpha-BHC were detected in monitoring well ES-2S.

1.6.2.5 Metals

Up to 17 metals were detected in groundwater samples analyzed for Target Analyte List (TAL) inorganics. Metals are naturally-occurring in sediments, soils, and groundwater. Given the lack of upgradient wells, metals concentrations have been compared to groundwater concentrations at side-gradient locations. All six of the side-gradient wells contained metals, and groundwater from three of those wells had one or two MGP-related metals. Wells with lead concentrations of more than an order of magnitude greater than the side-gradient wells were ES-2S (near the former large gas holder) and ES-5 (off-site, northeast of large gas holder area). Lead was the only MGP-related metal for which significantly high concentrations were found in groundwater from these wells (e.g., five times the groundwater quality standard at ES-5).

1.6.3 Analytes Detected in Surface Water

Seven surface water samples from the Tailrace and two surface water samples from the Eastern Ditch were collected during the PSA/IRM study. Three surface water samples were collected from Oneida Creek during the RI. These RI samples were collected from the mouth of the creek and locations upstream and downstream of the Tailrace.

1.6.3.1 PAHs

PAHs were detected in four of seven surface water samples from the Tailrace and in both surface water samples from the Eastern Ditch. The highest concentrations of PAHs (25 µg/l and 29 µg/l) were detected near the intersection of the Eastern Ditch and the Tailrace. PAHs were not detected in any of the Oneida Creek surface water samples.

1.6.3.2 BTEX

The highest concentration of BTEX in surface water, 76 µg/l, was reported in a surface water sample collected from the Tailrace upstream of the Site. BTEX compounds were also detected near the intersection of the Eastern Ditch and the Tailrace at 25 and 29 µg/l. Other VOCs, including chloroform, styrene, and 1,2-dichloroethene, were also detected. BTEX compounds were not detected in any of the Oneida Creek surface water samples.

1.6.3.3 Cyanide

Cyanide was detected in seven Tailrace surface water samples at concentrations up to 90 µg/l. Cyanide was not detected in any of the Oneida Creek surface water samples.

1.6.3.4 PCBs/Pesticides

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

1.6.3.5 Metals

Up to 20 metals were detected in surface water samples collected from the Tailrace and Eastern Ditch. Metals BUTLs were exceeded in four samples.

1.6.4 Presence of NAPL in Soil and Groundwater

Non-aqueous phase liquid (NAPL) was observed in soil samples collected from 20 on-site soil borings. However, the NAPL was not present in a distinct layer or zone, but rather in scattered discontinuous blebs adsorbed to the soil. NAPL was also observed in three dredge spoil samples but only in scattered discontinuous blebs adsorbed to the soil. NAPL was not observed in any of the monitoring wells.

1.7 OVERVIEW OF CONSTITUENT FATE AND TRANSPORT

The purpose of this section is to summarize the pathways through which constituents detected in the various environmental media may be transported and the potential for migration of these constituents away from the source area(s), based on the discussions presented in the RI Report.

Potential risks to human health and the environment, potential routes of exposure, and potential receptors are discussed in Section 1.8, which summarizes the baseline risk assessment.

The environmental pathways evaluated as potential routes of migration include air, groundwater, surface water, and soil/sediment. Constituents of concern for various routes were selected based on historical investigations, results of analytical sampling conducted during the RI, and results of the human health risk assessment and fish and wildlife impact analysis conducted during the RI. The fate and transport discussion is limited primarily to the sediment and groundwater routes because they pose the greatest potential for migration. The primary compounds or compound groups of concern for these routes are BTEX and PAHs.

1.7.1 Potential Routes of Migration

The potential migration pathways, including migration via air, groundwater, surface water, and soil/sediment, were evaluated in detail in the RI Report. A summary of the RI evaluation is discussed below.

Routes that pose a potential for migration of Site-related constituents include the groundwater, surface water, sediment, and subsurface soil routes. Although groundwater is an incomplete exposure pathway, the groundwater route is a potential route of migration based on the detection of potentially Site-related constituents in groundwater on-site and immediately off-site. Surface water is also a potential route of migration, but RI sampling did not indicate the migration of Site-related constituents to Oneida Creek. Sediments in the Tailrace containing Site-related constituents can potentially migrate away from the Site. Compounds that are relatively mobile in soils can potentially move vertically downward via percolation. The air route does not appear to be a significant route of migration due to the low potential for particulate transport and the relative lack of impacts to site surface soils.

1.7.2 Persistence

A detailed discussion of the persistence of PAHs, BTEX, cyanide, and MGP-related metals is presented in the RI Report. A summary of that discussion is presented below.

BTEX compounds are relatively mobile in many shallow soil environments, but do tend to be more persistent in deeper soils and groundwater. BTEX compounds tend to volatilize relatively rapidly from surface soil and surface water. Organic carbon partition coefficients for BTEX are relatively low, indicating limited ability to adsorb to soils and a preference to partition to groundwater. Once in the groundwater system, biodegradation of BTEX (and other hydrocarbons and related organic compounds) can be significant and rapid in the presence of oxygen (Borden and Bedient, 1986).

Low, medium, and high molecular weight PAHs were detected in soil, sediments, and groundwater at the Site. The potential mobility of PAHs in soil is primarily related to the organic carbon partition coefficient (Koc). The low molecular weight PAHs have Koc values in the range of 10^3 to 10^4 ml/g, which indicate a moderate potential to be adsorbed to organic material. Medium and higher molecular weight compounds with larger Koc values (10^4 to 10^6 ml/g) have a much greater tendency to adsorb and resist movement through soil. Volatilization of the lower molecular weight compounds from shallow soils may be similar to VOCs. However, some PAHs in soil may be transported to groundwater and then move laterally in the aquifer, depending on soil and water conditions.

Medium and higher molecular weight PAHs adsorb to soil more than lower molecular weight PAHs do, as shown by the RI analytical results. PAHs from all molecular weight classes (low, medium, and high) were detected in soil samples at the Site. However, in groundwater, the PAHs detected most frequently and in the highest concentrations were of the low molecular weight class, such as naphthalene and 2-methylnaphthalene.

Cyanide persistence in both soil or groundwater depends on its form as free cyanide or iron-complexed cyanide (Meussen *et al.*, 1992). Meussen's study indicates that cyanide in groundwater at former MGP Sites occurs primarily in the iron-complexed form. In the absence of light, decomposition is very slow (USEPA, 1980). Upon exposure to sunlight, however, rapid photolysis occurs, yielding hydrogen cyanide.

The persistence and environmental fate of metals that were detected at the site is described in the chemical profiles presented in Appendix M of the RI Report.

1.7.3 Migration

Of the four major migration routes mentioned in Section 1.7.1 (air, groundwater, surface water/sediment, and soil), the groundwater and sediment routes are the primary means by which detected compounds could be transported beyond the Oneida Site.

Chemical constituents in soils at depths greater than two feet BGS have limited ability to migrate by re-sedimentation or soil movement. Subsurface soils deeper than two feet BGS may be an indirect route for migration by adsorbing certain compounds and by serving as a route for NAPL migration. NAPL migration is primarily laterally through the fill, sand, and gravel units. Downgradient vertical migration is limited by the clayey confining unit.

1.8 RISK ASSESSMENT RESULTS

1.8.1 Human Health Risk Assessment

The complete baseline human health risk assessment (HHRA) is presented in Appendix L of the RI Report.

1.8.1.1 Summary

The baseline HHRA examined the potential risk to human health from constituents present in various media at and near the Site. Given the conservative (health protective) approach used in performing the risk assessment, the hazards and risks calculated herein may be overstated, especially for the reasonable maximum exposure (RME) exposure scenario. Data used in the risk assessment were obtained from the RI, as well as from the PSA completed in 1994. The exposure pathways of concern for current off-site residents include exposure to Site-related constituents in sediment and surface water in the Tailrace and in off-site surface soil. The groundwater pathway was determined to be incomplete for all current and future receptors.

Noncarcinogenic hazard indices and carcinogenic risks were quantified for current residents, hypothetical future residents, and on-site workers. Potential pathways, including dermal contact with surface water, surface and subsurface soil, and sediment, ingestion of surface and subsurface soil and sediment, and inhalation of volatiles and fugitive dust, were quantitatively evaluated.

Two exposure levels were assessed for the current and hypothetical future receptors: exposure of an average individual (central tendency or CT) and exposure of a more highly exposed individual (RME). The RME results were used for decision-making purposes.

To assess the possible noncarcinogenic health effects associated with exposure, the chronic daily intakes (CDIs) were estimated for oral, inhalation, and dermal exposure. The CDI values were then compared to the available USEPA oral reference doses (RFDs) or inhalation reference concentrations (RFCs). A hazard index (HI) value greater than 1 indicated a potential concern.

Except for future workers, hazard indices for current and future residents exceeded 1, indicating a potential for the occurrence of adverse health effects. The increased hazards derived for these receptors were due primarily to the presence of manganese in surface water; zinc, copper, 2-methylnaphthalene, naphthalene, PAHs, and mercury in surface soils; and antimony, naphthalene, pyrene, fluoranthene, acenaphthene, 2-methylnaphthalene, endrin aldehyde, and fluorene in sediment.

The results of the USEPA Lead Uptake Biokinetic Model indicated that lead in soil and sediment near the site does not pose a threat to children, as the predicted blood lead concentrations for over 97 percent of the exposed population were expected to be below 10 μg/dL. The criterion of a blood level of 10 μg/dL or less in 95 percent of children was used as a health guideline. The predicted blood lead concentration (geometric mean) of current and future children was 4.1 μg/dL.

To assess possible carcinogenic health effects associated with exposure, the lifetime average daily exposure (LADE) was estimated for oral, inhalation, and dermal exposure. The LADE values were then multiplied by the available USEPA oral slope factor, or inhalation unit risk factor, for each chemical to calculate the upper bound excess lifetime risk of a receptor developing cancer due to a given chemical by a given exposure pathway. The USEPA has established a target risk range for carcinogenic effects of 1 in 1,000,000 (1E-06) to 1 in 10,000 (1E-04) for Superfund Sites. Although the site is not a Superfund Site, the target risk range has been adopted to assess the risk posed by the Site.

Except for the CT risk to future workers, CT and RME cancer risks exceeded the USEPA target range of 1E-06 to 1E-04 for current and future residents, indicating a potential increase in excess carcinogenic risk in these receptors. The risks for these exposure scenarios were due primarily to the presence of PAHs and arsenic in soils and PAHs, arsenic, carbazole, and benzene in sediment.

1.8.1.2 Conclusions

The risk assessment results indicate that there are potential carcinogenic and noncarcinogenic health threats to both current and future receptors at the Site. This is based primarily on exposure to manganese (which is not associated with former MGP-related operations) in surface water; PAHs and metals in soils; and benzene, PAHs, other SVOCs, and metals in sediment located at and near the Site. This assessment of potential health threats is based on a number of highly conservative (health protective) assumptions, which increase the calculated potential health threat. The greatest potential health threat is the threat to current and hypothetical future residents who have contact with on-site soil and Tailrace sediment. The actual health threat to receptors will likely be substantially lower based on the conservative assumptions inherent within risk assessment calculations.

1.8.2 Ecological Risk Assessment - Fish Tissue Analysis

1.8.2.1 Purpose

The PSA for the site determined that potential constituent migration and possibility of impacts to Oneida Creek biota required further evaluation. The purpose of the fish tissue analysis and sediment evaluation was to further explore the potential for adverse ecological impacts to Oneida Creek aquatic life attributable to constituent releases from the Site.

The objectives of the impact analysis study were:

- to determine the potential impacts on fish and
- to determine whether any constituents found in fish tissue were related to the Oneida Site.

The method used to achieve the first objective was to collect representative fish tissue samples for chemical analysis and to review applicable standards, guidelines, and technical literature to relate chemical concentrations to levels associated with observable impacts. The degree to which observed chemicals were attributable to migration from the site was determined by collecting samples at, upstream, and downstream of the most likely discharge point for site chemicals.

1.8.2.2 Summary

This section provides a summary of the results of the ecological risk assessment/fish tissue analysis conducted as part of the RI. A complete description of this analysis is presented in the RI report.

Oneida Creek is a Class C(t) waterbody in the area near the Site and exhibits conditions suitable for direct contact recreation and trout propagation. The Oneida Creek habitat is suitable for survival of a diverse aquatic ecological community. No indications of chemical-related stress (staining, sheens, or unusual odors) were observed in the creek during inspection of the sampled creek segments. The creek exhibits a high resource value to humans, as it supports recreational angling for several gamefish species. NYSDEC conducts annual stocking of trout at the Route 5 bridge on Oneida Creek, approximately one mile upstream of the confluence of the Tailrace and Oneida Creek.

The distribution of constituents in fish tissue did not indicate that Site-related constituents are migrating into Oneida Creek and contributing to adverse ecological impact. Compounds detected at trace concentrations in fish tissue include fluoranthene, fluorene, phenanthrene, pyrene, and Aroclors 1254 and 1260. PAHs are commonly present in urban watersheds, and low levels of PCBs are widespread throughout New York State waters. Low levels of arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc were detected in fish tissues.

Sediments in Oneida Creek exhibited higher concentrations of PAHs upstream of the Site, indicating the presence of sources elsewhere in the watershed. When screened against upstream concentrations, only benzene was retained for analysis of ecological effects in sediments. The NYSDEC sediment guidance presents no screening concentration for benzene. A TOC-adjusted screening concentration was derived from USEPA Ecotox Threshold values for freshwater sediment. The benzene concentrations in Oneida Creek sediment are two orders of magnitude lower than this screening criterion. The available data indicate that the site has had no measurable impact on Oneida Creek.

SECTION 2

GOALS AND REQUIREMENTS

2.1 INTRODUCTION

The purpose of this section is to 1) specify federal and state statutes, regulations, and guidelines that are potentially applicable to the development of remediation goals and remedy selection for the Oneida Site, 2) develop and present preliminary remediation goals to be used in the development of remedial action objectives for the Oneida Site, and 3) identify remedial action objectives for the purpose of evaluating the effectiveness of remedial alternatives for the Oneida Site.

Federal and state goals and requirements, including chemical-, action-, and location-specific standards, criteria, and guidelines that may be applicable or relevant at the Oneida site are discussed in Section 2.2. Preliminary remediation goals (PRGs), consisting of chemical-specific long-term cleanup goals for specific media, are presented in Section 2.3. Remedial action objectives (RAOs), consisting of media-specific goals for protecting human health and the environment and for meeting PRGs to the extent practicable and cost effective, are discussed in Section 2.4.

2.1.1 Federal Goals and Requirements

In accordance with Section 300.430(e)(2)(i) of the National Contingency Plan (NCP), remediation goals should be established based on exposure levels that are protective of human health and the environment and should be developed by considering Applicable or Relevant and Appropriate Requirements (ARARs) under federal environmental or state environmental laws. USEPA guidance for Superfund Sites specifies that remedial actions should be evaluated, in large part, based on compliance with ARARs, such as maximum contaminant levels for groundwater and surface water, and protecting human health and the environment using appropriate risk analysis.

Section 121 of CERCLA (42 U.S.C. Section 9621) establishes requirements for the selection of remedial actions at Superfund Sites. Section 121 establishes the fundamental requirement that actions be selected and carried out consistent, to the extent practicable, with the NCP in a manner that provides for a "cost-effective response." Section 121(d) generally requires that remedial actions attain a degree of cleanup and control of future releases that ensure protection of human health and the environment. Section 121(d)(2) further provides that selected remedial actions, or the completion of actions, must attain a level or standard of control that attains "legally applicable or relevant and appropriate standards". At a minimum, such actions are to attain a level of protection or standard of control which is equivalent to ARARs promulgated under federal and state laws.

2.2 NEW YORK STATE SCGs

New York State Standards, Criteria and Guidelines (SCGs) are standards or requirements that implement the New York State Environmental Conservation Law. Since New York State does not have ARARs in its statute, SCGs are used to avoid misinterpretation of New York State requirements. Remedial actions conducted in New York State are required to attain SCGs to the extent practicable as presented in the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #HWR-90-4030 (NYSDEC, 1990). SCGs are based on USEPA's ARARs and include Federal standards which are more stringent than the New York State standards. NYSDEC requires that SCGs be taken into account when determining the remediation goals for a Site.

In addition to SCGs, there are "to be considered" items, or TBCs. TBCs include guidance documents, advisory criteria, and guidelines issued by federal or state agencies that are not promulgated or binding under federal or state law and do not have the status of SCGs. However, such guidance may be considered appropriate for protection of human health and the environment and are evaluated along with SCGs in determining the appropriate remedy for a Site.

NYSDEC has identified the following three types of SCGs:

- Chemical-specific SCGs (e.g., action levels applicable to a given substance);
- Action-specific SCGs (e.g., design and performance standards for particular facilities or units); and
- Location-specific SCGs (e.g., siting restrictions due to wetlands, historical Sites, and other location-related resources).

The three types of SCGs listed above, along with any appropriate TBCs, are discussed in Sections 2.2.1, 2.2.2, and 2.2.3, respectively, as they pertain to the Oneida Site.

2.2.1 Chemical-Specific SCGs

Chemical-specific SCGs are health-based or risk-based concentration limits, goals, or ranges in various environmental media for specific hazardous substances. Chemical-specific SCGs include remediation goals for chemicals of concern in designated media (such as soil or sediment), which can be used in the development of remedial action objectives for site media.

The primary residuals detected at the Site are MGP-related constituents (i.e., BTEX, PAHs, cyanide and certain metals). The classes of chemicals associated with these constituents that have the greatest potential impact at the Site are PAHs, BTEX, cyanide, and metals. Chemical-specific SCGs were also developed for certain chemicals that are not considered MGP-related.

Statutes, regulations, and guidelines to be used in the identification of chemical-specific SCGs are listed in Table 2.1. Chemical-specific SCGs that may be applicable to a former MGP Site, such as the Oneida (Sconondoa Street) Site, are listed in Tables 2.2 through 2.5. These SCGs are numerical criteria or standards for protecting human health and the environment from potentially adverse impacts posed by former MGP Sites.

Chemical-specific TBCs, such as soil action levels established for two MGP Sites in Iowa and one MGP site in New York State, are also listed in Table 2.1.

2.2.1.1 Soil

NYSDEC has developed soil cleanup objectives and levels to protect human health and the environment from potentially significant impacts. NYSDEC considered a variety of factors, including soil contact and ingestion, residential land use, a one-in-one-million cancer risk, impacts of soil leaching on groundwater and drinking water quality, background soil concentrations, detection limits, and related factors. These soil cleanup objectives and levels are listed in TAGM #HWR-94-4046 for over 125 different organic and inorganic compounds based on a soil organic carbon content of one percent (NYSDEC, 1994). The values in Table 2.2 are based on the TAGM #HWR-94-4046 methodology and the risk assessment for the Site.

Five background surface soil samples were collected at the Site and were used in the development of soil cleanup SCGs as shown in Table 2.2. Three samples were collected to the east of the NMPC facility: (1) on residential property across the Eastern Ditch, (2) near the Oneida Department of Public Works/Highway Department building, and (3) on public park property southwest of Oneida Creek. Two samples were collected to the north of the facility: (1) on a field near the northern end of the gravel road, extending from Sconondoa Street to Harden Street, and (2) along the abandoned railroad bed, which is currently used as a bicycle and hiking trail by local residents. The background sample concentrations were compared to the results of the subsurface and surface soil samples. Most organic compounds were not detected, but total PAHs ranged from 4 to 253 mg/kg in these background samples.

Background upper tolerance limits (BUTLs) were calculated for each detected constituent in soil based on the background sampling locations. These BUTLs define, in a statistical manner, soil background levels at the Site.

The formula for calculating a BUTL is as follows:

$$\text{BUTL} = \overline{X} + k(a)$$

where $\overline{X}$ = statistical mean value for a background chemical
k = tolerance factor
a = standard deviation

The tolerance factors are provided in a USEPA guidance document (USEPA, 1989b).

TABLE 2.1
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF CHEMICAL-SPECIFIC SCGs
Oneida Site

REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
FEDERAL				
Resource Conservation and Recovery Act (RCRA)	42 U.S.C. Section 6901 et. seq.			
Identification and Listing of Hazardous Wastes	40 CFR Part 261	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 40 CFR Parts 260-266.	SCG	Neither coal nor petroleum-based residuals are listed hazardous wastes. For Oneida residuals determined to be characteristically hazardous based on the TCLP, the requirements are applicable. The TCLP limit for benzene is 0.5 mg/l. These regulations do not set cleanup standards, but would need to be considered when establishing remedial action objectives.
Clean Water Act (CWA)	33 U.S.C. Section 1251-1376			
Ambient Water Quality Criteria Guidelines	40 CFR Part 131	Establishes toxicity-based surface water quality criteria for protection of aquatic organisms and human health.	SCG	Ambient water quality criteria would be potentially applicable in establishing remedial action objectives for surface water.
Safe Drinking Water Act (SDWA)	40 U.S.C. Section 300			
National Primary Drinking Water Standards	40 CFR Part 141	Establishes maximum contaminant levels or MCLs, which are health-based standards for public water supply systems with at least 15 service connections or that serve a minimum of 25 persons.	Not Applicable	These standards are not applicable as no action under consideration would affect a public water supply system nor do plans exist for future use of groundwater as a public water supply source.
Maximum Contaminant Level Goals (MCLGs)	40 CFR 141.50-141.51	Non-enforceable health goals for public water systems.	Not Applicable	
Clean Air Act (CAA)	40 U.S.C. Section 7401-7642			
National Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Establishes ambient air quality standards for pollutants for the protection of public health.	SCG	These standards are to be considered in establishing remedial action objectives for air.

TABLE 2.1
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF CHEMICAL-SPECIFIC SCGs
Oneida Site

REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)				
Record of Decision, Fairfield Coal Gasification Site, Fairfield, IA	U.S. EPA Region VII, Sept. 1990	Establishes action levels for contaminated soils at 500 mg/kg total PAHs and 100 mg/kg carcinogenic PAHs.	TBC	RODs for MGP sites with similar histories, constituents of concern, and receptors/pathways are considered in establishing action levels for media of concern at the Oneida site.
Record of Decision, Peoples Natural Gas Coal Gasification Site, Dubuque, IA	U.S. EPA Region VII, Sept. 1991	Establishes action levels for contaminated soil at 500 mg/kg total PAHs and 100 mg/kg carcinogenic PAHs for soils to 6 foot depth; 2,900 mg/kg total PAHs and 200 mg/kg carcinogenic PAHs for soils below 6 foot depth.	TBC	RODs for MGP sites with similar histories, constituents of concern, and receptors/pathways are considered in establishing action levels for media of concern at the Oneida site.
STATE				
New York State Environmental Conservation Law				
Inactive Hazardous Waste Disposal Sites	Article 27, Title 13	Establishes general cleanup goals for environmental media to levels that will eliminate a significant threat to the environment. This allows NYSDEC to designate inactive hazardous waste disposal sites.	SCG	Sites are listed based on evidence of a significant threat posed by hazardous waste disposed of at the site. A significant adverse impact on the environment and/or a significantly increased risk to human health would constitute a significant threat. The Oneida site is not listed on the registry of Inactive Hazardous Waste Disposal Sites.
NYSDEC Division of Hazardous Substances Regulation				
Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 372-376.	SCG	Neither coal nor petroleum-based residuals are listed hazardous wastes. For Oneida residuals determined to be characteristically hazardous based on the TCLP, the requirements are applicable. The TCLP limit for benzene is 0.5 mg/L. These regulations do not set cleanup standards, but would need to be considered when establishing remedial action objectives.

TABLE 2.1
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF CHEMICAL-SPECIFIC SCGs
Oneida Site

REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
NYSDEC Soil Cleanup Objectives	Division of Hazardous Waste Remediation, TAGM HW94-4046, 1994.	Establishes soil cleanup objectives based on residential land use and protecting groundwater quality.	SCG	See Table 2.2.
NYSDEC Technical Guidance for Screening Contaminated Sediment	Division of Fish and Wildlife Divison of Marine Resources November, 1993	Describes the methodology for establishing sediment criteria for the purpose of identifying contaminated sediment potentially causing harmful impacts to marine and aquatic ecosystems.	SCG/TBC	See Table 2.3 a and b.
Public Health Law, Drinking Water Supplies	10 NYCRR Part 5	Establishes maximum contaminant levels or MCLs which are health-based standards for public water systems.	Not Applicable	These standards are not applicable as no action under consideration involves construction of a public water supply system or future use of groundwater as a public water supply source.
New York State Water Classificati and Quality Standards				
Surface Water Classifications and Standards for Class C Waters	6 NYCRR Parts 701, 702, 704	Defines surface water classifications and ambient water quality standards that are the basis for estalishing effluent limitations under the SPDES program.	SCG	The Oneida Creek is classified as a Class C water body.
Groundwater Quality Standards	6 NYCRR Part 703.5	Establishes quality standards for groundwater and incorporates federal and state MCLs.	SCG	These criteria are potentially applicable in establishing remedial action objectives for groundwater.
NYSDEC Ambient Water Quality Standards and Guidance Values	Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1	Provides a compilation of ambient water quality standards and guidance values for toxic and non-conventional pollutants for use in NYSDEC programs, including the SPDES permit program.	SCG	These standards and guidance values are applicable in establishing remedial action objectives for surface water and groundwater. NYSDEC standards and guidance values for Class C surface water and Class GA groundwater are listed in Table 2.4.

TABLE 2.1
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF CHEMICAL-SPECIFIC SCGs
Oneida Site

REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
New York State Ambient Air Quality Guidelines	6 NYCRR Part 257 Air Guide-1	Establishes state ambient air quality standards and guidelines for evaluating air quality impacts.	SCG	See Table 2.5.
NYSDEC Division of Environmental Remediation Record of Decision, Owego Co Gasification Plant Site, Owego, NY	NYS ID# 754008	Establishes remedial action cleanup goal of 12 ppm or less of total carcinogenic PAHs and 500 ppm total PAHs for site surficial soils. Deeper soils remediated to protect groundwater.	TBC	RODs for MGP sites with similar histories, constituents of concern, and receptors/pathways are considered in establishing action levels for media of concern at the Oneida site.
NYSDEC Division of Environmenta Remediation Risk-Based Corrective Action	Procedures for Inactivation of Petroleum-Impacted Sites	Specifies methods to develop site cleanup criteria for many of the chemicals associated with the primary site constituents, such as PAHs and BTEX.	TBC	A draft document is expected to be released by NYSDEC in late 1997.

TABLE 2.2
POTENTIAL PRGS FOR ONSITE SOIL (MG/KG) (1)

	Risk-based PRG			Background Upper
MGP-Related Residual[2]	Human Health[3]	Ecological	SCG-based PRG[4]	Tolerance Limit[5]
Volatiles				
Benzene	8.7	-	0.28	-
Ethylbenzene	3,600	-	25	-
Toluene	5,200	-	6.9	-
Xylenes	75,000	-	5.5	-
Semivolatiles				
Benzo(a)anthracene	7.2	-	0.224	19
Benzo(a)pyrene	0.72	-	0.061	18
Benzo(b)fluoranthene	7.2	-	5.1	18
Benzo(k)fluoranthene	72	-	5.1	16
Chrysene	724	-	1.8	23
Dibenzo(a,h)anthracene	0.73	-	0.014	-
Fluoranthene	15,000	-	50	55
Fluorene	13,000	-	50	5.7
Indeno(1,2,3-c,d)pyrene	7.3	-	15	4.3
2-Methylnaphthalene	6,900	-	50	0.39
Naphthalene	6,900	-	50	0.33
Pyrene	11,000	-	50	28
Pesticides/PCBs				
none				
Inorganics				
Arsenic	3.2	-	7.5 **	15
Copper*	16,000	-	25 **	90
Mercury	110	-	0.1	0.15
Zinc	120,000	-	20 **	93

(1) PRG = preliminary remediation goal. A dash (" - ") indicates that the item is not applicable or that no value is available.

(2) An asterisk ("*") indicates that the chemical is not MGP-related.

(3) The risk-based PRGs are based on a hazard quotient = 0.2 or a 10-6 cancer risk, whichever produces the lower PRG. Values are based on commercial-industrial land use.

(4) SCG = standard, criterion, or guideline. The values listed are recommended soil cleanup objectives from TAGM HWR-94-4046 based on the lower of the values associated with residential exposure or protection of groundwater adjusted using the measured organic carbon concentration of 4.6% (NYSDEC, 1994). The SCG for total semivolatile organic compounds is < 500 ppm. An asterisk ("**") indicates that PRG presented is the value presented or site background.

(5) Background upper tolerance limits (BUTLs) for surface soil (see Appendix L of the RI Report).

TABLE 2.3a
POTENTIAL PRGS FOR ONEIDA CREEK SEDIMENT (MG/KG) (1)

MGP-Related Residual	Other Risk-based Value	SCG-based PRG(2)						Background Upper Tolerance Limit(3)
		Human Health Bioaccumulation	Benthic Aquatic Life Acute Toxicity	Benthic Aquatic Life Chronic Toxicity	Wildlife Bioaccumulation	Lowest Effect Level	Severe Effect Level	
Volatiles								
none								-
Semivolatiles								
Benzo(a)anthracene	-	0.13	-	-	-	-	-	1.5
Benzo(a)pyrene	-	0.13	-	-	-	-	-	1.5
Benzo(b)fluoranthene	-	0.13	-	-	-	-	-	1.2
Chrysene	-	0.13	-	-	-	-	-	1.7
Pesticides/PCBs								
none								
Inorganics								
none								

(1) PRG = preliminary remediation goal. A dash ("-") indicates that the item is not applicable or that no value is available.

(2) Based on sediment criteria from NYSDEC (1993) using a total organic carbon (TOC) concentration = 10.1%

(3) Background upper tolerance limits (BUTLs) for sediment in Oneida Creek (see Appendix L of RI report).

TABLE 2.3b
POTENTIAL PRGS OTHER SEDIMENT (MG/KG) (1)

MGP-Related Residual(2)	Risk-based PRG		SCG-based PRG(4)	Background Upper Tolerance Limit(5)
	Human Health(3)	Ecological		
Volatiles				
Benzene	6.5	-	24	0.018
	-			
Semivolatiles				
Acenaphthene	860	-	50	5.4
Benzo(a)anthracene	1.2	-	0.224	8.2
Benzo(a)pyrene	0.12	-	0.061	8.3
Benzo(b)fluoranthene	1.2	-	5.1	6.1
Carbazole*	44	-	-	0.78
Chrysene	120	-	1.8	12
Dibenzo(a,h)anthracene	0.12	-	0.014	0.52
Fluoranthene	610	-	50	18
Fluorene	590	-	50	3.8
Indeno(1,2,3-c,d)pyrene	1.2	-	15	5.7
2-Methylnaphthalene	500	-	50	0.93
Naphthalene	500	-	50	1.3
Pyrene	450	-	50	20
Pesticides/PCBs				
Endrin aldehyde*	0.12	-	20	0.10
Inorganics				
Antimony*	6.2	-	SB	10
Arsenic	0.52	-	7.5 **	8.8

(1) PRG = preliminary remediation goal. A dash (" - ") indicates that the item is not applicable or that no value is available. These PRGs are for sediments outside Oneida Creek: Tailrace, Eastern Ditch, and drainage swale.
(2) An asterisk ("*") indicates that the chemical is not MGP-related.
(3) The risk-based PRGs are based on a hazard quotient = 0.2 or a 10-6 cancer risk, whichever produces the lower PRG. Values are based on commercial-industrial land use.
(4) SCG = standard, criterion, or guideline. The values listed are recommended soil cleanup objectives from TAGM HWR-94-4046 based on residential exposure or protection of groundwater and on the measured organic carbon concentration of 4.6% (NYSDEC, 1994). The SCG for total semivolatile organic compounds is < 500 ppm. A double asterisk ("**") indicates that the cleanup objective presented is the value presented or site background.
(5) Background upper tolerance limits (BUTLs) for surface soil (see Appendix L of the RI report).

TABLE 2.4
POTENTIAL PRGS FOR GROUNDWATER (MG/L) (1)

MGP-Related Residual(2)	Risk-based PRG	SCG-based PRG(3) NYS Class GA Standard(4)	SCG-based PRG(3) NYS Class GA Guidance Value(4)	Background Upper Tolerance Limit
Volatiles				
Benzene	-	0.0007	-	-
Ethylbenzene	-	0.005	-	-
Toluene	-	0.005	-	-
Xylenes	-	0.005	-	-
Semivolatiles				
Acenaphthene	-	-	0.020	-
Acenaphthylene	-	-	0.020 (a)	-
Benzo(a)anthracene	-	-	2.0E-06	-
Benzo(a)pyrene	-	2.0E-06	-	-
Benzo(b)fluoranthene	-	-	2.0E-06	-
Benzo(k)fluoranthene	-	-	2.0E-06	-
Fluorene	-	-	0.050	-
Indeno(1,2,3-cd)pyrene	-	-	2.0E-06	-
2-Methylnaphthalene	-	-	0.010 (b)	-
Naphthalene	-	-	0.010	-
Phenanthrene	-	-	0.050	-
Pyrene	-	-	0.050	-
Pesticides/PCBs				
Heptachlor*	-	1.0E-06	-	-
Inorganics				
Aluminum*	-	-	0.2 (c)	-
Arsenic	-	0.025	-	-
Copper*	-	0.20	-	-
Iron*	-	0.25	-	-
Lead	-	0.025	-	-
Manganese*	-	0.25	-	-

(1) PRG = preliminary remediation goal. A dash (" - ") indicates that the item is not applicable or that no value is available.

(2) An asterisk ("*") indicates that the chemical is not MGP-related.

(3) SCG = standard, criterion, or guideline.

(4) From NYSDEC, 1993. (a) Value for acenaphthene. (b) Value for naphthalene. (c) Secondary maximum contaminant level (USEPA, 1996)

TABLE 2.5
POTENTIAL PRGS FOR AIR (UG/M^3)

MGP-Related Residual	NYS Air Guidelines(1)	
	AGC(2)	SGC(3)
Volatiles		
Benzene	0.12	30
Ethylbenzene	1,000	100,000
Toluene	2,000	89,000
Xylenes	300	100,000
Semivolatiles		
Benzo(a)anthracene	-	-
Benzo(a)pyrene	0.002	-
Benzo(b)fluoranthene	-	-
Benzo(k)fluoranthene	-	-
Chrysene	-	-
Dibenzo(a,h)anthracene	-	-
Fluoranthene	-	-
Fluorene	-	-
Indeno(1,2,3-c,d)pyrene	-	-
2-Methylnaphthalene	-	-
Naphthalene	120	12,000
Pyrene	-	-
Inorganics		
Arsenic	0.00023	0.2
Lead	1.5	-
Mercury	0.3	12
Zinc	50	150
Cyanide	12	150

(1) Acceptable ambient level guidelines from New York State Air Guide 1. A dash ("- ") indicates that no value is available (NYSDEC Division of Air Resources, 1991).
(2) Annual Guidance Concentration
(3) Short-term ($\leq$ 1hour) Guideline Concentration

The NYSDEC-recommended soil cleanup objective listed in the 1994 guidance for organic parameters corresponds to whichever is lower: the human health-based level (based on residential land use) or the groundwater-protective level. To develop soil cleanup objectives for organics for protecting groundwater quality, the NYSDEC used a procedure based on organic constituent partitioning between the soil and water as a function of organic carbon content (e.g., equilibrium partitioning theory). For metals and other inorganics, the NYSDEC soil cleanup objectives are based on eastern United States or Site-specific background levels. Correction factors are also applied to account for dilution and other forms of attenuation as constituents migrate into the subsurface (NYSDEC, 1994b).

The NYSDEC soil cleanup objectives for organic parameters listed in Table 2.2, based on residential exposure or groundwater protection, were adjusted based on an average background total organic carbon (TOC) content of 4.6 percent measured in the background soil samples collected in the site vicinity, as shown in the following equation:

$$Cs = (f) \times (Koc) \times (Cw)$$

where Cs = allowable soil or sediment concentration

f_{oc} = fraction of organic carbon in the soil or sediment

Koc = partition coefficient between water and soil media (from technical literature)

Cw = appropriate water quality SCG

Risk-based values for commercial/industrial land use are also presented in Table 2.2. Appendix O of the RI report provides the procedure by which the commercial/industrial soil concentration guidelines were developed based on USEPA methodology for evaluating risks from commercial/industrial exposures. Soil concentration guidelines listed in Table 2.2 are presented for each of the residuals: volatile organics, PAHs, and metals. Cyanide and lead, two MGP related residuals, were not included based on the results of the risk assessment for this Site (see Appendix L of the RI Report).

2.2.1.2 Sediment

Sediment screening criteria have been established by the NYSDEC Division of Fish and Wildlife specifically for preliminary assessments of the risk to aquatic ecosystems and to human and wildlife consumers of aquatic life (NYSDEC, 1993b). These criteria for constituents in Oneida Creek and the Tailrace or other sediment are considered SCGs or TBCs and are listed in Tables 2.3a and 2.3b, respectively.

The NYSDEC sediment screening criteria for organics are derived using the equilibrium partitioning approach, which relates sediment concentrations to surface water concentrations. This approach estimates a compound's biological impacts based on its affinity for organic carbon in the sediment. The concentration of a biologically available compound in water is predicted and related to potential toxicity and bioaccumulation by comparing water concentrations estimated from sediment concentrations and equilibrium partitioning theory to existing criteria established for surface water quality. The organic carbon normalized sediment criterion and the Site-specific sediment criterion for a particular compound are derived based on the following equations:

$$C_{SOC} = K_{OW} \times C_W$$

$$C_S = f_{oc} \times C_{SOC}$$

where C_{SOC} = organic carbon normalized sediment criterion

K_{OW} = partition coefficient between water and sediment media (from technical literature)

C_W = appropriate New York State ambient water quality SCG

C_S = Site-specific sediment criterion

f_{oc} = fraction of organic carbon in sediment

The sediment screening criteria for organic compounds listed in Table 2.3a are calculated based on a TOC content of 10.1 percent, the mean TOC concentration found in Oneida Creek (Parsons ES, 1997). The criteria listed in Table 2.3b are calculated based on a TOC content of 4.6 percent, as found in surface soils. The Tailrace, Eastern Ditch, and drainage swale sediments were considered to be similar to surface soils in that the exposure mechanisms are the same because the sediments historically have little or no water covering them for much of the year (Parsons ES, 1997).

The NYSDEC sediment screening criteria for metals are based on levels observed to affect aquatic life and wildlife as reported in the scientific literature (Long and Morgan, 1995; Persaud *et al.*, 1992). Two levels of risk, lowest and severe, have been established by the NYSDEC for metals in sediment. The scientific basis for these screening criteria, in particular, is weakened by the complex natural interactions of metals among different types of sediment, different aquatic species, and variables such as dissolved oxygen and pH in an aquatic system.

BUTLs were also calculated for each detected constituent in sediment based on data from two Tailrace samples (both upstream), two Eastern Ditch samples (one upstream, one downstream), and five Oneida Creek samples (one upstream and four downstream of confluence of the Tailrace and Oneida Creek). Constituents having maximum concentrations above their respective background concentrations are assumed to be present due to Site-related impacts. Constituents having maximum concentrations at or below their respective background concentrations are assumed not to be Site-related. BUTLs for each detected constituent in sediment are presented in Tables 2.3a and 2.3b.

The NYSDEC sediment screening criteria are guidelines that do not necessarily represent the final concentrations that must be achieved through sediment remediation. Both sediment testing and risk management need to be considered to determine when remediation is appropriate and what final concentrations should be achieved.

2.2.1.3 Groundwater and Surface Water

NYSDEC has also developed standards and guidance values to protect groundwater and surface water (NYSDEC, 1993a). These values were developed by the State, as appropriate, based on levels of protection for drinking water sources, fish propagation and survival, and human and wildlife consumption of fish. NYSDEC Division of Water's ambient water quality standards and guidance values for chemicals detected at the Oneida site in Class GA groundwater (i.e., for any groundwater) are listed in Table 2.4. BUTLs for groundwater are not listed, because background samples are not available. In addition, cyanide and zinc are not included for groundwater based on the site risk assessment results. Surface water SCGs are not considered applicable or relevant and appropriate for the site for reasons cited in the RI. The baseline HHRA and the fish tissue assessment determined that there were no Site-related constituents present in surface water at concentrations posing a significant risk to human health or the environment.

The maximum contaminant levels (MCLs) for drinking water established under the Federal Safe Drinking Water Act and Part 5 of the New York State Public Health Law (10 NYCRR) are not applicable at the Oneida Site. There appears to be no potential for future use of groundwater at Oneida as a public water supply source based on the current water supply infrastructure. Residents of the City of Oneida receive public water from the City of Oneida Water Department (City of Oneida Water Department Superintendent, 1994a). The municipal water supply for the City of Oneida comes from Florence Creek and Glen Moore Reservoir located more than twenty miles to the north of the Site (NYSDOH, 1982; City of Oneida Water Department Superintendent, 1994b). In addition, the New York State Atlas of Community Water System Sources does not list any municipal or non-municipal community water supply intakes in Madison or Oneida County that could be impacted by the Site. The nearest public drinking water supply serves a trailer park located three miles east of the Site on the other side of Oneida Creek (NYSDOH, 1982). Any new water supply source would need to be evaluated to determine its acceptability to the Madison County Health Department. Installation of water supply wells near the Site is highly unlikely.

2.2.1.4 Air

NYSDEC's Division of Air Resources air quality guidelines for MGP-related residuals are listed in Table 2.5. These guidelines are TBCs that are based on protecting public health from impacts due to inhalation. Short-term Guideline Concentrations (SGCs) pertain to exposures of a few hours or less, whereas Annual Guideline Concentrations

(AGCs) apply to long-term exposure. SGCs may need to be considered in assessing impacts due to excavation or material transport during site remediation, and AGCs for dust and VOCs, such as benzene, may need to be considered, depending upon the type of remediation being evaluated.

2.2.2 Action-Specific SCGs

Action-specific SCGs are technology- or activity-based requirements or limitations pertaining to waste remediation. These SCGs are prompted by and apply to the implementation of particular remedial activities that are selected for remediating a Site. Statutes, regulations, and guidelines used in the identification of action-specific SCGs for the Oneida site are listed in Table 2.6. Action-specific TBCs are also listed in Table 2.6.

2.2.2.1 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) and counterpart New York State waste management laws and regulations under 6 NYCRR Parts 370 through 375 provide several potentially applicable, action-specific SCGs because these regulations govern the management of hazardous and solid waste in New York State. In general, soil in place is not a waste unless it is excavated and processed by being moved to another Site, treated, or disposed. RCRA guidance is available for determining what constitutes generation of a hazardous or solid waste.

Toxicity Characteristic Leaching Procedure (TCLP) limits are specified in 40 CFR Part 261 and 6 NYCRR Part 371. These regulations also define the corrosivity, reactivity, and ignitability characteristics under RCRA. Federal regulations limit the corrosivity RCRA characteristic to liquids (40 CFR Part 261.22). The reactivity characteristic is defined in qualitative terms (see 40 CFR Part 261.23). However, disposal facilities currently use *de facto* limits of 250 parts per million (ppm) of releasable cyanide (i.e., hydrogen cyanide) and 500 ppm of releasable sulfide (i.e., hydrogen sulfide) based on USEPA SW-846 test methods (USEPA, 1994). The ignitability characteristic is defined for a solid material in 40 CFR Part 261.21 as an oxidizer or a material causing fire and, when ignited under standard temperature and pressure, burning vigorously and persistently so as to create a hazard.

MGP Process Residuals

The manufactured gas industry operated during the period from the early 1800s until the mid-1950s, so any process residuals at historic MGP Sites would have been generated before the enactment of RCRA and, thus, before the November 19, 1980, effective date of USEPA's hazardous waste treatment, storage, and disposal facility regulations. Therefore, *in situ* site materials that are hazardous by characteristic are not subject to RCRA regulation. However, if materials exceeding hazardous waste characteristic parameters are excavated and processed, they are deemed to have been generated and can become subject to the generator requirements of 40 CFR Part 262 and the transport, storage, and disposal requirements under 40 CFR Parts 263 through 265 of RCRA regulations.

TABLE 2.6
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
ONEIDA SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
FEDERAL					
Any Site Remediation Activity	Occupational Health and Safety Act	29 U.S.C. Section 651-678			
	Worker Health and Safety	29 CFR 1910.120	Training, personnel protection, medical monitoring, and other health and safety requirements for employers and employees engaged in hazardous waste site operations.	SCG	These regulations would apply to remedial activities associated with site wastes identified as hazardous and to remedial activities involving construction
		29 CFR 1926	Standards for general construction.		
Management of Hazardous Waste Generated Onsite	Resource Conservation and Recovery Act (RCRA)	42 U.S.C. Section 6901 et. seq.			
	Standards for Hazardous Waste Generators; Manifesting, Pre-transportation, Reporting Requirements	40 CFR Part 262 Subparts B, C, D	Regulations governing packaging, labeling, reporting, and manifesting of hazardous waste.	SCG	These generator requirements are potentially applicable to remedial activities involving the offsite transport of hazardous waste generated onsite.
Institutional Controls	Resource Conservation and Recovery Act (RCRA)	40 U.S.C. Section 6901 et. seq.			
	Land Disposal Facility Notice in Deed	40 CFR 264/265 116-119(b)(1)	Establishes provisions for a deed notation for closed hazardous waste disposal units, to prevent land disturbance by future owners.	SCG	These regulations are potentially applicable because closed areas may be similar to closed RCRA units.
Generation, Management, and Treatment of Hazardous Waste	Resource Conservation and Recovery Act (RCRA) Subtitle C - Hazardous Waste Management	40 U.S.C. Section 6901 et. seq.			
	Identification and Listing of Hazardous Wastes	40 CFR Part 261	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 40 CFR Parts 260-266.	SCG	MGP residuals are not a listed hazardous waste Neither coal nor petroleum-based residuals are listed hazardous wastes. For Oneida residuals determined to be characteristically hazardous based on the TCLP, the requirements are applicable The TCLP limit for benzene is 0.5 mg/L. These regulations do not set clean-up standards, but would apply during various remedial actions.
	Standards for Hazardous Waste Generators	40 CFR Part 262			
	Hazardous Waste Determinations	40 CFR Part 262.11	Generators must characterize their wastes to determine if the waste is hazardous by listing (40 CFR 261, Subpart D), by characteristic (40 CFR 261, Subpart C), or excluded from regulation (40 CFR 261.4).	SCG	These regulations would be applicable to wastes generated during remedial activities at the site. Neither coal nor petroleum-based residuals are listed hazardous wastes, but may be hazardous by characteristic (particularly for benzene toxicity)

TABLE 2.6
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
ONEIDA SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Generation, Management, and Treatment of Hazardous Waste (cont.)	90-Day Accumulation Rule	40 CFR Part 262.34	Allows generators of hazardous waste to store and treat hazardous waste at the generation site for up to 90 days in tanks, containers, and containment buildings without having to obtain a RCRA hazardous waste permit.	SCG	Currently, hazardous MGP soils and residuals can be blended with dry, combustible material in 90-day units to render them non-hazardous. However, this may change if land ban treatment standards, which include the dilution prohibition, are established for MGP residuals. This does not apply to petroleum-based residuals as they are subject to LDRs, including UTSs.
	Standards for Owners/Operators of Hazardous Waste Treatment, Storage, Disposal (TSD) Facilities	40 CFR Part 264/265			
	General Facility Standards	Subpart B	General requirements for owners/operators of TSD facilities including general waste analysis and compatibility; notices and inspection requirements; location and construction standards; and security.	SCG	These subpart standards would be applicable for the construction, operation or closure of a new or currently permitted TSD facility used for management of remediation waste classified as a hazardous waste or for the closure of existing interim-status and new land disposal facilities where hazardous waste will remain in place after completion of closure. These subparts should be considered if existing waste treatment facilities at a site are to be used for the management of hazardous remediation waste.
	Releases from Solid Waste Management Units	Subpart F	Requires the establishment of a detection, compliance, and corrective action monitoring program to ensure protection of the groundwater by assessing the performance of the TSD facility during operations. The groundwater monitoring program is required to be performed during the post- closure period for land disposal facilities where hazardous waste remains in place after closure.	SCG	
	Closure and Post-Closure	Subpart G	Establishes closure and post-closure requirements for TSD facilities, including post-closure property uses.	SCG	
	Tank Systems	Subpart J	Tank systems for the treatment or storage of hazardous wastes are to be designed and operated in a manner to prevent releases to the environment.	SCG	Applicable for the tank treatment and/or storage of all remediation waste that is classified as a hazardous waste.
	Corrective Action for Solid Waste Management Units	Subpart S	The EPA or delegated state authority can designate a Corrective Action Management Unit (CAMU) or a Temporary Unit (TU) to allow more flexible management of remediation wastes within these units. Placement or consolidation of remediation waste within these units does not constitute land disposal or creation of a unit subject to minimum technology requirements.	SCG	NYSDEC is authorized to designate CAMUs.

TABLE 2.6
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
ONEIDA SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Generation, Management, and Treatment of Hazardous Waste (cont.)	Miscellaneous Units	Subpart X	New miscellaneous units must be designed, constructed, and operated to meet regulatory performance standards.	SCG	Standards applicable to the construction and operation of new miscellaneous units used to treat remediation waste that is classified, or is sufficiently similar to a hazardous waste. These regulations apply to thermal desorption units that are not classified as incinerators or industrial furnaces.
Capping of Hazardous Waste	RCRA Subtitle C	40 U.S.C. Section 6901 et. seq.			
	Standards for Capping: Surface Impoundments Waste Piles Landfills	40 CFR Part 264/265 Subpart K Subpart L Subpart N	Regulations governing placement of cap. Requirements for installation, permeability, maintenance of cover; elimination of free liquids or solidification; run-on/run-off damage control; and post-closure use of property.	SCG	RCRA hazardous waste placed at site after the effective date of the requirements, or placement of hazardous waste into another unit will make requirements applicable when the waste is being covered with a cap for the purpose of leaving it behind after the remedy is completed. These requirements are not applicable unless documented placement occurs or has occurred.
Capping of Non-Hazardous Waste	RCRA Subtitle D	42 U.S.C. Section 6901 et. seq.			
	Criteria for Classification of Solid Waste Disposal Facilities	40 CFR Part 257	Minimum criteria for siting, construction, operation, and closure of solid waste disposal facilities. Each State is to develop, permit, and enforce a solid waste management program based on EPA requirements.	SCG	These regulations are applicable to remedial activities which would leave wastes and spill residues in place or to construction of remediation waste management facilities. MGP and petroleum related site residuals must be identified as solid and/or hazardous waste in order to determine applicability of waste management consideration. These requirements are not applicable unless documented placement occurs or has occurred.
Water Treatment Discharges	Clean Water Act	33 U.S.C. Section 1251-1376			
	Wastewater Discharge Permits; Effluent Guidelines, Best Available Technology (BAT) and BMPPT	40 CFR Parts 122, 125, 401	Permit requirements for point source discharges to waters of the United States; establishes effluent standards and requirements for preventing toxic releases.	SCG	Would be applicable for remedial actions involving a direct wastewater discharge to surface waters.
	Discharge to publicly-owned treatment works (POTW)	40 CFR Part 403.5	Discharge must comply with local POTW pretreatment program.	SCG	Requirements would be applicable to remedial actions involving a discharge to a POTW.
	Underground Injection Control Program	40 CFR Parts 144-147	Provisions for protection of groundwater drinking water resources.	SCG	Would be applicable for remedial actions involving reinjection of treated water.

TABLE 2.6
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
ONEIDA SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Air Emissions from a Point Source	Clean Air Act (CAA)	40 U.S.C. Section 7401-7642			
	National Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Establishes ambient air quality standards for protection of public health.	SCG	NAAQS may be applicable in evaluating whether there are air impacts at the site during remedial activities.
	New Source Review (NSR) and Prevention of Significant Deterioration (PDS) Requirements	40 CFR Part 52	New sources or modifications which emit greater than the defined threshold for listed pollutants must perform ambient impact analysis and install controls which meet best available control technology (BACT).	SCG	These regulations are potentially applicable and would require a comparison of potential emissions from the remedial activity to the emission thresholds for NSR.
	National Emission Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR Part 61 40 CFR Part 63	Source-specific regulations which establish emissions standards for hazardous air pollutants (HAPs).	SCG	NESHAPs could be relevant and appropriate if HAP emissions from remedial activities exceed the thresholds for compliance.
	New Source Performance Standards (NSPS)	40 CFR Part 6	Source-specific regulations with establish testing, control, monitoring and reporting requirements for new emission sources.	SCG	NSPS could be relevant and appropriate if stream-generating equipment, thermal desorption units, or other regulated new sources were to be used onsite.
	Air Emission Standards for Process Vents	40 CFR 264/265	This regulation applies to process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air/stream stripping operations that manage hazardous waste with an organic concentration of at least 10 parts per million by weight (ppmw). Performance standards for closed-vent systems and control devices are specified in this regulation to demonstrate compliance with the above standards.	SCG	This regulation would be applicable to the onsite treatment of remediation waste designated as hazardous waste having an organic concentration of at least 10 ppmw.
Land Disposal of Hazardous Waste	RCRA Subtitle C	40 U.S.C. Section 6901 et. seq.			
	Land Disposal Restrictions (LDRs)	40 CFR Part 268	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes Universal Treatment Standards (UTSs) to which hazardous wastes must be treated to prior to land disposal.	TBC	Petroleum-based residuals are subject to LDRs, including UTSs. MGP residuals are currently classified as "newly regulated", however, under the proposed Phase IV LDR rule, MGP residuals would be subject to the EPA LDRs that govern mineral processing wastes. MGP residuals exhibiting a hazardous characteristic would need to be treated to meet UTS for all hazardous constituents present in the residuals. As of May 1997, the interim deadline for finalization of the proposed rule is April 15, 1998.
	Phase IV Supplemental Proposal on Land Disposal of Mineral Processing Wastes	62 FR 25997	Proposed supplemental Phase IV LDR rule (i) requires the waste or residual meet certain UTSs, (ii) prohibits storage except to facilitate treatment or disposal, (iii) prohibits the use of dilution to meet UTSs, and (iv) applies LDR paperwork requirements to the waste.		

TABLE 2.6
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
ONEIDA SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Generation, Management, and Treatment of Hazardous Waste	Requirements for Management of Hazardous Contaminated Media (Hazardous Waste Identification Rule (HWIR) - Media)	61 FR 18879 40 CFR Part 260, et al.	Proposed rule which addresses contaminated media that are currently subject to regulation as hazardous wastes under RCRA. Allows more flexible management standards for media and wastes generated during site cleanups. Modifies LDR treatment requirements and gives USEPA and authorized states authority to remove certain wastes from regulation as hazardous waste under Subtitle C.	TBC	The USEPA has published two alternative HWIR rules: the "Harmonized Approach" which establishes bright line constituent-specific concentrations to divide high-risk and low-risk waste, and the "Unitary Approach" which would exempt all remediation waste from Subtitle C regulation provided the waste is managed in accordance with a remedial action plan. Regulatory relief for management of any hazardous residuals generated at the Oneida site would depend upon which approach is adopted.
Characteristic Hazardous Waste Treatment in Utility Boilers	MGP Site Remediation Strategy	MGP Site Remediation Strategy MGP Subcommittee, Edison Electric Institute (EEI, 1993)	Strategy document intended to facilitate responsible parties undertaking the source removal of heavily contaminated organic residues and contaminated soils at MGP sites in a manner that is consistent with the RCRA hazardous waste program. The remediation strategy is based on the fact that contaminated soils can be burned in coal-fired utility boilers and covers relevant onsite activities including excavation, accumulation and treatment in 90-day units, and offsite transportation.	TBC	The remediation strategy applies only to the management of excavated solid materials that are hazardous by characteristic. The strategy does not supersede existing regulations; it is not intended to be the presumptive remedy under CERCLA; nor can it serve as a shield against enforcement under RCRA or any other statute. The strategy should be implemented taking into account site-specific circumstances. It would not necessarily be appropriate or practical at all sites.
Treatment of Groundwater	Technical Impracticability (TI) Waiver for Groundwater Restoration	Guidance for Evaluating the Technical Impracticability of Groundwater Restoration (USEPA, 1993a)	Provides guidance on addressing sites where restoration of groundwater to background conditions is not feasible or practicable. Sources of groundwater impacts should be removed where practicable and where significant reduction of current and future risk can be realized. Guidance also addresses DNAPL and impracticability of its removal.	TBC	This guidance was prepared primarily for Superfund site cleanups, but can be considered for the Oneida site as needed. There have been at least 23 TI waivers issued by the USEPA at Superfund sites across the U.S.
All	USEPA Presumptive Strategy for MGP sites	---	Presumptive strategy initiative for MGP sites currently being developed by USEPA in collaboration with EEI, AGA, and industry. The strategy is to include a "remedy selection process" for decision making of management options effective at MGP sites. Also included will be case studies and technology description summary sheets for a number of industry-advocated technologies.	TBC	The MGP site presumptive strategy guidance document is currently under development. NOTE: This guidance will become an SCG once issued in final form.
STATE					
Generation, Management, and Treatment of Hazardous Waste	NYSDEC Division of Regulatory Affairs Siting of Industrial Hazardous Waste Facilities	6 NYCRR Part 361	Establishes procedures for selecting appropriate sites for hazardous waste facilities.	SCG	These regulations are potentially applicable for remedial activities which would involve the construction of remediation hazardous waste management facilities

TABLE 2.6
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
ONEIDA SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Generation, Management, and Treatment of Hazardous Waste (cont.)	NYSDEC Division of Hazardous Substances Regulation Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 372-376.	SCG	MGP residuals are not a listed hazardous waste. Neither coal nor petroleum-based residuals are listed hazardous wastes. For Oneida residuals determined to be characteristically hazardous based on the TCLP, the requirements are applicable. The TCLP limit for benzene is 0.5 mg/L. These regulations do not set clean-up standards, but would apply during various remedial actions.
	New York State Hazardous Waste Management Facility Regulations	6 NYCRR Part 370,373,372	Establishes New York State's EPA-equivalent hazardous waste management program. Includes regulations for hazardous waste facility construction, operation, and closure; and standards for hazardous waste generation, manifesting, and transport.	SCG	[See RCRA Hazardous Waste Management Regulations, 40 CFR Parts 262 and 264/265 under Federal SCGs listed in this table.]
	Corrective Action for Solid Waste Management Units	6 NYCRR Part 373-2.19	The NYSDEC Commissioner can designate a Corrective Action Management Unit (CAMU) or a Temporary Unit (TU) to allow more flexible management of remediation wastes within these units. Placement or consolidation of remediation waste within these units does not constitute land disposal or creation of a unit subject to minimum technology requirements.	SCG	NYSDEC is authorized to designate CAMUs for the purpose of implementing remedial actions under 6 NYCRR Part 373-2.6(1) or RCRA.
Capping of Non-Hazardous Waste	New York State Solid Waste Management Facility Regulations	6 NYCRR Part 360, 364 6 NYCRR Part 360-2,15	Establishes New York State's EPA equivalent solid waste management program. Includes regulations governing construction, operation, and closure of solid waste disposal facilities. Established landfill closure and post-closure requirements.	SCG	These regulations are applicable to remedial activities which would leave wastes and spill residues in place or to construction of remediation waste management facilities. Coal and petroleum-based site residuals must be identified as solid and/or hazardous waste in order to determine applicability of waste management consideration. These requirements are not applicable unless documented placement occurs or has occurred.
Land Disposal of a Hazardous Waste	Land Disposal Restrictions (LDRs)	6 NYCRR Part 376	Restricts land disposal of hazardous wastes that exceed specific criteria.	SCG	The NY State LDR program mirrors the Federal LDR program prior to its adoption of UTSs in September 1994. Therefore, NY State LDRs do not include UTSs or a treatment standard for benzene that fails TCLP. NY plans to adopt federal UTSs in the future.
Water Treatment Discharge	New York State Regulations on the State Pollution Discharge Elimination System (SPDES)	6 NYCRR Parts 750-758	Defines permitting requirements for water treatment discharges including discharges made to a POTW.	SCG	The regulations would be applicable for alternatives that include a discharge to surface water or a POTW.

TABLE 2.6
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF ACTION-SPECIFIC SCGs
ONEIDA SITE

ACTION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Water Treatment Discharge (cont.)	Groundwater Effluent Standards	6 NYCRR Part 703.6	Establishes effluent standards and/or limitations for discharges to Class GA groundwater.	SCG	These regulations would be applicable for alternatives that include discharges to groundwater.
	Groundwater Effluent Limitations	Technical and Operational Guidance Series (TOGS) 1.1.2	This provides a substance-by-substance list of effluent limitations for substances having an ambient water quality standard or guidance value. It restates the effluent standards in 6 NYCRR Part 703.6 and provides effluent limitations for the substances that have an ambient standard but do not have an effluent standard in Part 703.	SCG	These regulations would be applicable for alternatives that include discharges to groundwater.
	NYSDEC Division of Water: Guidance on Groundwater Contamination Strategy	Technical and Operational Guidance Series (TOGS) 2.1.1	Establishes strategies for source control and remediation of groundwater contamination.	SCG	These strategies are potential guidelines when evaluating groundwater remediation options.
	NYSDEC Division of Water: Guidance on Permits/Standards for Underground Injection Recirculation (UIR)	Technical and Operational Guidance Series (TOGS) 2.1.2	Provides guidance on applicability of SPDES permits and groundwater effluent standards when using UIR for groundwater remediation.	SCG	This guidance is to be used when injection or recirculation of groundwater is considered as a remedial action.
Air Emissions from a Point Source	New York State Air Pollution Control Regulations	6 NYCRR Parts 120, 200-203, 207, 211, 212, 219 Air Guide-1	Establishes emissions standards for new sources of air pollutants, incinerators, and specific contaminants.	SCG	Requirements would be applicable to alternatives that result in air emissions of regulated substances or equipment.
	New York State Ambient Air Quality Standards	6 NYCRR Part 257	Establishes state ambient air quality standards and guidelines for protection of public health.	SCG	May be applicable in evaluating air impacts during remedial activities. Establishes short-term action limits for occupational exposure.
All	Proposed Standard Remedy Framework for the Remediation of Former MGP Sites in New York State	Draft Document Issued by MGP Workgroup of the Power Pool (MGP Workgroup, 1996)	Establishes "Standard Remedies," or remedial actions, corresponding to specified site conditions for the remediation of MGP sites. Standard remedies are developed based on protection of human health and the environment, technical feasibility, and future land use considerations (residential, comm./ind., vacant land).	SCG	These standard remedies are potential guidelines for developing and evaluating remedial options for MGP sites.
LOCAL					
Water Treatment Discharge	Local County or Municipality Pretreatment Requirements	Local regulation	Establishes pretreatment requirements for water prior to discharge to the local sanitary sewer system.	SCG	These requirements are established separately for each water discharge that is routed through a municipal wastewater treatment plant prior to discharge.

Until 1990, MGP site remediation wastes could be disposed of under RCRA as non-hazardous solid wastes which were not subject to regulation under Subtitle C (hazardous waste program) of RCRA. This is due to the fact that in the mid 1980's, USEPA ruled that MGP wastes qualified for the Bevill Amendment exclusion for mineral processing wastes. In addition, MGP residuals typically exhibited none of the hazardous toxicity characteristics then in effect.

Due to more recent regulatory changes, however, MGP site remediation wastes now may be classified as hazardous waste subject to Subtitle C regulation. This is primarily due to the fact that in 1990, USEPA ruled that remediation waste from "historic" Sites no longer qualifies for the Bevill Amendment exclusion; therefore, MGP site remediation wastes are now subject to hazardous waste regulation if they exhibit a hazardous characteristic. Moreover, in 1990 USEPA established the Toxicity Characteristic (TC) Rule which expanded the regulated compound list for toxicity characteristics to add 24 organic constituents, including benzene, a common component in coal- and petroleum-based residuals.

The effect of the loss of the Bevill status also affected land disposal of MGP site remediation wastes which exhibit a hazardous characteristic. Land disposal requirements for hazardous waste as they apply to coal- and petroleum-based residuals under the Federal Land Ban Program are discussed further in Section 2.2.2.2.

RCRA Exceedances

Data from the Oneida site PSA indicated that all hazardous characteristic testing was negative.

The New York State RCRA program does not currently included federal changes made to RCRA after June 1993. The NYSDEC plans to publish a new regulatory proposal in December 1997 which will incorporate 48 federal changes made to RCRA between June 1993 and July 1997. Major additional topics include: land disposal restriction rule changes (see Section 2.2.2.5), organic air emissions standards for tanks, the universal waste rule, and the expanded public participation rule.

In addition, on August 12, 1997, the USEPA proposed approval of a number of previous New York State RCRA rule changes. This action will allow for state delegation of additional USEPA RCRA programs, including its 1990 toxicity characteristics revisions, boiler/industrial furnace requirements, and corrective action management unit (CAMUs) provisions, and will eliminate the need for duel permitting relating to these programs. These program delegations are scheduled to take effect on October 14, 1997.

2.2.2.2 Land Disposal Restrictions (LDRs)

Federal Land Ban Program

The Hazardous and Solid Waste Amendments (HSWA) to RCRA were signed into law on November 8, 1984. These amendments include specific provisions, known as land disposal restrictions (LDRs), restricting the land disposal of RCRA-classified hazardous waste. The specific purpose of the LDRs is to minimize the potential for future human health and environmental risks by requiring treatment of hazardous wastes prior to their land disposal. The site waste streams anticipated to exceed hazardous waste regulatory standards are coal-based process residuals and petroleum-contaminated residuals.

The LDRs are a complex set of regulations, presented in 40 CFR Part 268, and LDRs are applicable only to remedial actions constituting placement (land disposal) of hazardous waste. If a waste becomes subject to a land disposal restriction, its regulatory status is determined by its regulatory classification at the point of generation. Thus, waste excavated and found to be hazardous is subject to the LDR program even if later rendered nonhazardous. To become eligible for land disposal, the waste must be treated to specified concentration levels for each hazardous constituent present in the waste (not merely the constituent(s) that caused the waste to be classified as hazardous) using best demonstrated available technology ("BDAT"), or in some cases, a treatment methodology specified in the rule for a particular class of constituents. Variances have been allowed for this pre-treatment requirement.

MGP Process Residuals

USEPA has classified MGP residuals as "newly regulated" (55 Fed. Reg. 22560, 22667-68, June 1, 1990) because they were excluded from hazardous waste regulations in 1984 when the LDR program was enacted. Under the HSWA statute, USEPA must take separate action to apply the LDR program to wastes that have only recently become subject to Subtitle C regulation. Although USEPA has gradually made most hazardous waste subject to the LDR program, the prohibition has not yet been made applicable to MGP residuals which no longer retain the Bevill status. However, as discussed below, USEPA has promulgated regulations which may affect future MGP site remediation.

In September 1994, USEPA promulgated a list of Universal Treatment Standards (UTSs) specifying the concentrations to which the constituents in hazardous waste must be treated to be eligible for land disposal. In the same rulemaking, USEPA promulgated treatment standards for the organic constituents covered by the expanded list of toxicity characteristic parameters, including benzene. USEPA is required to adopt these land ban treatment standards for characteristic mineral processing wastes that in 1990 lost their Bevill status.

On January 25, 1996, the USEPA presented the Phase IV Supplemental Proposal on Land Disposal of Mineral Processing Wastes (61 FR 2338). Items covered in this proposed rule include clarification of the Bevill Exclusion for mining wastes, changes to the definition of solid waste for mineral processing wastes, application of UTSs to characteristically-hazardous mineral processing waste, and other associated issues. The Supplemental Phase IV LDR proposed rule would apply to all of the hazardous wastes from MGPs that no longer have Bevill status. In addition, the proposed rule prohibits the storage of MGP hazardous waste except to facilitate treatment or disposal and prohibits the use of dilution to meet UTSs (dilution prohibition).

On May 12, 1997, the USEPA finalized several of the associated issues covered in the 1996 Proposed Supplemental Phase IV LDR rule, including streamlining measures for reducing the paperwork associated with the LDR Program (62 FR 25997). Also on May 12, 1997, the USEPA presented the Second Phase IV Supplemental Proposal which revised new hazardous waste provisions originally proposed in the January 1996 Supplemental Phase IV Proposal. This second proposed rule: 1) revises UTSs for twelve metal constituents in affected wastes, including characteristic mineral processing wastes; 2) addresses LDR sampling procedures; 3) solicits comments on a conditional exclusion for secondary mineral processing materials, on co-processing of materials in Bevill-exempt mining units, and on whether certain mineral processing wastes currently excluded from federal hazardous waste regulations warrant regulatory control; and 4) restricts the use of most hazardous waste as fill material. The new interim deadline for finalization of this rule is April 15, 1998 (RCRA Hotline, June 1997).

The USEPA continues to support using the TCLP (SW-846 Test Method 1311) to determine whether MGP wastes are hazardous and believes MGP wastes can be thermally treated to achieve UTSs for organic constituents.

Petroleum-Based Residuals

Federal LDRs and UTSs would apply to petroleum-based residuals if they are generated as part of a site remediation and they exhibit a hazardous characteristic.

New York State Land Disposal Restrictions

The New York State LDR program mirrors the Federal LDR program prior to its adoption of UTSs in September 1994. Therefore, UTSs are not currently included in New York State LDR statutes. New York State plans to adopt federal UTSs as part of the State RCRA modification proposal planned to be published in December 1997.

2.2.2.3 MGP Combustion Strategy

In 1993, USEPA and Edison Electric Institute (EEI) developed a strategy for burning soils containing MGP residuals in coal-fired utility boilers. A USEPA-approved document describing that strategy, consistent with the RCRA hazardous waste program, was published by EEI in April 1993 (EEI, 1993). The document applies only to the management of excavated MGP solid materials that are hazardous by characteristic, and covers relevant on-site activities including excavation, accumulation and treatment in 90-day units, and off-site disposal.

The MGP combustion strategy is based on the capability of soils containing MGP residuals to be burned with coal and other fuel in high efficiency utility boilers or in equivalent high-efficiency combustion units. The strategy requires that remediation waste that exhibits a hazardous characteristic be rendered non-hazardous before it leaves the generation Site. This may be accomplished through the use of 90-day tanks, containers, or containment buildings covered by 40 CFR Section 262.34(a). Under Federal regulations, waste may be treated in such units during the 90-day accumulation period without a permit, and if the waste thereafter no longer exhibits a hazardous characteristic, any further management of the waste, including the burning of such materials in utility boilers, no longer would be subject to Subtitle C of RCRA.

Treatment in 90-day units can consist of blending characteristically hazardous MGP soils with relatively dry, combustible materials, such as coal, coal fines, clean wood chips, corn cobs, and clean soil. A blending ratio can be established by using a field testing process that will ensure that the most concentrated sample of MGP soils is rendered non-hazardous within the 90-day accumulation period.

2.2.2.4 MGP Presumptive Remedies Initiatives

USEPA is currently developing guidance for identifying presumptive remedies acceptable for particular types of Superfund Sites (i.e., those which have similar wastes and characteristics and would be suited to a particular remedy or set of remedies). The presumptive remedy approach is one tool within the Superfund Accelerated Cleanup Model (SACM) to streamline site investigations and speed up the remedy selection processes. Over time, presumptive remedies are expected to ensure consistency in remedy selection and reduce the cost and time required to clean up similar types of Sites.

The USEPA draft presumptive strategy for MGP Sites is in preparation. The agency has solicited input from EEI, the American Gas Association (AGA), and the utility industry as a whole. The EEI and AGA are collaborating on recommendations for a remedy selection management process at MGP Sites that emphasizes overall site management rather than exclusively focusing on removal actions. Two other documents have been submitted to the USEPA. The first is case studies of the technologies or strategies for inclusion in the presumptive strategy document. Technologies covered include: co-burning, asphalt batching, brick manufacture, cement kilns, thermal desorption, bioremediation, in-situ stabilization, containment, source removal (natural attenuation), and pure tar removal. The second submittal includes a technology description summary sheet for each technology included.

2.2.2.5 Water Treatment Discharge

If the chosen remediation alternative at the Oneida site includes a release to surface water, then discharge limits would need to be established for individual MGP-related residuals, based on site conditions and water quality SCGs. The NYSDEC guidance for estimating surface water discharge limits is described in the Division of Water's SPDES guidance for permit development contained in the following Technical and Operational Guidance Series (TOGs) documents (NYSDEC, various dates):

1.3.1	Waste Assimilative Capacity Analysis & Allocation for Water Quality-Based Effluent Limits	May 1990
1.3.1C	Development of Water Quality-Based Effluent Limits for Metals/Amendment	August 1991
1.3.2	Toxicity Testing in the SPDES Program	May 1990

The NYSDEC guidance for estimating surface water discharge limits is based on two items: (1) the best available treatment technology that is economically achievable, and (2) mixing of the discharge water with upstream surface water to allow water quality standards to be met downstream of the discharge. If pretreated water from Oneida site remediation activities were discharged to the publicly owned treatment works (POTW), then pretreatment limits established through either the municipality or the NYSDEC would have to be met. In this case, acceptance criteria by the POTW would be a volume of less than 10,000 gallons per day and attainment of the lowest detectable limit or levels in Oneida Creek (Personal Communication, 1997a).

There are no known surface water intakes downstream of the Site or public water supply wells located within three miles of the Site; therefore SCGs for public water supplies developed by the NYS Department of Health were not considered in estimating surface water discharge limits.

2.2.2.6 Air Emissions from a Point Source

Methodologies for calculating air discharge limits are available from NYSDEC (1991). Calculating air discharge limits from a point source involves two steps: (1) estimating emissions of volatile organics and fugitive dust (sometimes termed a box model) and (2) estimating air concentrations as they disperse from the emission source (sometimes termed a dispersion model). Models for estimating air emission rates and dispersion are available from USEPA. Maximum 1-hour, 24-hour, and annual average air concentrations are typically estimated.

2.2.2.7 Additional Regulatory Initiatives

The proposed HWIR-media rule addresses contaminated media that currently are subject to regulation as "hazardous waste" under RCRA. The purpose of the proposed rule is to develop more flexible management standards for media and wastes generated during site cleanups. The proposed rule modifies LDR treatment requirements and permitting procedures for higher-risk, contaminated media and gives EPA and authorized states the authority to remove certain lower-risk, contaminated media from regulation as "hazardous wastes" under most of Subtitle C of RCRA. This would be accomplished through the establishment of a "Bright Line", which is a set of constituent-specific concentrations to divide high-risk and low-risk media. As of mid-September 1997, the USEPA is reportedly in the process of abandoning the approaches outlined herein in favor of a more limited rule while calling on Congress to provide a more comprehensive solution. Nonetheless, the proposed HWIR-media rule as it appears currently is reviewed herein.

The USEPA presents two alternative approaches to managing contaminated media. One approach, the *Unitary Approach*, would exempt all contaminated media from Subtitle C that meets certain conditions, and thereby lessen regulatory requirements. A second approach presented in the proposed HWIR-media rule is the *Hybrid Contingent Management Option*, or Harmonized Approach, a combination of the Bright Line and Unitary Approach. Impacts of this latter approach would depend on whether concentrations of constituents at MGP Sites fall below proposed Bright Line values. The impact each approach could have on waste management practices at MGP Sites is summarized below:

- The proposed Harmonized Approach would apply only to hazardous media generated during site investigation or remediation activities. This approach would not alter the definition of hazardous MGP site wastes or establish cleanup goals for MGP site materials.
- The proposed Unitary Approach is a condensed approach to hazardous waste remediation and would apply to all hazardous wastes, including non-media wastes generated at MGP Sites, and wastes that are hazardous based on the toxicity characteristic due to benzene levels at MGP Sites.

The HWIR-media regulations were proposed to provide greater flexibility to regulators and managers of hazardous waste remediation Sites. However, the degree to which existing RCRA rules may or may not apply will depend on Site-specific situations and the degree to which the overseeing regulatory agency at any particular site chooses to apply these revisions to RCRA (Wargo and Pluhar, 1996).

The HWIR-media regulations are scheduled to be finalized by June 30, 1998 (USEPA RCRA Hotline, June 1997).

Groundwater Restoration Technical Impracticability (TI)

The USEPA has issued guidance on addressing Sites where restoration of groundwater to background conditions is not feasible or practicable. The guidance is contained in a USEPA memorandum entitled, "Guidance for Evaluating the Technical

Impracticability of Groundwater Restoration" (USEPA, 1993a). One of the significant points of this guidance is that sources of groundwater impacts need to be removed but only where practicable and, in general, where significant reduction of current or future risk can be realized. This USEPA guidance also addresses DNAPL and the impracticability of its removal. While this guidance was prepared primarily for Federal Superfund site cleanups, it is USEPA guidance that can be considered for the Oneida project as needed. There have been at least 23 Technical Impracticability (TI) waivers issued by the USEPA at Superfund Sites across the United States one of which is NMPC's Saratoga Springs former MGP site.

2.2.3 Location-Specific SCGs

Location-specific SCGs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Potential location-specific SCGs for the Oneida site include restrictions on certain land development activities in floodplains, wetlands, and navigable waters of the United States; restrictions to protect critical habitats for endangered or threatened species; restrictions on activities in areas designated as wilderness, wildlife refuges or sole-source aquifers for drinking water; and restrictions to preserve historic structures and properties. Statutes, regulations, and guidelines to be used in the identification of location-specific SCGs for the Oneida site are listed in Table 2.7. Some of these statutes, regulations, and guidelines and their relevance to the Site are discussed below.

100-Year Floodplain/Floodway

A floodplain is composed of a floodway and a flood fringe. The floodway is that part of the floodplain considered to be the zone of highest hazard due to the passage of larger floods. The flood fringe is a zone of floodwater storage outside the floodway where water moves slowly or is ponded during a once-in-100-year flood event. A review of the Federal Emergency Management Agency (FEMA) flood insurance rate map for the Oneida study area shows that all of the site is located within the 100-year flood fringe of the regulated floodway of Oneida Creek (Figure 1.7). Federal, state, and local floodplain management laws and regulations are applicable SCGs in the event that remedial activities involve excavation or fill within the 100-year floodplain or floodway.

Wetlands

Wetlands greater than 12.4 acres in size or wetlands having unusual local importance are regulated by the NYSDEC. In addition, general requirements under 6 NYCRR Parts 662 to 665 of the New York State Freshwater Wetlands Act, and permitting requirements under Section 404 of the Clean Water Act (CWA) may be applicable to remedial activities conducted in wetlands located on-site or to remedial activities that may result in the discharge of dredge or fill material into the wetlands located on-site.

TABLE 2.7
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF LOCATION-SPECIFIC SCGs
ONEIDA SITE

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
FEDERAL					
Floodplain	Hazardous Waste Facility Located on 100-yr Floodplain	40 CFR 264.18(b)	A Treatment, Storage, and Disposal (TSD) Facility must be designed and operated to avoid washout.	SCG	Requirements are applicable because the site is located within the 100-year floodplain (based on review of FEMA map).
	Floodplain Management	40 CFR 6, Subpart A; 40 CFR 6.302	Activities taking place within floodplains must be done to avoid adverse impacts and preserve beneficial values in floodplains.	SCG	Requirements are applicable because the site is located within the 100-year floodplain (based on review of FEMA map).
Fault	Hazardous Waste Facility Located Near a Bedrock Fault	40 CFR 264.18(a)	New hazardous waste TSD facilities cannot be constructed within 200 feet of a fault displaced within Holocene time.	Not Applicable	Bedrock faults displaced within the Holocene time have not been identified in review of local and regional geology.
Wetlands	Clean Water Act (CWA) Section 404	33 U.S.C. 1344			
	Dredge and Fill in Wetlands	33 CFR Parts 320-330 40 CFR Part 230	Discharge of dredge or fill material into wetlands are regulated by a permit.	SCG	Not applicable to remedial activities resulting in a discharge of dredge or fill material because no juristiction wetlands have been identified on the site.
	Executive Order 11990 Protection of Wetlands	40 CFR Part 6 Subpart A	Executive Order 11990 activities taking place within wetlands must be done to avoid adverse impacts.	SCG	Not applicable to remedial activities conduted because no jurisdiction wetlands have been identified on the site.
Historic Areas	National Historic Preservation Act	16 U.S.C. 470; 16 U.S.C. 469			
	Preservation of Historic Properties Controlled by a Federal Agency	36 CFR Part 800	Actions must be planned to preserve historic properties and minimize harm to National Historic Landmarks.	SCG	No potentially historic MGP buildings remain on the site.
	Preservation of Area Containing Artifacts	36 CFR Part 65	Actions must be done to preserve and recover any historical/archeological artifacts found.	Not Applicable (at this time)	No significant historic or archeological artifacts have been identified to date on the site.

TABLE 2.7
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF LOCATION-SPECIFIC SCGs
ONEIDA SITE

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Critical Habitat	Endangered Species Act and Fish and Wildlife Coordination Act	16 U.S.C. 1531			
	Critical Habitat of Endangered Species	50 CFR Part 200, Part 402 40 CFR Parts 320-330	Actions must be taken to conserve critical habitat in areas where there are endangered or threatened species.	Not Applicable	No endangered or threatened species have been identified in characterization studies to date within a two-mile radius of the site.
Wilderness Area	Wilderness Act	16 U.S.C. 1131			
	Activities in Federally-Owned Wilderness Areas	50 CFR 35.1	Area must be administered to preserve wilderness areas.	Not Applicable	Site is not on or near a federally-owned wilderness area.
Wildlife Refuge	Wildlife Refuge System	16 U.S.C. 668dd			
	Activities in Areas Designated in Wildlife Refuge System	50 CFR Part 27	Activities are restricted in areas designated as part of the National Wildlife Refuge System.	Not Applicable	Site is not on or near a federally designated National Wildlife Refuge.
Waters of the United States	Clean Water Act (CWA) Section 404	33 U.S.C. 1344			
	Discharge of Dredge or Fill Material into Waters of the United States	33 CFR Parts 320-330 40 CFR Part 230	Discharges must be authorized in accordance with Section 404. Activities may qualify for a Nationwide permit authorized by the District Engineer of the USACOE.	SCG	Would be applicable to remedial activities resulting in a discharge of fill or dredged material into the Oneida Creek.
Stream or River Area	Fish and Wildlife Coordination Act	16 U.S.C. 661			
	Modification to Waterways that Affects Fish or Wildlife	40 CFR 6.302	Actions must be taken to protect fish or wildlife when diverting channeling, or otherwise modifying a stream or river.	SCG	Would only be applicable to remediation activities that result in modifications to the Oneida Creek.
	Wild and Scenic Rivers Act	16 U.S.C. 1271, Section 7			
	Actions in Designated Wild and Scenic River Areas	40 CFR 6.302 (e)	Actions in federally-designated wild, scenic, or recreation river areas must avoid adverse effects.	Not Applicable	Remedial work on site would not impact a federally-designated wild or scenic river area.

TABLE 2.7
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF LOCATION-SPECIFIC SCGs
ONEIDA SITE

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Stream or River Area (cont.)	Rivers and Harbors Act 1899 Section 10	33 U.S.C. Section 403			
	Obstruction or Alteration of Naigable Waters of the U.S.	33 CFR Parts 320-330	Permit required for structures or activities that will affect navigable waters of the United States.	SCG	Would be applicable to remedial actions that obstruct or alter the Oneida Creek.
STATE					
Floodplain	TSD Facility Permiting Requirements	6 NYCRR Subpart 373-1	Facility must be designed and operated to avoid washout.	SCG	Requirements are applicable because the site is located within the 100-year floodplain (based on review of FEMA map).
	Hazardous Waste Facility Located on 100-yr Floodplain				
Aquifer	Secure Landfill Design and Operation Requirements -	6 NYCRR Part 373-2.14	A secure landfill facility shall not be located over groundwater recharge areas serving public water supplies. Waste shall be no closer than 10 feet to an aquifer. New landfill units must have double liner systems with leachate collection if the landfill is located within one-quarter mile from an underground source of drinking water.	Not Applicable	The site is not located over a groundwater recharge area serving a public water supply.
	Hazardous Waste Facility Located Over a Aquifer				
Fault	Siting of Industrial Hazardous Waste Facilities	6 NYCRR Part 361			
	Hazardous Waste Facility Located Near Fault		New hazardous waste facilities cannot be constructed within 200 feet of a fault displaced within Holocene time.	Not Applicable	Bedrock faults displaced within the Holocene time have not been identified in review of local and regional geology.
Wetlands	New York State Freshwater Wetlands Act	ECL Article 24 and 71			
	New York Freshwater Wetlands Implementation Program	6 NYCRR Parts 662-665	Activities in wetlands areas must be conducted to preserve and protect wetlands.	SCG	Would be applicable to remedial activities conduted in the juristiction wetlands that have been identified on the site.

TABLE 2.7
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF LOCATION-SPECIFIC SCGs
ONEIDA SITE

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Historic Area	New York State Parks, Recreation, and Historic Preservation Law	Section 14.09			
	Preservation of Historic Structures or Artifacts		Actions must be planned to preserve and recover historic structures or artifacts at sites regulated by the state.	SCG	No potentially historic MGP buildings remain on the site.
Critical Habitat	Endangered and Threatened Species of Fish and Wildlife	6 NYCRR Part 182	State regulations for protection of threatened and endangered species	Not Applicable	No endangered or threatened species have been identified.
Waters of New York State	Protection of Waters Program	6 NYCRR Part 608	Protection of Waters permit program regulates: (1) any disturbance of the bed or banks of a protected stream or watercourse, (2) construction and maintenance of dams, and (3) excavation or fill in navigable waters of the State.	SCG	Would be applicable to remediation activities that result in modifications (temporary or permanent), excavation, or filling within the Oneida Creek.
	CWA Section 401 State Water Quality Certification (WQC) Program	33 U.S.C. 1341	State 401 WQC permit must be provided to Federal permitting agency (USACOE) for any activity including, but not limited to, the construction or operation of facilities which may result in any discharge into navigable waters of the U.S.	SCG	Would be applicable to remedial activities that result in a discharge into the Oneida Creek. State authority under Section 401 of the CWA only extends where the area in question is integral navigable waters.
Coastal Zone	Coastal Zone Erosion	6 NYCRR Part 505	Land use, development, and other activities in coastal areas subject to coastal flooding and erosion must obtain a coastal erosion management permit.	Not Applicable	Site is not located within a New York State coastal area.
Freshwater Sediments	Sediment Dredging	NYSDEC Interim Guidance Freshwater Navigitional Dredging	Establishes three levels or "classes" of sediment quality based on contaminant concentration, and assigns dredge and disposal options to each class.	TBC	This guidance would be considered for remedial actions involving dredging and disposal of Tailrace sediment.

TABLE 2.7
STATUTES, REGULATIONS, AND GUIDELINES USED IN THE IDENTIFICATION OF LOCATION-SPECIFIC SCGs
ONEIDA SITE

LOCATION	REQUIREMENTS	CITATION	DESCRIPTION	SCG or TBC	COMMENT
Floodplain	Floodplain Management Criteria for State Projects	6 NYCRR Part 502	Establishes floodplain management practices for projects involving State-owned and State-financed facilities. Key requirements include limitations on projects, including placement of fill, which may result in an increase in flood levels or water surface elevations during a base flood discharge.	TBC	Requirements should be considered because the site is located within the 100-year floodplain (based on review of FEMA maps).
LOCAL					
Floodplain	Flood Damage Prevention	City of Utica Code of Ordinances Chapter 19, "Flood Damage Prevention Law"	Variances are needed for activities occurring within floodplains shown to not cause an increase in flood levels during a base flood discharge. If shown to cause an increase, a variance will not be given.	SCG	Requirements are applicable because the site is located within the 100-year floodplain (based on review of FEMA map).

Wetland identification work conducted as part of the Preliminary site Assessment identified numerous regulated freshwater wetlands within a 1-mile radius of the site on the revised NYSDEC 1986 Freshwater Wetlands map and USFWS National Wetlands Inventory map, but none of these wetlands are affected by the Site.

Several wetland areas were observed at the base of the railroad tracks that occur to the north of the Site. Some of these areas serve as storm water retention basins for the City of Oneida storm water outfall.

Two persistent freshwater wetland areas associated with the Tailrace were also observed. A small emergent wetland exists along the banks of the Tailrace near the railroad bridge that passes over the gravel access road. Another wetland area is located approximately 200 feet farther downstream.

Navigable Waters

Permitting requirements under the NYSDEC Protection of Water Resources Program, Section 10 of the River and Harbors Act, and Section 404 of the CWA would be applicable if any remedial activities involve discharge of dredge or fill material to Oneida Creek, because Oneida Creek is a navigable water tributary. Remedial activities involving or resulting in modifications (e.g., diversion, channeling, and excavation) of Oneida Creek would also be subject to permitting requirements under the NYSDEC Protection of Waters Program.

Under Section 404 of the CWA, the United States Army Corps of Engineers (USACOE) has jurisdiction over the discharge of dredge or fill material into waters of the United States. Certain remedial activities at the Oneida site may qualify for a nationwide permit authorized by the District Engineer (DE) of the USACOE.

A Section 401 State Water Quality Certification (or waiver thereof) from NYSDEC would be required for any activity including, but not limited to, the construction or operation of facilities that may result in a discharge into Oneida Creek. State authority under Section 401 of the CWA applies only when the area in question is integral with navigable waters.

In addition, the NYSDEC has issued the “Interim Guidance for Freshwater Navigational Dredging” to evaluate dredging and dredge material disposal options (NYSDEC, 1994). The guidance establishes three levels or “classes” of sediment quality, based on sediment screening parameter thresholds, and assigns dredging and sediment disposal options for each class. Sediment sampling methodology for dredge site characterization and post-dredging monitoring requirements are also covered in the guidance. The NYSDEC is currently using this guidance to assist in the evaluation of potential impacts of dredging and dredge material management projects under the State 401 Water Quality Certification program (Personal Communication, 1997b).

Endangered Species/Critical Habitat

Review of NYSDEC Natural Heritage Program files indicates that there are two known occurrences of endangered plant species within the Oneida city limits. The locations of these species are not presently known with sufficient accuracy to determine their distance or orientation from the Oneida site (NHP, 1993).

Historic Structures

NMPC and the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP) have negotiated a general agreement for a process for handling compliance for MGP Sites in accordance with the New York State Parks, Recreation and Historic Preservation Law. The OPRHP has stated that remediation of the Oneida site will have "No Impact" on cultural resources currently listed in or eligible for listing in the State and National Registers of Historic Places. Although several Sites of cultural importance have been identified near the Oneida Site, continuous development and construction within the site since the mid-1800's has limited the potential for recovering evidence of prehistoric occupation.

2.3 PRELIMINARY REMEDIATION GOALS

Preliminary remediation goals (PRGs) are chemical-specific, long-range target cleanup goals developed to assist in the selection of a preferred site remedy. USEPA risk assessment guidance describes the procedure for determining PRGs (USEPA, 1991). PRGs have the following four attributes:

- They are concentration goals for specific media and land use combinations based on SCGs, quantitative estimates of risk, or reliable background concentrations;
- They can be identified at the beginning of the investigation;
- They are dynamic values that are modified throughout the course of the investigation and engineering evaluation as Site-specific information is accumulated; and
- In their final form in the Proposed Remedial Action Plan (PRAP) and in the Record of Decision (ROD), they will serve as a starting point for determining the extent of site remediation.

2.3.1 Soil PRGs

Soil PRGs were developed for the Site based on future land use scenarios and the baseline Human Health Risk Assessment (HHRA) results presented in the RI Report (Parsons ES, 1997). These soil PRGs are listed in Table 2.8 and are discussed below.

TABLE 2.2
POTENTIAL PRGS FOR ONSITE SOIL (MG/KG) (1)

MGP-Related Residual(2)	Risk-based PRG		SCG-based PRG(4)	Background Upper Tolerance Limit(5)
	Human Health(3)	Ecological		
Volatiles				
Benzene	8.7 -	-	0.28	0.28
Ethylbenzene	3,600	-	25	25
Toluene	5,200	-	6.9	6.9
Xylenes	75,000	-	5.5	5.5
Semivolatiles				
Benzo(a)anthracene	7.2	-	0.224	19
Benzo(a)pyrene	0.72	-	0.061	18
Benzo(b)fluoranthene	7.2	-	5.1	18
Benzo(k)fluoranthene	72	-	5.1	16
Chrysene	724	-	1.8	23
Dibenzo(a,h)anthracene	0.73	-	0.014	-
Fluoranthene	15,000	-	50	55
Fluorene	13,000	-	50	5.7
Indeno(1,2,3-c,d)pyrene	7.3	-	15	4.3
2-Methylnaphthalene	6,900	-	50	0.39
Naphthalene	6,900	-	50	0.33
Pyrene	11,000	-	50	28
Pesticides/PCBs				
none				
Inorganics				
Arsenic	3.2	-	7.5 **	15
Copper*	16,000	-	25 **	90
Mercury	110	-	0.1	0.15
Zinc	120,000	-	20 **	93

(1) PRG = preliminary remediation goal. A dash (" - ") indicates that the item is not applicable or that no value is available.

(2) An asterisk ("*") indicates that the chemical is not MGP-related.

(3) The risk-based PRGs are based on a hazard quotient = 0.2 or a 10-6 cancer risk, whichever produces the lower PRG. Values are based on commercial-industrial land use.

(4) SCG = standard, criterion, or guideline. The values listed are recommended soil cleanup objectives from TAGM HWR-94-4046 based on the lower of the values associated with residential exposure or protection of groundwater adjusted using the measured organic carbon concentration of 4.6% (NYSDEC, 1994). The SCG . for total semivolatile organic compounds is < 500 ppm. An asterisk ("**") indicates that PRG presented is the value presented or site background.

(5) Background upper tolerance limits (BUTLs) for surface soil (see Appendix L of the RI Report).

On-site Soil

Soil PRGs for the site were developed based on commercial-industrial exposure, residential exposure or groundwater protection taking into account background upper tolerance limits (BUTLs) for surface soil (Table 2.2). The PRGs associated with commercial-industrial exposure are based on a hazard quotient equal to 0.2 or a 10^{-6} cancer risk, whichever produces the lower PRG. The risk-based PRGs are based on values as presented in Appendix O of the RI Report. These values are intended to protect humans from adverse impacts due to soil dermal contact, soil ingestion, and soil inhalation based on commercial/industrial land use. The recommended soil cleanup objectives from NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-94-4046 based on residential exposure or protection of groundwater (NYSDEC, 1994b) were also included. Finally, the BUTLs are maximum Site-specific background levels found in surface soil. Values for specific constituents listed in Table 2.8 are either the commercial/industrial risk-based value or the soil cleanup objective value, whichever is lower, except when the BUTL exceeds the lower of the two values (see Appendix D of this FS for a more detailed discussion of the selection of on-site soil PRGs).

Off-site Soils

PRGs for off-site soils, listed in Table 2.8, were drawn from PRGs associated with commercial-industrial exposure, PRGs from NYSDEC TAGM HWR-94-4046, and BUTLs for surface soil. The risk-based potential PRGs for soil are calculated using commercial/industrial land use values. The PRGs from NYSDEC TAGM HWR-94-4046 are based on direct contact where such a value is available. Otherwise, the values are based on protection of groundwater or a general ceiling value for the type of chemical.

2.3.2 Sediment PRGs

The sediments in the vicinity of the site have been divided into two groups: those in Oneida Creek and "other" sediments. "Other" sediments are those outside Oneida Creek, including those found in the Tailrace, the Eastern Ditch and the drainage swale between the ditch and Oneida Creek.

The PRGs for Oneida Creek sediments, presented in Table 2.3a, are for lack of any more applicable values, based on draft NYSDEC guidance (NYSDEC, 1993b). The published criteria were modified based on a measured site concentration of organic carbon of 10.1 percent.

The PRGs for the other sediments, presented in Table 2.3a, were handled in a manner identical to that for off-site soil. The exposure mechanisms for sediments were considered the same as those for surface soil because they may have little or no water covering them for much of the year. The criteria for these sediments were modified based on a measured organic carbon concentration of 4.6 percent, the same concentration used for the soil criteria.

2.3.3 Groundwater PRGs

Groundwater PRGs are listed in Table 2.8. These values are either NYS Class GA Standards or NYS Class GA Guidance Values (listed in Table 2.4), except for the value for aluminum, which is from USEPA (see Appendix D of this FS for a more detailed discussion of the selection of groundwater PRGs). Therefore the position on groundwater PRGs and BUTLs is based on SCGs and the risk assessment.

2.4 REMEDIAL ACTION OBJECTIVES (RAOs)

Remedial action objectives (RAOs) have been developed for the purpose of evaluating the applicability of remedial technologies and the effectiveness of remedial alternatives. These objectives consist of media-specific goals for protecting human health and the environment and for meeting SCGs to the extent practicable in a cost-effective manner. RAOs have been established based on Site-specific information, including the nature and extent of site constituents, human and ecological risk assessment results, PRGs, existing site conditions, and future land use plans. RAOs typically focus on controlling ecological receptor (humans, wildlife, aquatic life) exposure to chemicals of concern via exposure routes such as dermal contact, ingestion, and inhalation and on controlling the release of hazardous substances into the environment (groundwater, surface water, soils, and sediments).

Preliminary RAOs for the Site have been established based on the nature and extent of contamination and the PRGs. Protecting human health and the environment, technical feasibility, and practicability of achieving these goals were considered. Final RAOs are usually presented, along with the preferred remedy, by the lead agency (NYSDEC) in the Proposed Remedial Action Plan and the subsequent Record of Decision.

RAOs for the Site are as follows:

1. Maintain the current commercial-industrial use of the NMPC property for the foreseeable future.

2. Maintain use of the Tailrace to transmit stormwater to Oneida Creek by maintaining existing Tailrace invert elevations at its upstream and downstream ends in accordance with the City of Oneida's request.

3. Eliminate contact with sediments in Tailrace exceeding PRGs.

4. Eliminate contact with surface soils, both on-site and off-site (Tailrace banks), exceeding PRGs.

5. Remove or control identified sources of significant impacts.

6. Monitor groundwater, as needed, to evaluate groundwater quality following site remediation.

SECTION 3

IDENTIFICATION AND SCREENING OF TECHNOLOGIES

3.1 INTRODUCTION

This section describes the following steps needed to develop remedial action alternatives:

- Preliminary screening of the technologies and process options with respect to implementability, effectiveness, and cost.
- Identification of potentially suitable technologies, including innovative technologies, and/or process options.

The NYSDEC TAGM HWR-90-4030 specifies that individual remedial technologies should be preliminarily screened on their ability to meet media-specific remedial action objectives, their implementability, and their short-term and long-term effectiveness. In addition, the EPA National Oil and Hazardous Substances Pollution Contingency Plan (abbreviated as the NCP) under CERCLA states in 40 CFR Section 300.430 that cost can be used as a criterion to preliminarily screen remedial alternatives. The NCP states that grossly excessive costs, compared to the overall effectiveness of alternatives, may be used as one of several factors to eliminate alternatives. In addition, similar alternatives providing effectiveness and implementability equivalent to that of another alternative, but at a greater cost, may also be eliminated.

Screening for effectiveness considers three important aspects: 1) the ability of the process to handle estimated volumes or areas and meet the remedial action objectives; 2) the potential for the process to impact human health and the environment during implementation; and 3) the reliability and record of performance for the process. Implementability encompasses technical feasibility, availability of the technologies, and the administrative feasibility of implementing a technology or process (USEPA, 1988 and NYSDEC, 1990). If an alternative requires equipment, specialists, or facilities that are not available within a reasonable period of time, it may be eliminated from further consideration (USEPA, 1993b). Screening based on cost focuses on both the costs of construction and any long-term operation and maintenance costs (USEPA, 1993b).

Screening and technology summary information is presented herein, with additional information available for coal and petroleum based residuals in Section 3 of the Draft Feasibility Study Guidance Document for Former Manufactured Gas Plant Sites (Parsons ES, 1996). As coal and petroleum related constituents are similar, the soil and sediment technologies presented herein are potentially applicable to the Site. Many of the groundwater technologies presented are capable of remediating petroleum and chlorinated constituents as well as coal related constituents. Cost information for screening is provided in the text and tables for each technology considered and represents the technology cost only, not the overall remedial cost to achieve a cleanup objective. Cost rating levels are derived from the USEPA's Remediation Technologies Screening Matrix and Reference Guide (USEPA, 1993c).

Remedial action technologies that would facilitate the RAOs listed in Section 2.4 and address the following types of media: soil (includes purifier material), sediment, and groundwater are considered. Surface water does not need to be addressed, because any impacted surface water will be addressed as a result of addressing soil and/or sediment.

Both conventional and innovative remediation technologies are evaluated. Innovative treatment technologies, per the USEPA, refer to alternative treatment technologies (i.e., "alternatives" to land disposal) with limited full-scale experience and performance and cost data. Innovative technologies are identified where appropriate in the following tables. For the purpose of this FS, technologies are not considered innovative if they have at least one field trial at full-scale.

Tables 3.1 and 3.2 provide a summary of the technology screening process. Technologies are identified as potentially applicable for non-aqueous and aqueous media, respectively, for implementability and effectiveness as they pertain to Oneida site conditions and for cost as per NCP guidelines. Non-aqueous media include soil and sediment. Aqueous media include groundwater and filtrate generated during dewatering. Technologies are categorized into general response actions, which include no action, institutional controls, capping, containment, removal, dewatering, preparation, treatment, and disposal. The "retained" and "not retained" status of each technology is stated in Tables 3.1 and 3.2 and summarized in Tables 3.3 and 3.4.

Note: A detailed discussion of applicable remedial technologies is provided in the FS Guidance Document for former MGP Sites (Parsons ES, 1996a). Therefore, only a very brief discussion is provided herein.

3.2 INSTITUTIONAL CONTROLS

One category of general response actions is institutional controls. Institutional controls generally provide readily-implementable methods for preventing exposures to Site-related residuals. Deed restrictions, runoff controls, and site security via fencing, locked entranceways, and "no trespassing" signs are typically highly effective, especially when used in conjunction with other remediation technologies. Monitoring of groundwater is an effective way to document changes in chemical characteristics over time. The cost to implement institutional controls can vary widely due to Site-specific circumstances. For example, costs for groundwater monitoring depend on the size of the area requiring monitoring, the number of parameters being monitored, and the length of time monitoring is required.

3.3 CONTAINMENT TECHNOLOGIES

Soil and sediment covers can reduce potential exposure by preventing direct contact with site residuals. An impermeable soil cap can both prevent direct contact and significantly reduce infiltration from precipitation or flooding. Barrier walls were evaluated based on their ability to

TABLE 3.1
SCREENING OF REMEDIAL TECHNOLOGIES FOR SOILS AND SEDIMENTS ASSOCIATED WITH THE ONEIDA (SCONONDOA STREET) SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (2)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (1)
No Action	None	None	Achievement of remedial action objectives is dependent on compounds detected. Allows natural attenuation to occur.	Readily implementable. Not likely to be acceptable to public or regulatory agencies.	None	Retained for Comparative Purposes
Institutional Controls	Access Control	Deed Restrictions, Fencing/Posting	Achievement of remedial action objectives is dependent on compounds detected. Depends on future use and enforcement. Does not reduce contamination. Allows natural attenuation to occur. Prevents exposure to site contaminants from trespassing due to site proximity to public highway and waterway.	Readily implementable. Legal requirements and authority needed.	Variable	Retained
	Runoff Controls	Revegetation, Grading	Effective in minimizing surface water erosion due to runoff. Can be used along the perimeter to keep offsite runoff from migrating onsite and to control onsite runoff on caps.	Readily implementable if it does not interfere with the site's future redevelopment plans.	Variable	Retained
Containment	Soil Capping	Soil Cover	Effective for isolating shallow material from exposure. Limited effectiveness for minimizing infiltration.	Although requires time to implement, still readily implementable.	Low	Retained
		Impermeable	Most effective and reliable as a physical and hydraulic impermeable barrier. Effective at minimizing direct contact and infiltration.	Requires more time to implement than soil cap.	Medium	Retained
	Sediment Covering	Sediment Cover	Effective beneath quiescent water only.	Implementable.	Medium	Not Retained
	Sediment Containment	Sheetpile, berm or dike	Effective as needed.	Implementable	Low	Retained
Source Removal	Excavation of Soils and Sediment	Mechanical Excavation	Large scale (heavy equipment) mechanical excavation is reliable and effective. Flow diversion and runon/runoff control often required.	Easily implemented due to use of conventional earth moving equipment.	Low	Retained

TABLE 3.1
SCREENING OF REMEDIAL TECHNOLOGIES FOR SOILS AND SEDIMENTS ASSOCIATED WITH THE ONEIDA (SCONONDOA STREET) SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (2)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (1)
Preparation	Sediment Dewatering	Plate and Frame Filter Press	Effective. Least problematic with free phase in sediments.	Implementable.	Low	Not Retained
		Belt Filter Press	Not effective for sediments with free phase material due to clogging. Sensitive to incoming feed characteristics; filtrate would need to be treated.	Potentially implementable.	Low	Not Retained
		Gravity Settling	Limited effectiveness for sediments with free phase material due to clogging of drainage pores.	Implementable. Requires use of a reasonable footprint for construction of a pad.	Low	Retained
		Recessed Chamber Filtration *(Innovative)*	Not effective for large volumes of sediments or for sediments with high solids content. Energy intensive. An innovative form of "plate and frame" dewatering.	Potentially implementable. Technical difficulties implementing.	Low	Not Retained
	Soil / Sediment Preparation (following excavation)	Solidification	Effective at improving the material handling of wet sediments/soils and for increasing mechanical strength of sediments/soils.	Easily implementable through the use of fly ash or lime. Sediment/soil volume would increase after solidification.	Low	Retained
		Consolidation (Uncontained)	Effective for consolidating contaminated material/ sediment in one central location for treatment.	Readily implementable. Eliminates regulatory and cost implication associated with transporting the material.	Low	Not Retained
		EPRI/ARC Clean Soil Process *(Innovative)*	Proven effective at bench and pilot scale. Limited data at full-scale.	Potentially implementable. Innovative technology.	Low	Not Retained
		Soil/Sediment Blending	Effective at stabilizing and rendering material nonhazardous by reducing the volatile compound concentration. Effective as a form of pretreatment for thermal desorption, co-burning, stabilization, etc.	Implementable.	Low	Retained
		Soil/Sediment Screening	Effective at sizing soil/sediment particles and for removing debris from the material prior to treatment.	Readily implementable.	Low	Retained

TABLE 3.1
SCREENING OF REMEDIAL TECHNOLOGIES FOR SOILS AND SEDIMENTS ASSOCIATED WITH THE ONEIDA (SCONONDOA STREET) SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (2)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (1)
Treatment	Onsite treatment	Chemical Oxidation *(Innovative)*	An effective and proven technology for converting compounds of concern to less harmful species.	Implementable for solids when combined with a liquid to form a slurry. Not cost effective for high concentrations due to large amounts of oxidizing agents required.	Medium	Not Retained
		Composting/Land Farming/ Prepared Bed Treatment	Generally not effective at obtaining desired cleanu levels at sites as a "stand alone" process.	Piling of material is implementable. Typically need the addition of a bulking agent.	Medium	Not Retained
		CYAN-REM *(Innovative)*	Effectiveness proven at a bench scale only	Potentially implementable. Innovative technology. Large amounts of water requiring treatment would be generated.	High	Not Retained
		Extraction/Soil Washing	Proven effective for gross contamination. May need to be combined with other technologies to meet cleanup levels.	Implementability can be hindered by developing a wash solution for complex wastes.	Medium	Not Retained
		Thermal Desorption	Effective form of treatment for and sediment soils with low to high levels of organic contamination. Proven effective at full-scale.	Implementable on site and off site.	Low to Medium (Depending on throughput)	Retained (Applicable also to Purifier Soil)
		IWT-Advanced Chemical Treatment *(Innovative)*	Effective form of in-situ "stabilization". Limited testing at full-scale.	Potentially implementable. Innovative technology.	Medium	Not Retained
		Slurry Phase Bioremediation Treatment	Relatively effective at the bench-scale for sediment and soils. Not effective for purifier material due to woodchips and complexed CN. Carcinogenic PAHs reduced 6 to 45% during bench scale. Addition of Fenton's Reagent will increase reduction of higher-ringed PAHs.	Potentially implementable.	Medium	Not Retained
		Stabilization	Fly-ash/lime, cement kiln dust, and lime proven effective at stabilizing PAHs, BTEX, and metals in soils and sediment. Lack of long-term leaching data in soils and sediment.	Potentially implementable either exsitu or insitu using large diameter augers.	Low to Medium	Not Retained

TABLE 3.1
SCREENING OF REMEDIAL TECHNOLOGIES FOR SOILS AND SEDIMENTS ASSOCIATED WITH THE ONEIDA (SCONONDOA STREET) SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (2)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (1)
Treatment (Cont'd)		Sulchem Process (Innovative)	Limited effectiveness at bench-scale. Effective at destroying organic compounds with boiling points above 350°C.	Innovative technology. No full-scale data. Potentially implementable.	Medium	Not Retained
	Offsite treatment	Incineration	Effective for destruction of organic compounds. Destruction removal efficiency for inorganics, i.e. metals and cyanide, is typically high. Dependent on physical/chemical properties of individual compounds.	Implementable for offsite treatment. Proven technology. Permitting and treatability testing may be time consuming.	High	Not Retained
	Recycle/Reuse	Thermally Desorbed Soil in Hot/Cold-Mix Asphalt (Bituminous Concrete)	Proven effective. Potential for leaching from asph without pretreatment. Asphalt products meet NYSDOT specifications. No long term data available. Not time and cost effective for large quantities of soil due to low solids blending rate relative to asphalt feedstock.	Potentially implementable. A limited number of facilities are technically prepared and permitted to process.	Medium	Retained. (Applicable also to Purifier Soil)
		Cold-Mix Asphalt without Thermal Pretreatment (Bituminous Concrete)	Proven effective. TCLP extracts of asphalt mixes not consistently meet NYSDEC groundwater quali standards. Not time and cost effective for large quantities of soil due to low solids blending rate at the inlet. No long term data available.	Potentially implementable; not fully proven. Asphalt must be used within one year of generatio	Medium allowing for significant levels of aggregate	Retained.
		Brick Manufacture	Proven effective. Not time and cost effective for large quantities of soil due to low solids blending rate at inlet. No long term data available.	Potentially implementable. Difficulty identifying a facility that is technically prepared and permitted to process residuals and has systems in place for soil storage and runoff disposal.	Low to Medium	Retained. (Applicable also to Purifier Soil)
		Cement Manufacture	Proven effective. Not time and cost effective for large quantities of soil due to low solids blending rate at the inlet. No long term data available.	Potentially implementable. Difficulty identifying a facility that is technically prepared and permitted to process material and has systems in place for soil storage and runoff disposal.	Medium	Retained. (Applicable also to Purifier Soil)
		Co-Burning in a Utility Boiler	Proven to be a technically effective method of remediation. No long term data available. Not time and cost effective for large quantities of soil due to low solids blending rate at the inlet.	Potentially implementable. Acknowledged by EPA at least until Land Ban Phase II gets revised (199 An environmental assessment of the impacts from process residuals may be initiated by the EPA.	Low to Medium	Retained. (Applicable also to Purifier Soil)
		Fuel Recovery	Proven effective. Effects of vouable quantities or in flow rates appear to be minimal.	Potentially implementable at least one facility in New York State is permitted uncer RCRA.	Variable	Retained

TABLE 3.1
SCREENING OF REMEDIAL TECHNOLOGIES FOR SOILS AND SEDIMENTS ASSOCIATED WITH THE ONEIDA (SCONONDOA STREET) SITE

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (2)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (1)
Disposal	Off Site	Permitted Landfill	Reliable and effective for disposal of non-hazardous material and soil in a permitted landfill. Does not destroy chemicals of concern.	Potentially implementable for disposal of non-hazardous materials.	Low	Retained
		Hazardous Waste Landfill	Effective if managed properly at a RCRA-permitte landfill for isolating wastes from exposure to huma health or the environment via groundwater.	Implementable for disposal of hazardous wastes. Some RCRA hazardous wastes may require treatment prior to disposal.	Medium	Retained
	On Site	Landfill	Effective given proper construction of onsite landill. Compounds are not treated but left on site.	Time consuming to implement. Requires handling of excavated soils. Difficulty obtaining permits to construct in a floodplain.	Variable	Not Retained

NOTES.

1 Technologies "not retained" will not be considered for further evaluation at the Oneida site.

2 The cost presented represents the cost to implement a technology and does not represent the overall remedial cost to achieve a remedial action objective. The relative cost of technologies is presented as follows:

- "None"
- "Inadequate Information"
- "Variable"
- "Low": Less than $100/ton | Less than $150/CY | Less than $2/SF of land area
- "Medium": $100-$300/ton | $150 to $450/CY | $2 to $5/SF of land area
- "High": More than $300/ton | More than $450/CY | More than $5/SF of land area

A typical conversion factor of 1.5 tons per CY was assumed to generate the cost categories based on CYs.

Overall cost represents design, construction, and O&M costs of the core process that defines each technology, exclusive of mob/demob, and pre- and post-treatment including transportation. Rating levels based on tonnage are based on EPA/542/B-93/005 document, Remediation Technologies Screening Matrix and Reference Guide, July 1993.

TABLE 3.2
SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER AND FILTRATE AT THE GLOVERSVILLE (HILL STREET SITE)

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (2)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (1)
No Action/ Limited Action	None	None	Achievement of remedial action objectives is dependent on compounds detected. Allows natural attenuation to occur.	Readily implementable.	None	Retained for comparative purposes (with monitoring)
Institutional Controls	Access Control	Alternate Water Supply	Effective at minimizing exposure to the contaminated water source. Allows natural attenuation to occur.	Implementable. There are no public water supply wells located within 3 miles of the site; however, they are located upgradient. Private wells within a 3 mile radius are not hydraulically connected to the aquifers below the site.	Variable	Not Retained
		Deed Restrictions	Depends on future site use and enforcement. Does not reduce contamination. Allows natural attenuation to occur.	Readily implementable. Legal requirements and authority needed.	Variable	Retained
	Monitoring	Groundwater Monitoring	Effective in documenting changes in chemical characteristics over time, requires preparation of a monitoring plan. Allows natural attenuation to occur.	Readily implementable.	Variable	Retained
Containment	Barrier Walls	Slurry Trenches with perimeter groundwater collection	Effective in containing contaminant plume. Hydraulic controls can increase effectiveness. Chemical compatibility may be a concern. Should have a confining layer to tie into.	Implementable. Depth range limited.	Low to Medium	Retained
		Sheetpile Barrier Wall with perimeter groundwater collection	Effective in containing contaminant plume. Hydraulic controls can increase effectiveness. Continuity is a concern between separate sheetpiles. Must have a confining layer to tie into.	Implementable. Depth range limited (less than 30'); can be impeded by large subsurface objects.	Medium to High	Not Retained
		Vibrating Beam Barrier Wall *(Innovative)*	Effectiveness questioned due to concern with continuity between each injection. Must have a confining layer to tie into	Readily implementable due to it being an in situ process. Depth range limited (less than 30').	Low	Not Retained

TABLE 3.2
SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER AND FILTRATE AT THE GLOVERSVILLE (HILL STREET SITE)

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (2)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (1)
Containment (Cont'd)	Barrier Walls (Cont'd)	Geomembrane Barrier Wall	Effective at resisting chemical attack. Not effective at staying leakproof and tear free. Must have a confining layer to tie into.	Implementable. Problems in past during installation.	Medium to High	Not Retained
	Extraction	Extraction Wells (Horizontal or Vertical)	Reliable and effective for capture of groundwater.	Readily implementable. Locations need to be predetermined.	Variable	Retained
		Extraction (i.e. Collection) Trenches	Effective at collecting groundwater.	Implementable. Locations need to be predetermined. Depth limited to <30 ft.	Variable	Not Retained
Treatment	Physical/Chemical Treatment	Activated Carbon	Proven effective with organic constituents, including BTEX, coal, petroleum, and chlorinated based constituents. Should be used in conjunction with other technologies. Disposal or regeneration of spent carbon required	Readily implementable.	High	Retained
		Air Stripping	Effective for VOCs, including BTEX, chlorinated VOCs, and low molecular weight PAHs. Pretreatment required. Works well in conjunction with other technologies.	Readily implementable.	Low	Retained
		Alkaline Hydrolysis *(Innovative)*	Limited testing of effectiveness at a full scale.	Potentially implementable.	Inadequate Information	Not Retained
		Bag Filtration	Effective at filtering out solids from the untreated aqueous stream.	Implementable.	Low	Retained
		Chemical Oxidation	Effective for converting chlorinated, petroleum, and coal-based constituents to less harmful residuals. Not cost effective for high concentrations due to large amounts of oxidizing agents required.	Implementable.	Low	Not Retained
		Chemical Precipitation	Effective as a pretreatment for the removal of metals. Used successfully during the GAC-FBR NMPC Demonstration.	Implementable.	Low	Retained
		Coagulation/Flocculation	Effective at removing suspended matter from an aqueous discharge stream.	Implementable.	Low	Retained

TABLE 3.2
SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER AND FILTRATE AT THE GLOVERSVILLE (HILL STREET SITE)

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (2)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (1)
Treatment (Cont'd)	Physical/Chemical Treatment (Cont'd)	Dissolved Air/Froth Flotation	Effective as a pretreatment for removal of insoluble so that more expensive downstream operations are not affected. Effective over gravity separation when the specific gravity of the suspended media is very close to that of water.	Implementable.	Inadequate Information	Not Retained
		In-situ Air Sparging	Effective at removing volatile compounds, including BTEX and other VOCs from perimeter groundwater.	Implementable.	Low	Not Retained
		Ion Exchange	Sorbplus proven effective at onsite water treatment system.	Implementable. Sorbplus already in use at a NMPC water treatment system.	Inadequate Information	Retained
		Neutralization	Effective at adjusting the pH of a an aqueous stream to a neutral level required for discharge	Implementable.	Variable	Retained
		Oil/Water Separator	Effective at removing free floating oil, grease, and settleable oily coated solids from oil-water mixtures.	Implementable	Low	Retained
		UV/Chemical Oxidation *(Innovative)*	Effective for iron-cyanide complexes from purifier materials. Also effective for VOCs and petroleum constituents. Not cost effective for high compound concentrations due to cost of chemicals.	Implementable.	Medium	Not Retained (3)
	Biological Treatment	Activated Sludge	Effective when used at POTWs for the co-treatment of groundwaters containing petroleum and coal-based constituents. Site groundwater will in many cases be too dilute to support an activated sludge system	Implementable. Influent water typically requires pretreatment for removal of suspended solids and free phase oil and tars. High maintenance.	Low to Medium	Not Retained
		Fluidized Bed Biological Treatment	Effective. Typically part of a treatment train. Used successfully at the lab, pilot, and full scales.	Implementable.	High	Not Retained
		In-Situ Bioremediation	Effective for the remediation of BTEX and some chlorinated constituents. Not proven effective for carcinogenic PAHs and complexed cyanide. Innovative.	Readily implementable. May require the introduction of nonindigenous microbes and reagents.	Low	Not Retained

TABLE 3.2
SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER AND FILTRATE AT THE GLOVERSVILLE (HILL STREET SITE)

RESPONSE ACTION	TECHNOLOGY TYPE	TECHNOLOGY	EFFECTIVENESS	IMPLEMENTABILITY	RELATIVE COST (2)	RETAINED OR NOT RETAINED FOR FURTHER EVALUATION (1)
Treatment (Cont'd)	Biological Treatment (Cont'd)	Intrinsic Bioremediation	Effectiveness is site-specific and constituent-specific. Best when used at sites with land buffer around source area. Works well in conjunction with other technologies. Proven effective not as source remediation, but for residual plumes.	Readily implementable. Treatment time typically in the order of years.	Low	Retained
		Reactive Barrier Wall *(Innovative)*	Limited proven effectiveness. Constituent-specific based on treatment media used.	Implementable at shallow levels in areas where there is no gross NAPL.	Inadequate Information	Not Retained
		Sequencing Batch Reactor	Proven effective at the laboratory scale on waters similar to site waters. Effective treatment of petroleum and chlorinated constituents Effective at resisting fluctuations in the influent.	Implementable. Very high maintenance. Time and labor intensive	Inadequate Information	Not Retained
		Wetlands Development	Limited effectiveness at hazardous waste sites. May be effective in polishing treatment of water from dewatered sediments.	Potentially implementable.	Inadequate Information	Not Retained
Disposal	Offsite Discharge	POTW	Reliable and effective with proper maintenance and operation. Proven effective for the treatment of groundwaters containing petroleum or coal-based constituents at POTWs with activated sludge units.	Readily implementable. Pretreatment may be required to meet discharge limits. Permit required.	Based on User Fees	Retained
		SPDES Discharge to Surface Water	Reliable and effective.	Implementable. Will typically require a SPDES permit. Pretreatment typically required to meet SPDES discharge limits.	Variable	Retained
		Permitted Treatment Facility	Effective disposal method.	Implementable if there is a nearby permitted treatment facility.	Variable	Retained
	Onsite Discharge	Land Application	Not effective for floodplain areas. Need a large land area. Gloversville site located adjacent to 100-year floodplain.	Readily implementable.	Variable	Not Retained
		Surface Water	Effective form of discharge	Implementable. Pretreatment may be required. No surface waterbody exists onsite.	Variable	Not Retained

NOTES:

(1) Technologies "not retained" will not be considered for further evaluation at the Gloversville site. Generally, the "retained" technologies would need to be used in conjunction with one or more of the other retained technologies in the form of a groundwater treatment train to achieve desired cleanup goals.

(2) The cost presented represents the cost to implement a technology and does not represent the overall remedial cost to achieve a remedial action objective. The relative cost of technologies is presented as follows:
- "None"
- "Inadequate Information"
- "Variable"
- "Low": Less than \$3.00 / 1,000 gallons \| Less than \$10 per vertical SF
- "Medium": \$3.00-\$10.00 / 1,000 gallons \| \$10 to \$20 per vertical SF
- "High": More than \$10.00 / 1,000 gallons \| More than \$20 per vertical SF

Overall cost represents design, construction, and O&M costs of the core process that defines each technology, exclusive of mob/demob, and pre- and post-treatment. Rating levels based on gallons are based on EPA/542/B-93/005 document; Remediation Technologies Screening Matrix and Reference Guide, July 1993.

(3) Considered primarily because workable options for cyanide removal are limited at this time.

TABLE 3.3
POTENTIALLY APPLICABLE TECHNOLOGIES RETAINED FOR REMEDIATING SOILS AND SEDIMENTS ONEIDA (SCONONDOA STREET) SITE

INSTITUTIONAL CONTROLS	CONTAINMENT	SOURCE REMOVAL	PREPARATION/ TREATMENT	DISPOSAL
Access Control - Deed restrictions - Fencing/Posting Runoff Controls - Revegetation - Grading	Soil Capping - Soil cover cap - Impermeable cap Sediment Containment - Sheetpile, berm, or dike	Excavation of Soils and Sediment - Mechanical excavation	Soil/Sediment Preparation - Gravity Settling Soil/Sediment Preparation - Solidification - Soil/Sediment Blending - Soil/Sediment Screening Offsite Treatment - Thermal desorption Recycle/Reuse - Hot-Mix Asphalt (thermally pretreated) - Cold-Mix Asphalt (thermally pretreated) - Cold-Mix Asphalt (without thermal pretreatment) - Brick Manufacture - Cement Manufacture - Co-burning in a utility boiler - Fuel Recovery	Offsite - Permitted landfill - Hazardous waste landfill

TABLE 3.4
POTENTIALLY APPLICABLE TECHNOLOGIES RETAINED FOR REMEDIATING GROUNDWATER AND FILTRATE
ONEIDA (SCONONDOA STREET) SITE

INSTITUTIONAL CONTROLS	CONTAINMENT	TREATMENT	DISPOSAL
Access Control	Barrier Walls	Physical/Chemical Treatment	Offsite discharge
- Deed restrictions	- Slurry trench/wall	- Activated carbon	- POTW
Monitoring	Extraction	- Air stripping	- SPDES discharge
- Groundwater monitoring	- Extraction wells (horizontal or vertical)	- Bag Filtration	- Permitted Treatment Facility
		- Chemical precipitation	
		- Coagulation/Flocculation	
		- Ion exchange	
		- Neutralization	
		- Oil/water separator	
		- Biological Treatment	
		- Intrinsic Bioremediation	

restrict the potential migration of NAPLs and to contain groundwater from flowing off-site. Short-term groundwater pumping was also evaluated to achieve steady-state groundwater table conditions in conjunction with an impermeable cap and to create an inward hydraulic gradient. Barriers for surface water diversion were also considered. All of these technologies were evaluated as described herein.

3.3.1 Soil/Sediment Containment Technologies

3.3.1.1 Soil Covers and Caps

A soil cover and an impermeable cap were considered for the Oneida Site. Either a cover or a cap can be topped with a vegetative surface layer, typically grass, or with crushed stone or asphalt (Figure 3.1). The surface layer of any cover or cap should be graded and maintained to control runoff, prevent flooding impacts, and minimize cap erosion. Various types of materials can be used to place a cover or cap, such as soils or alternate fill materials such as fly ash.

3.3.1.2 Sediment Covers

In situ sediment covers (i.e., soil that is submerged beneath surface water) have been installed at a limited number of Sites under varying site conditions. Sediment covers were not considered for the Site due to the need for the City to continually maintain (sedimentation removal) the Tailrace for stormwater transmission.

3.3.1.3 Sediment Containment

Sheetpile is commonly used to temporarily or permanently keep sediment away from the water flowing through a stream. Berms or dikes can also be used. Sheetpile is particularly considered when the entire flow of water cannot be rerouted around a construction Site.

3.3.2 Groundwater Containment Technologies

Containment technologies evaluated include subsurface barriers and forms of groundwater collection such as wells or trenches.

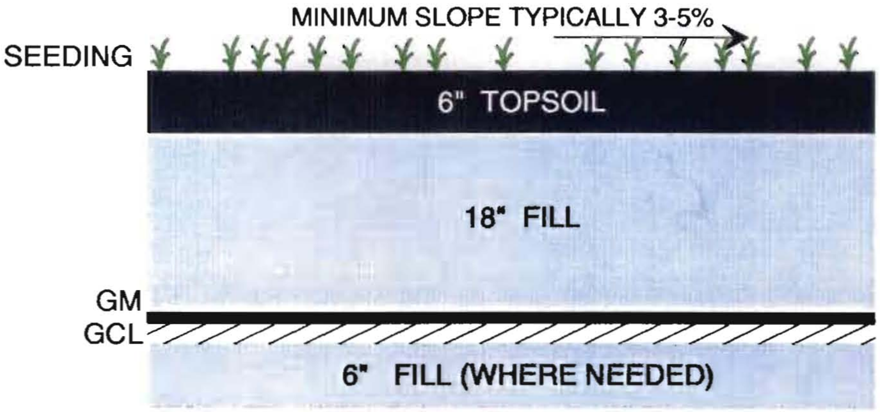
3.3.2.1 Subsurface Barriers

The following subsurface barrier wall technologies are considered potentially applicable at the Site for containment of groundwater: soil-bentonite, cement-bentonite, soil-attapulgite, cement-attapulgite, plastic concrete, and concrete slurry trenches; vibrating beam; geomembrane (for limited applications); and sheet pile barrier walls. Additional subsurface barrier walls were initially considered and found to be not applicable at the Oneida site due to their developmental stages and lack of a proven record of successful implementation. These include deep-soil mixing, compacted clay, conventional and jet grouting, and colloidal silica injection (Ludox$^{®}$). A summary of the screening of each of the applicable subsurface barrier wall technologies is presented in Table 3.2. All six forms of slurry trenches (i.e. soil-bentonite, cement-bentonite, soil-attapulgite, cement-

FIGURE 3.1

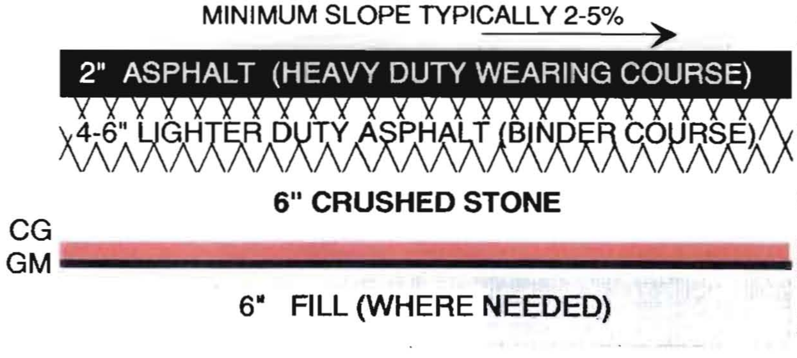
IMPERMEABLE CAP SCENARIOS

WITH GRASS COVER



TYPICAL UNIT COSTS
$0.20/SF (SEEDING)
$0.50/SF (TOPSOIL)
$0.75/SF (FILL)
$0.50/SF (GEOMEMBRANE)
$0.60/SF (GCL)
$0.20/SF (FILL)
$2.75/SF

WITH ASPHALT COVER



TYPICAL UNIT COSTS
$0.50/SF (HEAVY ASPHALT)
$0.80/SF (LIGHT ASPHALT)
$0.60/SF (CRUSHED STONE)
$0.15/SF (CUSHION GEOTEXTILE)
$0.50/SF (GEOMEMBRANE)
$0.20/SF (FILL)
$2.75/SF

CG - CUSHION GEOTEXTILE
GM - GEOMEMBRANE
GCL - GEOSYNTHETIC CLAY
SF - SQUARE FOOT

attapulgite, plastic concrete, and concrete) were grouped together in Table 3.2 and evaluated under the general topic of slurry trenches.

The following subsurface barrier wall technologies have been retained for further consideration at the Site: soil-bentonite slurry trench, soil-attapulgite slurry trench, vibrating beam barrier wall, geomembrane barrier wall (for limited applications), and sheet pile barrier wall. These types of walls are described elsewhere (Parsons ES, 1996a). Among these technologies, the soil-bentonite slurry appears to be the most promising subsurface barrier wall technology for potential use at the Site.

3.3.2.2 Groundwater Containment Via Collection

Extraction trenches and extraction wells are reliable and effective conventional methods for the containment of groundwater. Trenches are generally preferred if the groundwater to be collected extends within an elongated plume and is less than 20 to 25 feet deep. Wells are generally preferred if the groundwater to be collected is in multiple spots, if the area is broad laterally in both dimensions, or if the groundwater is deeper than 20 to 25 feet. Extraction wells are typically vertical wells; however, in recent years horizontal wells have been used particularly to collect shallow groundwater. The number and location of extraction trenches or wells needs to be determined based on the remedial action selected to maximize collection efficiency. Groundwater flow modeling would be used to provide a basis for optimizing numbers and locations of collection trenches or wells.

Groundwater extraction at the Site was retained for further evaluation in conjunction with a capping and barrier wall scenario to achieve hydraulic steady-state conditions in a shorter timeframe than would occur otherwise, and to establish an inward hydraulic gradient.

3.4 SOURCE REMOVAL

Source removal options evaluated for soils and sediments include use of conventional equipment such as backhoes and excavators. Odors and volatile organic concentrations would be monitored and controlled, as needed. The size of the Tailrace is small enough that more specialized underwater dredging technologies are not appropriate to consider for this Site.

3.5 PREPARATION OF SOILS AND SEDIMENTS FOR TREATMENT

Preparation of soils and sediments at Oneida could include soil screening, the dewatering of excavated soil and sediments,. and the possible addition of solidification agent to the soils or sediments for improving material handling.

3.5.1 Soil/Sediment Blending

Blending involves stabilizing compounds in soils and sediment with coal or other absorbent solid materials, as needed prior to treatment or disposal. During the blending process, volatile constituents are freed and/or absorbed by the coal. A critical aspect of stabilizing is to use as little stabilizing material as possible (Shosky *et al.*, 1995).

3.5.2 Soil/Sediment Screening

Screening of excavated material involves removing miscellaneous debris such as wood and other objects from excavated soils and sediment prior to remediation. Screening is conducted to remove large particles and debris and thereby meet particle size requirements of certain transport, treatment, or disposal requirements. A screening step was retained for further evaluation at Oneida as a pretreatment/materials handling step in the soil and sediment remediation schemes.

3.5.3 Dewatering

Three dewatering techniques were considered for use at Oneida following soil and sediment excavation. These techniques include dewatering by gravity, plate and frame press, and belt filter press. Each of these dewatering techniques can be tested at the bench-scale in a laboratory, as needed.

3.5.4 Solidification

Solidification is typically employed as a post-treatment step to make soils or sediments more manageable. The solidification process mixes an absorbent solid with wet soils or sediments to absorb excess water and improve material handling. Thus, solidification can provide dewatering as well as material handling benefits.

3.6 TREATMENT TECHNOLOGIES

Both innovative and conventional treatment technologies were evaluated for use at the Oneida Site. Detailed technology information pertinent to evaluating these methods is contained in the Draft Feasibility Study Guidance Document for Former Manufactured Gas Plant Sites (Parsons ES, 1996a). Many of these technologies are capable of remediating MGP residuals. Innovative technologies were not retained for further evaluation unless a Site-specific pilot-scale test has been successfully completed at another Site.

3.6.1 Soil/Sediment Treatment Technologies

Potential soil/sediment treatment technologies include on-site treatment, off-site treatment, and recycle/reuse options. On-site technologies evaluated include chemical oxidation, composting, CYAN-REM, extraction/soil washing, thermal desorption, IWT-Advanced Chemical Treatment, natural attenuation, passive bioventing, slurry phase bioremediation, in-place or ex-situ stabilization, and the Sulchem Process. As an off-site treatment, incineration was considered, although any technology suitable for use on-site could potentially be used off-site. Recycle and reuse options are also viable and consist of cold-mix asphalt production without thermal pretreatment, both hot- and cold-mix asphalt production with thermal pretreatment, brick manufacture, cement manufacture, and utility co-burning.

3.6.2 Groundwater/Filtrate Treatment Technologies

Nineteen different treatment technologies were identified for potential use at the site to treat groundwater and filtrate from dewatering operations. These remediation techniques include the following: activated carbon, activated sludge, air stripping, alkaline hydrolysis, bag filtration, chemical oxidation, chemical precipitation, coagulation/flocculation, dissolved air/froth flotation, fluidized bed biological treatment, *in situ* air sparging, *in situ* bioremediation, ion exchange, natural attenuation, neutralization, oil/water separation, reactive barrier walls, sequencing batch reactors, UV/chemical oxidation/REDOX, and wetland applications. Appendix F of the Draft Feasibility Study Guidance Document for Former Manufactured Gas Plant Sites (Parsons ES, 1996a) contains detailed technology data sheets on these water treatment options.

3.7 DISPOSAL OPTIONS

Disposal options have been identified for both soil/sediment media and aqueous streams. Off-site disposal options were considered applicable for media from the Site.

3.7.1 Soil/Sediment Disposal Options

Off-site disposal options have been identified for the remediation of soils and sediment from the Site. Soils and sediments can be excavated, transported by truck and disposed at an approved landfill permitted to receive these materials.

3.7.2 Aqueous Media Disposal Options

Site groundwater, leachate, surface water runoff, and filtrate from dewatering operations can be discharged or transported off-site to a publicly owned treatment works (POTW), to an adjacent surface water body, or to a permitted off-site treatment facility.

SECTION 4
DEVELOPMENT AND EVALUATION OF REMEDIAL ALTERNATIVES

4.1 INTRODUCTION

The Superfund regulations guiding remedial alternative evaluation efforts for CERCLA Sites are contained in the National Contingency Plan (NCP) under 40 CFR Part 300. Primary expectations of the NCP particularly relevant for developing and evaluating remediation alternatives, using CERCLA guidance, are as follows:

- Treatment of "principal threat wastes," comprised of liquids and highly mobile or high-risk toxic wastes, must be provided. This site does not appear to contain such principal threat wastes.
- Engineering controls (e.g., containment) should be used for materials that are not a principal threat.
- Institutional controls should be considered to supplement other actions and further reduce public health and ecological impacts.
- Complementary use of remedial technologies for more cost-effective overall remedies, such as combining containment of low threat wastes with institutional controls, should be evaluated.

4.2 DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section presents the development of three remedial alternatives for the Tailrace and three remedial alternatives for the on-site soil and groundwater. The remedial alternatives incorporate the elements of institutional controls, removal, containment, treatment, and disposal and are presented in Table 4.1. Each of the six alternatives are illustrated in Figures 4.1 through 4.5. The basis for these alternatives consists of the extent of PRG exceedances in the sediment, soil, and groundwater and the technologies retained from Section 3 for remediating these media. These alternatives do not address the Eastern Ditch or Oneida Creek for the following reasons: (1) the Eastern Ditch sediments do not exceed the sediment PRGs, and (2) as noted in the RI, the baseline HHRA and the fish tissue assessment determined that there were no Site-related constituents present in Oneida Creek surface water at concentrations posing a significant risk to human health or the environment.

4.2.1 Tailrace Alternatives

Sediment and spoils exceedances of the Site PRGs (see Table 2.8) cover similar areas along the Tailrace. Much of the sediment and spoils exceeding these PRGs lie near the western edge of the site and along a segment beginning at the intersection with the Eastern Ditch and ending approximately 300 feet downstream. Tailrace sediment PRG exceedances, were also found at two locations further downstream, 380 feet and 160 feet upstream of Oneida Creek, respectively.

TABLE 4.1
Media-Specific Remedial Action Alternatives
Oneida (Sconondoa Street) Site
Tailrace

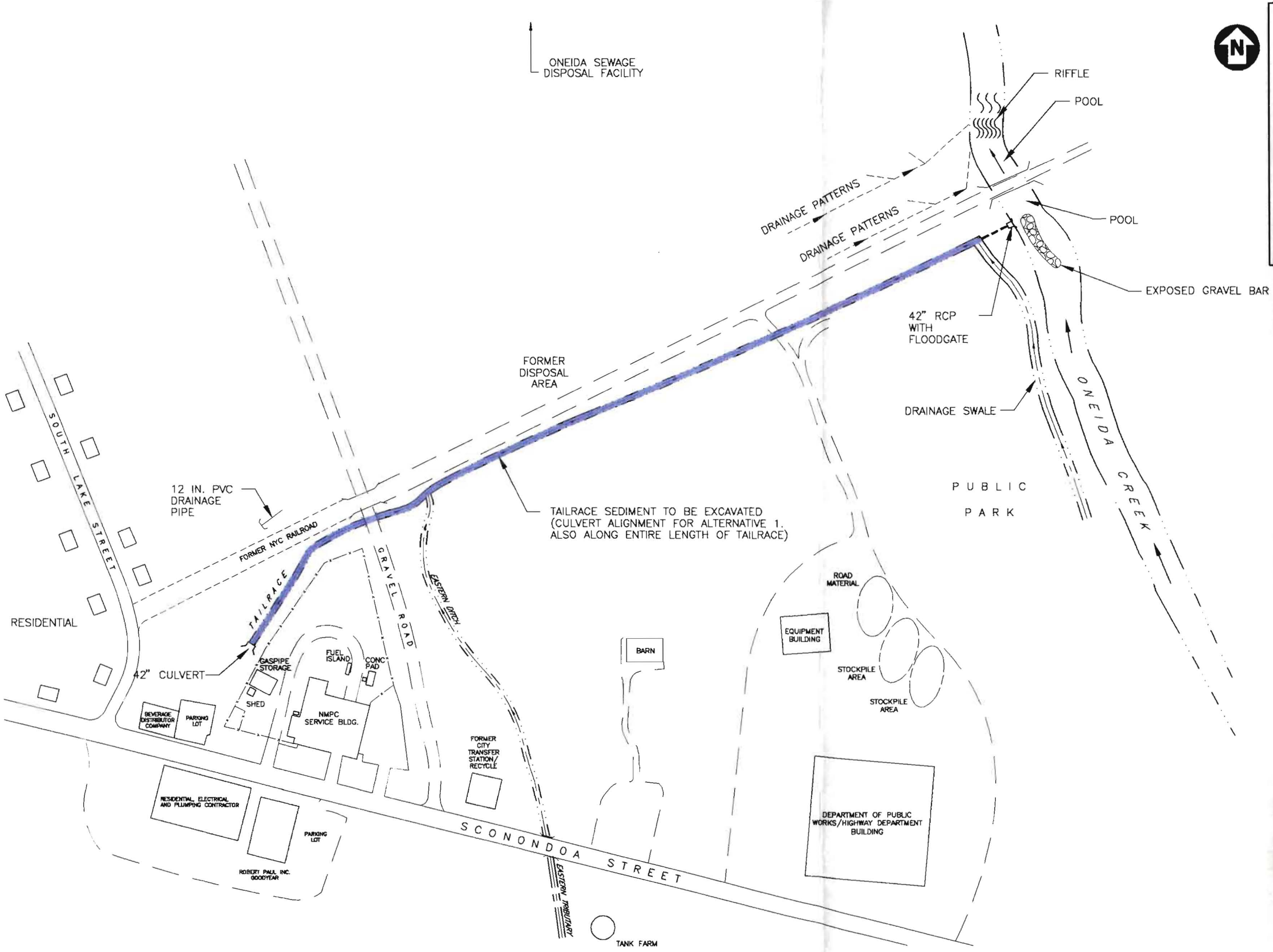
Alternative	Removal	Backfill/Restoration	Capping/Containment of Soils	Treatment/Disposal
Alternative 1 Limited Sediment Removal	Removal of approximately 1,220 cubic yards of sediment in Tailrace to 2.5 feet deep to place culvert. Removal of 150 cubic yards of material at Tailrace crossings.	Placement of 48-inch culvert.	Permeable cover of 1.5 feet of unclassifed fill and 6 inches of topsoil over culvert and spoils area.	Excavated sediment to be managed offsite.
Alternative 2 Sediment Removal and Restoration of Tailrace	Removal of approximately 1,780 cubic yards of sediment in Tailrace to 4 feet deep. Removal of 150 cubic yards of material at Tailrace crossings.	Backfill Tailrace, replace intermediate culverts, and replace flap valve.	Permeable cover of 1.5 feet of unclassified fill and 6 inches of topsoil over spoils area.	Excavated sediment to be managed offsite.
Alternative 3 Sediment and Spoils Removal and Restoration of Tailrace and Banks	Removal of approximately 1,780 cubic yards of sediment in Tailrace to 4 feet deep. Removal of approximately 2,960 cubic yards of spoils along Tailrace to 5 feet deep.	Backfill Tailrace, replace intermediate culverts, replace flap valve. Restore banks.	Permeable cover of 1.5 feet of unclassified fill and 6 inches of topsoil over former spoils area.	Excavated sediment and spoils to be managed offsite.

TABLE 4.1 (con't.)
Media-Specific Remedial Action Alternatives
Oneida Site
Soil / Groundwater

Alternative	Institutional Controls/ Limited Action	Removal	Capping/ Containment of Soils	Groundwater Management	Treatment	Disposal
Alternative 1 Limited Action	Deed restrictions by NMPC. Maintain existing security fence around site. Post "No Trespassing" signs onsite. Monitor groundwater at select locations as needed.	N/A	N/A	N/A	N/A	N/A
Alternative 2 Containment/Treatment	Deed restrictions by NMPC. Maintain existing security fence around site. Post "No Trespassing" signs onsite. Monitor groundwater at select locations as needed.	N/A	Asphalt cover on the site.	Installation of a bentonite slurry wall (assumed to be 3 feet thick for costing purposes).	Collection and treatment of groundwater using a prefilter and activated carbon treatment system as needed.	Excavated potential source materials (from installation of slurry wall) to be managed offsite at a solid waste management facility. Discharge treated water to City of Oneida sanitary sewer system or to Tailrace or Onedia Creek.
Alternative 3 Source Removal	Deed restrictions by NMPC. Monitor groundwater at select locations as needed.	Remove potential source area structures and associated materials. (See Note 1). (Estimated total in-place soil volume is 5,800 CY.)	Asphalt cover on the site.	No groundwater controls.		Excavated materials to be managed offsite.

Notes:

1. Source areas for this FS are defined as zones of surface and subsurface contamination that are associated with structures or equipment, storage areas, or by-product management areas that have been shown from site investigation efforts to be potentially impacting the local environment.



LEGEND:

—x——x—	FENCE
— — —	GRAVEL ROAD
▬	SEDIMENTS TO BE EXCAVATED TO 2.5 FT (ALTERNATIVE No 1) AND SEDIMENTS TO BE EXCAVATED TO 4.0 FT (ALTERNATIVE No 2)

NOTES:

1. THIS DRAWING IS BASED UPON NMPC'S ONEIDA SERVICE CENTER TOPOGRAPHIC MAP, DRAWING NUMBER D-51348-C DATED MAY 28, 1993. OFFSITE FEATURES DERIVED FROM AERIAL PHOTOGRAPHY, USGS 7.5 MINUTE ONEIDA QUADRANGLE AND FIELD OBSERVATIONS.
2. WETLAND LOCATIONS FROM USFWS NWI MAPS (1991) AND NYSDEC ARTICLE 24 WETLANDS MAP. BOUNDARIES DRAWN DO NOT DEPICT JURISTICTIONAL DELINEATION.

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Approximate Scale in Feet

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NO.	DATE	REVISION	BY

PROJECT NUMBER: 72652104000	DATE
DESIGNED BY: JHP	
DRAWN BY: SEH	08/04/97
CHECKED BY:	
ENGINEER NA REGISTRATION NUMBER NA DATE NA	

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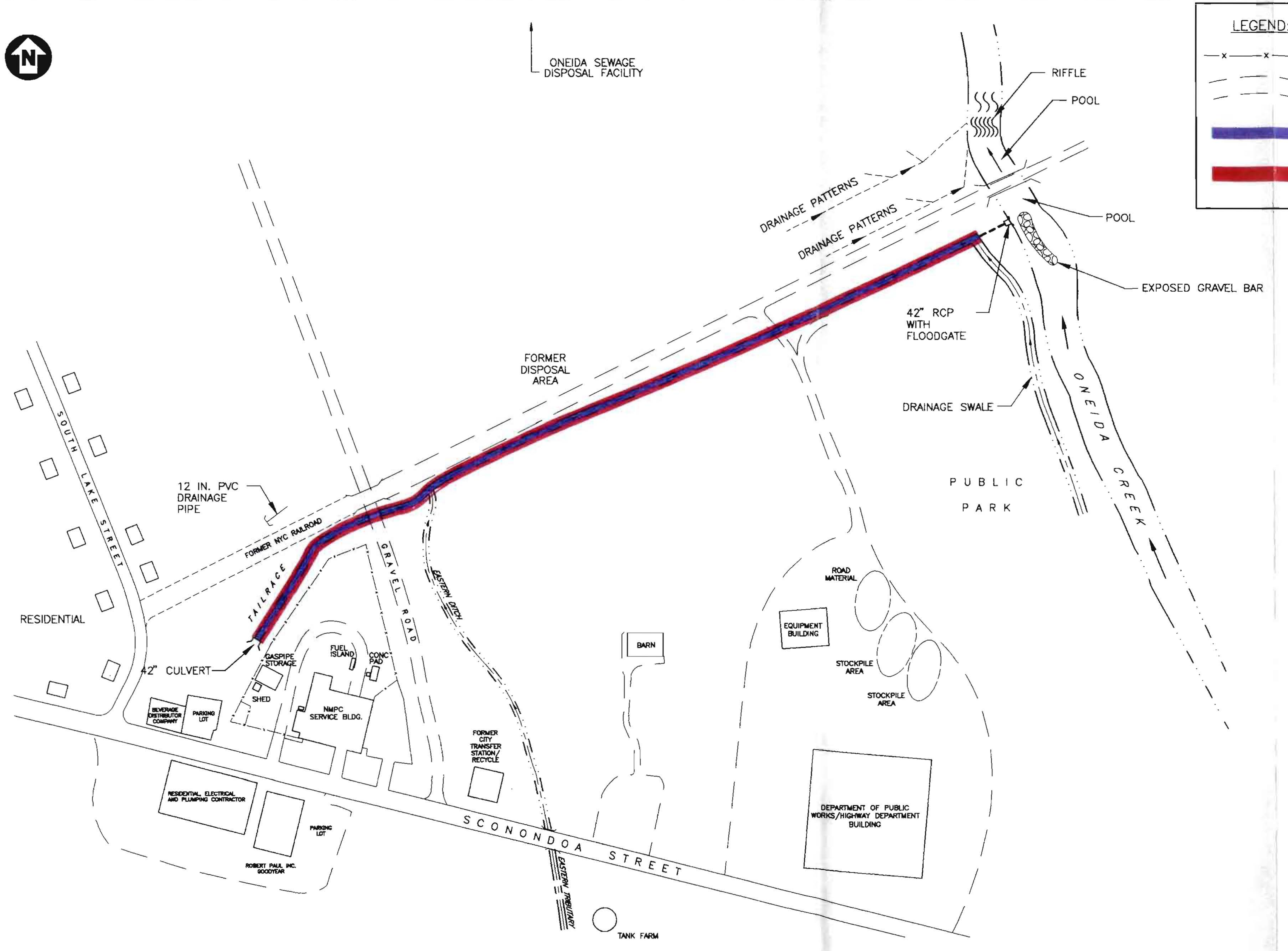
NIAGARA MOHAWK

CITY OF ONEIDA
MADISON COUNTY, NEW YORK STATE

TAILRACE ALTERNATIVES
No 1 AND 2

SCALE
1" = 180'
DRAWING NUMBER
4.1



LEGEND:

—x——x—	FENCE
— — —	GRAVEL ROAD
🟦	SEDIMENTS TO BE EXCAVATED TO 4.0 FT DEPTH
🟥	SPOILS TO BE EXCAVATED TO 5.0 FT DEPTH

NOTES:

1. THIS DRAWING IS BASED UPON NMPC'S ONEIDA SERVICE CENTER TOPOGRAPHIC MAP, DRAWING NUMBER D-51348-C DATED MAY 28, 1993. OFFSITE FEATURES DERIVED FROM AERIAL PHOTOGRAPHY, USGS 7.5 MINUTE ONEIDA QUADRANGLE AND FIELD OBSERVATIONS.
2. WETLAND LOCATIONS FROM USFWS NWI MAPS (1991) AND NYSDEC ARTICLE 24 WETLANDS MAP. BOUNDARIES DRAWN DO NOT DEPICT JURISTICTIONAL DELINEATION.

180' 90' 0 180'

Approximate Scale in Feet

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NO.	DATE	REVISION	BY

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DRAWN BY: SEH	08/04/97
CHECKED BY:	

ENGINEER NA
REGISTRATION NUMBER NA DATE NA

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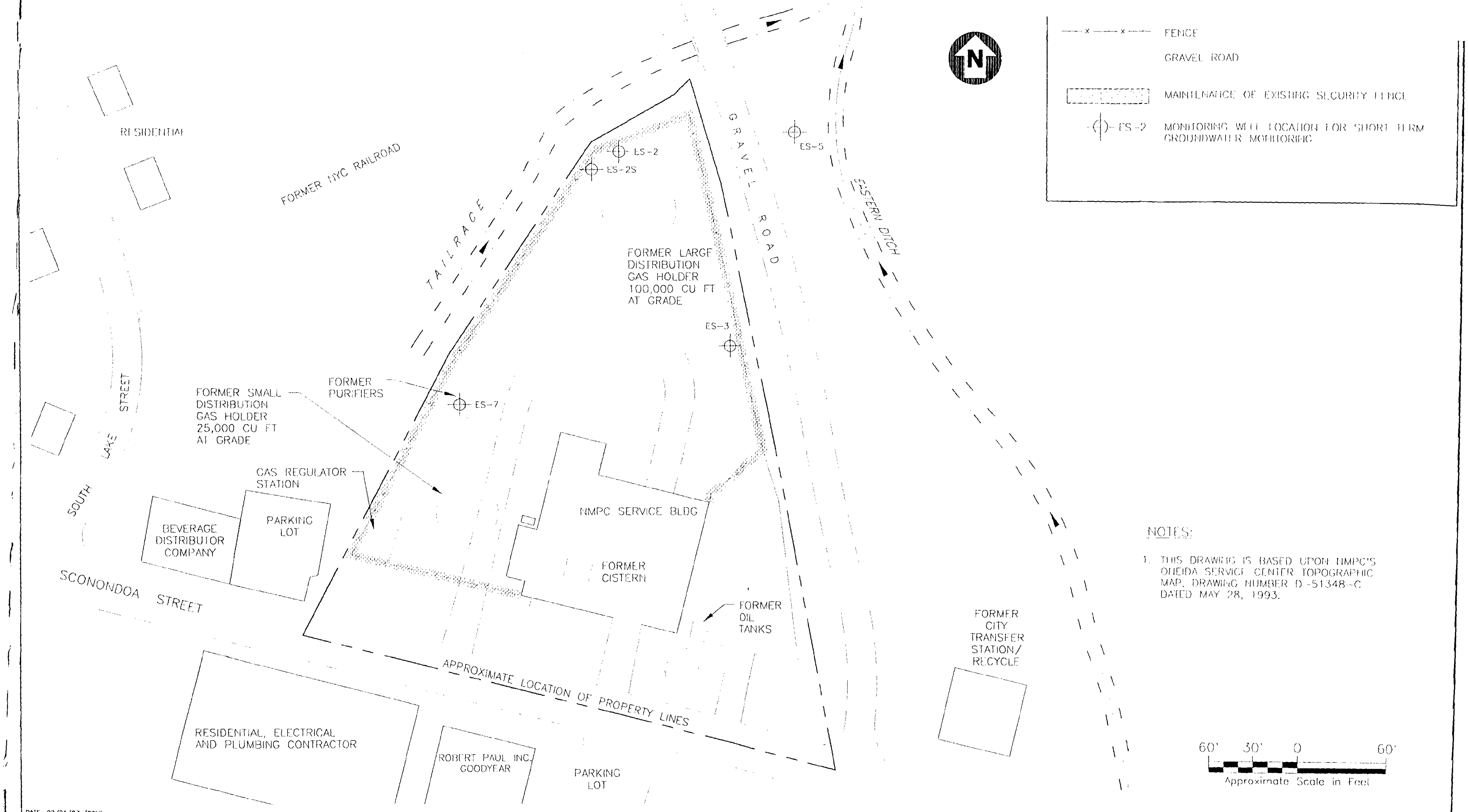
MADISON COUNTY, NEW YORK STATE

TAILRACE ALTERNATIVE No 3

SCALE 1" = 180'
DRAWING NUMBER 4.2



NOTES:

1. THIS DRAWING IS BASED UPON NMPC'S ONEIDA SERVICE CENTER TOPOGRAPHIC MAP, DRAWING NUMBER D-51348-C DATED MAY 28, 1993.

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NO.	DATE	REVISION	BY

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DRAWN BY: SEH DATE 08/04/97
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ENGINEER NA
REGISTRATION NUMBER NA DATE NA

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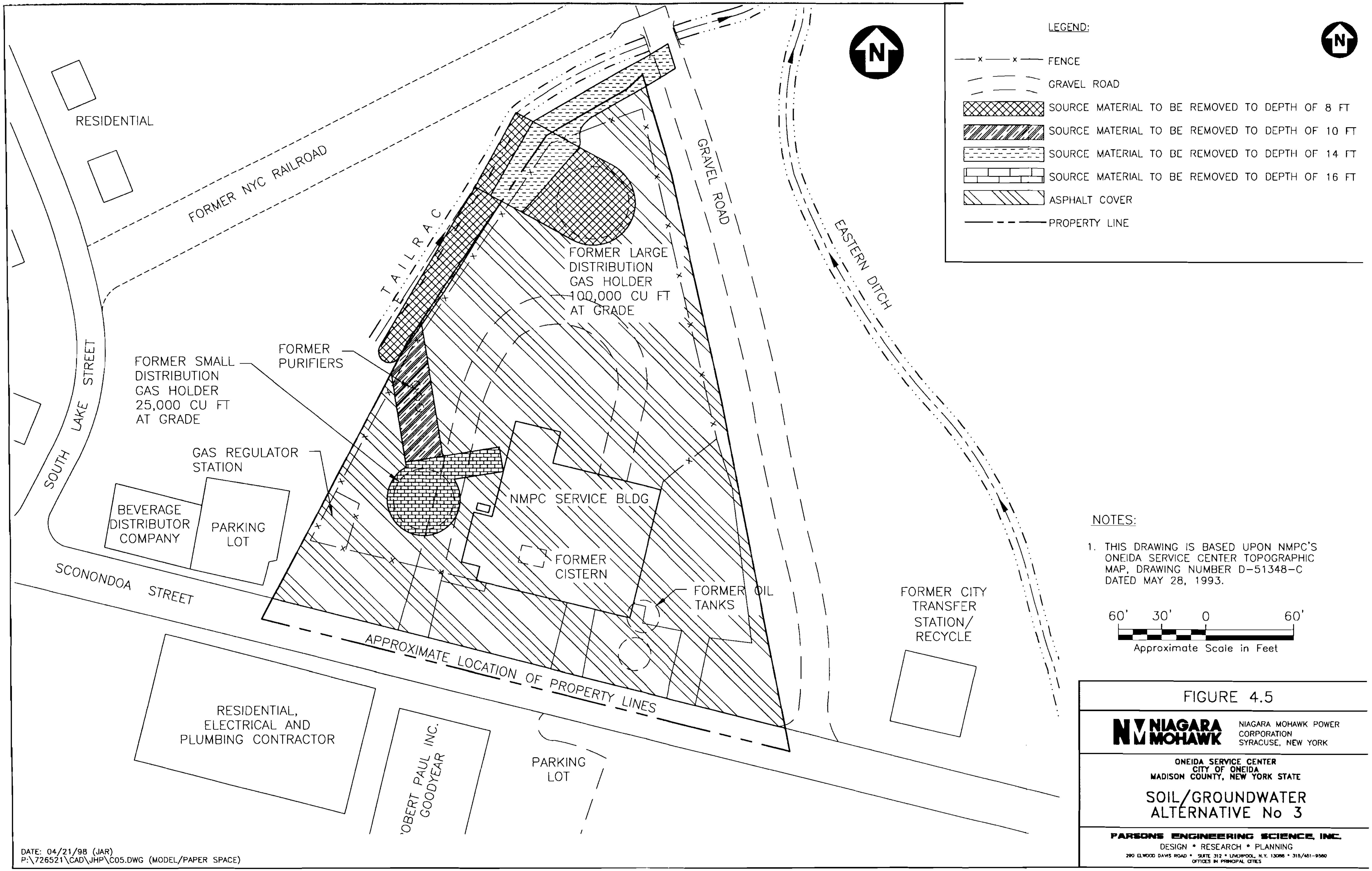
MADISON COUNTY, NEW YORK STATE

SOIL/GROUNDWATER ALTERNATIVE No 1

SCALE 1" = 60'
DRAWING NUMBER 4.3



NOTES:

1. THIS DRAWING IS BASED UPON NMPC'S ONEIDA SERVICE CENTER TOPOGRAPHIC MAP, DRAWING NUMBER D-51348-C DATED MAY 28, 1993.

FIGURE 4.5

NIAGARA MOHAWK
NIAGARA MOHAWK POWER CORPORATION
SYRACUSE, NEW YORK

ONEIDA SERVICE CENTER
CITY OF ONEIDA
MADISON COUNTY, NEW YORK STATE

SOIL/GROUNDWATER
ALTERNATIVE No 3

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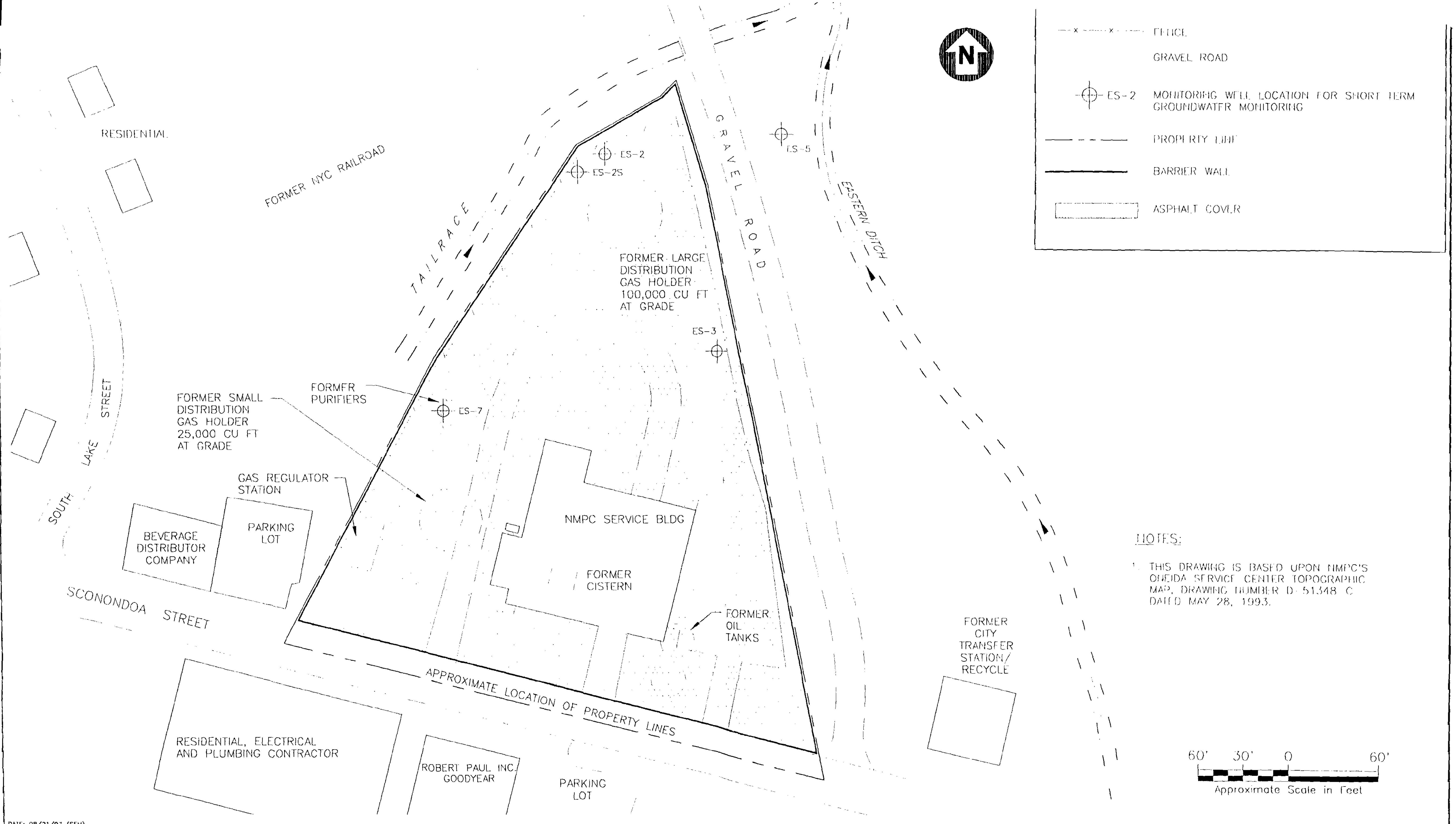

NOTES:

1. THIS DRAWING IS BASED UPON NMPC'S ONEIDA SERVICE CENTER TOPOGRAPHIC MAP, DRAWING NUMBER D-51348-C DATED MAY 28, 1993.

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DRAWN BY: SEH | 08/04/97
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REGISTRATION NUMBER NA DATE NA

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CITY OF ONEIDA
MADISON COUNTY, NEW YORK STATE

SOIL/GROUNDWATER ALTERNATIVE No 2

SCALE 1" = 60'
DRAWING NUMBER 4.4

Potentially applicable technologies discussed in Section 3 for remediating the sediment and spoils associated with the Tailrace are all incorporated into one or more of the proposed alternatives, except for sediment containment and sediment covering. Sediment containment with temporary sheet pile is unnecessary, because stormwater flows can be rerouted around the area during sediment and spoils excavation. The Tailrace water is typically a maximum of three to four feet deep at most, and the sediment PRG exceedances are not likely to be found at depths greater than 4 feet below the bottom of the Tailrace. Sediment covering is not an option based on the City of Oneida's needs to maintain the Tailrace invert elevations to adequately handle stormwater inputs. Another note about the retained technologies listed in Table 3.3 is that specific treatment and disposal options (type, location, etc.) for the soil and sediment are left for evaluation during the remedial design following this feasibility study. Off-site treatment and disposal is proposed over on-site treatment and disposal primarily based on anticipated future land use and costs.

Impacted groundwater from the Site is not contributing significantly to the constituents found in the Tailrace sediment and surface water. Partitioning calculations and flux calculations confirm that groundwater is not a significant source of impacts to the Tailrace sediment (see Appendix F) and that historic direct discharges to the Tailrace and upgradient sources are most likely the sources of impacts.

Potential impacts of on-site groundwater on Tailrace sediment organic MGP residual concentrations (i.e., BTEX and PAHs) have been quantified. These quantified impacts are based on calculations presented in Section 2 of Appendix F. Maximum estimated concentrations of MGP residual organics in sediment from the on-site groundwater with the highest MGP residual organic concentrations (i.e., ES-2S) are less than 10 milligrams per kilograms (mg/kg) except for two PAHs that have estimated maximum sediment concentrations of 20 to 80 mg/kg. By comparison, maximum sediment concentrations measured in Tailrace sediment for these two MGP residual organics are 2,700 and 9,600 mg/kg. Based on these conservatively high estimates of up to 80 mg/kg partitioned from groundwater to sediment, such partitioning does not appear to be significantly impacting Tailrace sediments. The Tailrace sediments were likely impacted primarily by direct releases to the Tailrace rather than by migration of residuals through the groundwater.

The Tailrace alternatives address both remedial action objectives (RAOs) for the Tailrace: (1) eliminating contact with sediments and dredge spoils exceeding PRGs, and (2) continuing use of the Tailrace as a stormwater drainageway to the Oneida Creek.

<u>Alternative 1</u> - Limited Sediment Removal and Placement of Culvert

1. Temporarily bypass Tailrace surface water flow.
2. Excavate approximately 1,220 cubic yards of sediment for placement of culvert. Manage excavated sediment off-site based on previous investigation results. Volume estimates are presented in Appendix C.
3. Place a 48-inch diameter culvert with a 0.5% gradient. A minimum 48-inch diameter culvert is necessary to carry the flow for a peak runoff rate (based on a 25-year, 24-hour

rainfall event). The City of Oneida has requested that the upstream and downstream invert elevations and the gradient be maintained.

4. Cover culvert and existing spoils area with 1.5 feet of unclassified fill and 6 inches of topsoil and vegetate.

Alternative 2 - Sediment Removal and Restoration of the Tailrace

1. Temporarily bypass Tailrace surface water flow.
2. Excavate approximately 1,780 cubic yards of sediment that exceeds PRGs (maximum depth of sample with PRG exceedance = 3.5 ft.). Manage excavated sediment off-site based on previous investigation results. Volume estimates are presented in Appendix C.
3. Replace excavated sediment with clean fill and recreate Tailrace.
4. Cover existing spoils area with 1.5 feet of unclassified fill and 6 inches of topsoil and revegetate to eliminate exposure pathways with spoils that exceed PRGs.

Alternative 3 - Sediment and Spoils Removal and Restoration of Tailrace and Banks

1. Temporarily bypass Tailrace surface water flow.
2. Excavate approximately 1,780 cubic yards of sediment that exceeds PRGs (maximum depth of sample with PRG exceedance = 3.5 ft.). Manage excavated sediment off-site based on previous investigation results. Volume estimates are presented in Appendix C.
3. Excavate approximately 2,960 cubic yards of spoils that exceed PRGs. Based on patterns of spoil deposition, these spoils extend up to 10 feet from either side of the Tailrace. These spoils were created from previous sediment removal efforts by the City of Oneida. Manage excavated spoils off-site based on previous investigation results. Volume estimates are presented in Appendix C.
4. Replace excavated sediments and spoils with clean fill and restore Tailrace and banks.
5. Cover excavated spoils area with 1.5 feet of unclassified fill and 6 inches of topsoil and vegetate.

4.2.2 On-site Soil/Groundwater Alternatives

Soil PRG exceedances are found on-site at depths up to 16 feet below ground surface (BGS). PRG exceedances in on-site soil exist mostly around the former large and small gas holder and purifier areas. Two samples, about 20 feet north of the site but south of the Tailrace, also contain PRG exceedances.

Areas with groundwater PRG exceedances correspond with areas showing on-site soil PRG exceedances with the exception of two monitoring wells (ES-3, ES-3S) along the eastern side of the property and ES-5, about 60 feet northeast of the site and downgradient of the former large gas holder. Each potential source was checked during investigations, and PAHs, BTEX, and metals make up most of the groundwater exceedances.

All six monitoring wells along the southern end of the site contain groundwater exceedances, but only for metals. While two of the metals can be associated with former MGP operations, the southern side of the Site is clearly upgradient based on the groundwater flow toward the northeast and the fact that lead, one of the exceedances, is a common urban pollutant.

A similar PRG exceedance situation exists for five off-site wells: groundwater from four of the five wells (i.e., ES-6, ES-11, ES-12, ES-13) contains only metal exceedances Groundwater from two off-site wells that are several hundred feet north of the site (ES-12, ES-13) is considered to contain background levels. Groundwater discharges from the site to the Tailrace and does not reach locations north of the Tailrace based on multiple rounds of water level measurements and groundwater flow modeling results conducted as part of this FS (see Appendix E). The fifth off-site well, ES-5, located 60 feet northeast of the Site, is much closer to the site than the other off-site wells and contains groundwater PRG exceedances for PAHs, BTEX, and metals.

The average flux or loading of dissolved MGP residuals being transported within groundwater to the Tailrace and subsequently to Oneida Creek has been estimated. Results of these estimates, as presented in Appendix F, are consistent with the surface water quality monitoring results which show no significant impacts on Oneida Creek water quality from benzene, PAHs or cyanide within on-site groundwater. In addition, containment or removal of source material is estimated to reduce benzene and PAH fluxes to Oneida Creek by approximately a factor of five. Furthermore, calculated fluxes or loadings of metals from on-site groundwater are up to two orders of magnitude lower than fluxes or loadings of metals from upgradient storm sewers based on existing conditions without on-site groundwater being contained or source materials being removed.

The potentially applicable technologies retained from Section 3 for remediating the soil and groundwater associated with the site have all been incorporated into the proposed alternatives. A critical point about one of the technologies, the pump and treat system, is its ineffectiveness in meeting groundwater PRGs. Over the last several years, the lack of effectiveness of pumping and treating groundwater for the purpose of groundwater remediation has been acknowledged. In 1989, the USEPA, in a directive about groundwater remediation at Superfund Sites, stated what had become widely accepted: that pumping groundwater can not bring groundwater concentrations down to levels that are below typical site PRGs for groundwater (USEPA, 1989a). A study published in 1991 by Oak Ridge National Laboratory further confirmed that groundwater pumping is ineffective for restoring groundwater quality to health-based concentrations due primarily to decreases in desorption of compounds from soil to groundwater and to the existence of immobile constituents either in the non-aqueous phase or trapped in zones of the subsurface with low hydraulic conductivity (Doty and Travis, 1991). It appears groundwater has not been remediated at any former MGP site to concentrations below health-based PRGs using pump and treat remediation.

On-site soils with PRG exceedances are addressed in at least one of the alternatives. Most of the groundwater PRG exceedances are addressed by soil removal, except for groundwater PRG exceedances at two off-site wells several hundred feet north of the site (ES-12 and ES-13) that are not impacted by the Site. The well along the Tailrace, ES-6, will be addressed along with the Tailrace spoils, while the well northeast of the site with PRG exceedances (i.e., ES-5) would fall under groundwater monitoring following on-site containment or source removal. Pumping groundwater from ES-5 or removing soil from the ES-5 vicinity would not significantly improve groundwater quality based on the inability of pump and treat systems to restore groundwater quality and based on soil concentrations not exceeding soil PRGs. Furthermore, pumping groundwater from ES-5 would result in withdrawing water from the adjacent Eastern Ditch and the Tailrace, which also inhibits the ability of pumping ES-5 to achieve capture. These points, in addition to local groundwater not affecting human health or the environment, make pumping of groundwater at ES-5 not cost effective.

The soil/groundwater alternatives meet the soil/groundwater RAOs of eliminating contact with surface soils exceeding PRGs, monitoring groundwater for off-Site impacts, determining the need for groundwater controls, and minimizing the potential impacts to the Tailrace via groundwater discharge from the Site. No off-site deed restrictions are considered at this time. Following is a brief description of each alternative:

Alternative 1 - Limited Action

1. Obtain a deed restriction, if needed, on the use of on-site groundwater.
2. Maintain existing fence around the site and post "No Trespassing" signs.
3. Conduct short-term groundwater monitoring on-site and directly northeast of the site to Year 5.
4. Evaluate whether to enhance intrinsic bioremediation of groundwater on-site and directly northeast of the Site.

Alternative 2 - Containment/treatment

1. Install a fully-encircling barrier wall around the Site. A fully-encircling wall would be necessary because a partially-enclosing wall is considered ineffective based on modeling results (see Appendix E). Operations may have to be temporarily relocated due to the deep excavation (43 feet deep) required to place the barrier wall.
2. Place an asphalt impermeable cap on-site to minimize water infiltrating into soil within the Site. A cross-section of this cap is shown in Figure 3.1.
3. Pump approximately two gallons per minute of groundwater inside the barrier wall to maintain an inward hydraulic gradient on-site. The estimated flow of two gallons per minute is based on groundwater flow modeling calibrated for the site as presented in Appendix E. Treat collected groundwater on or off-site.
4. Obtain a deed restriction, if needed, on the use of on-site groundwater.
5. Maintain existing fence around the site and post "No Trespassing" signs.
6. Conduct short-term groundwater monitoring on-site and directly northeast of the site with re-evaluation in Year 5.
7. Monitor groundwater to assess intrinsic bioremediation of groundwater on-site and directly northeast of the Site. Enhance if warranted.

Alternative 3 - Source Removal

1. Remove approximately 2,640 cubic yards of source material in the large and small holder areas to depths of 8 feet and 16 feet BGS, respectively, the maximum depths where PRG exceedances were found based on previous investigation results. Volume estimates are presented in Appendix C.
2. Remove approximately 2,477 cubic yards of source material to depths of 8 to 14 feet BGS in the area between the Tailrace and large holder, and upstream along the Tailrace, the maximum depths where PRG exceedances were found based on previous investigation results. Volume estimates are presented in Appendix C.
3. Remove approximately 890 cubic yards of source material to a depth of 10 feet BGS in the purifier slab area, the maximum depths where PRG exceedances were found based on previous investigation results. Volume estimates are presented in Appendix C.
4. Remove approximately 1,140 cubic yards of source material to a depth of 14 feet BGS in the area directly north of the Site, the maximum depths where PRG exceedances were found based on previous investigation results. Volume estimates are presented in Appendix C.
5. Manage excavated material off-site.
6. Replace excavated material with clean fill to pre-excavation grade and vegetate area near Tailrace.
7. Restrict the use of on-site groundwater via a deed restriction on the NMPC-owned property.
8. Conduct short-term groundwater monitoring on-site and off-site to Year 5.
9. Monitor groundwater northeast of the site and south of the Tailrace to assess intrinsic bioremediation of groundwater off-site.

4.3 EVALUATION CRITERIA

The detailed analysis of each alternative presented here uses the nine evaluation criteria outlined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Section 300.430; the USEPA "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA," (USEPA, 1988); and the NYSDEC TAGM 4030, "Selection of Remedial Actions at Inactive Hazardous Waste Sites." Each alternative is assessed to determine if it meets the following criteria:

Threshold Criteria

- Overall protection of human health and the environment
- Compliance with SCGs

Primary Balancing Criteria

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria

- State acceptance
- Community acceptance

For an alternative to be eligible for selection, the NCP requires that it meet the threshold criteria. If these criteria are met, the primary balancing criteria are evaluated to provide the best balance of trade-offs among alternatives. In addition, consideration is given to principal threats and practicable remediation (see 40 CFR Section 300.430(a)(1)(iii)). USEPA defines the term "principal threats" as one of two conditions: (1) toxic concentrations several orders of magnitude above levels for unrestricted use or (2) wastes that are both highly mobile and unable to be contained (USEPA, 1992). The term "practicable" is a Site-specific, subjective term. The USEPA has defined practicability for specific Sites based on cost effectiveness, impacts, implementability, and the extent of SCG compliance. In making the final selection of a preferred remedy, the modifying criteria are also considered.

The threshold and primary balancing criteria are evaluated in this section for each of the remedial alternatives. In terms of state acceptance, Parsons ES and NMPC have met with the NYSDEC and NYSDOH during the project, and the agencies will comment on this FS and then prepare the Proposed Remedial Action Plan and Record of Decision that specifies the site remedy. To address community acceptance, NMPC has made presentations at public meetings and solicited input from the community. Eventually, these modifying criteria will be evaluated in subsequent documents to be prepared by the State of New York: the Proposed Remedial Action Plan (PRAP) and the Record of Decision (ROD).

4.3.1 Overall Protection of Human Health and the Environment

The overall protection of human health and the environment criterion entails determining whether, considering the Site's characteristics and impacts, risks to human health and the environment are eliminated, reduced, or controlled. This assessment is based on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with SCGs.

4.3.2 Compliance with SCGs

This evaluation criteria is used to determine whether an alternative complies with the federal and state chemical-specific, location-specific, and action-specific SCGs identified in Section 2.

4.3.3 Long-term Effectiveness and Permanence

The long-term effectiveness and permanence of a remedial action depends on the following:

- Permanence of the remedial alternative,
- Magnitude of the risk remaining after remediation, and
- Adequacy and reliability of controls, if any, used to manage treatment residuals or untreated wastes that remain at the site following remediation.

4.3.4 Reduction of Toxicity, Mobility, or Volume

This criterion focuses on the impact of treatment technologies in eliminating any significant threats at a site through destruction of toxic contaminants, reduction of their total mass, or irreversible reduction of the total volume of contaminated media. The reduction of toxicity, mobility, or volume criterion includes consideration of the following:

- Type of treatment or recycling process and type of materials,
- Amount of hazardous materials that would be destroyed or treated, including how principal threats would be addressed,
- Degree of expected reduction in toxicity, mobility, or volume estimated wherever reasonably possible as a percent reduction,
- Degree to which treatment would be irreversible,
- Type and quantity of residuals that would be present following treatment, and
- Fulfillment of the preference for treatment as a principal element.

4.3.5 Short-term Effectiveness

Short-term effectiveness encompasses the effects of an alternative on human health and the environment during the construction and implementation phase until RAOs are met. Short-term effectiveness considers the following:

- Protection of the community during remedial construction activities,
- Environmental impacts to site NMPC employees and remediation workers during remedial construction activities,
- Time until remedial response objectives are achieved, and
- Protection of workers during remedial construction activities.

4.3.6 Implementability

Implementability considers the technical and administrative feasibility of implementing an alternative and the availability of the services and materials required during its implementation. The implementability evaluation involves examining the issues of:

- Construction and operation,
- Reliability of technology,
- Monitoring considerations,
- Ease of undertaking additional remedial actions,
- Activities needed to coordinate with other offices and agencies, including NMPC's on-site utility operations,
- Availability of adequate off-Site treatment, storage capacity, and disposal services, and
- Availability of necessary equipment, specialists, skilled operators, and provisions to ensure any necessary additional resources.

4.3.7 Cost

The cost evaluation assesses estimated capital costs and annual operation and maintenance (O&M) costs. Capital costs consist of present and future and direct and indirect expenses. Direct capital costs include engineering, labor, equipment, and material expenses. Indirect capital costs include expenditures for engineering, licenses, permits, contingency allowances, and other services not part of the actual installation costs. O&M costs are the annual costs incurred after the remedial actions are constructed and may include, but are not limited to operating labor, energy, chemicals, and sampling and analysis.

In this FS, present worth for each alternative was calculated using a service life of 30 years wherever long-term operation and maintenance is needed, following remediation and a discount rate of 4 percent. A 4 percent discount is calculated according to the NYSDEC TAGM 4030, which recommends using a discount rate equivalent to the 30-year U.S. Treasury bond rate before taxes and after inflation (see Appendix C).

Individual alternative cost estimates and cost assumptions used in the development of alternatives are provided in Appendices B and C.

4.4 DETAILED EVALUATION OF ALTERNATIVES

The evaluation of the alternatives is divided into two sections: Tailrace alternatives and soil/groundwater alternatives. Within each section, three alternatives are described and evaluated using each of the criteria described above, except for the modifying criteria.

4.4.1 Evaluation of Tailrace Alternatives

4.4.1.1 Evaluation of Alternative 1 - Limited Sediment Removal and Placement of Culvert

Alternative Description

The purpose of this alternative would be to replace the open ditch with a culvert and to cap dredge spoils with a permeable cover. Surface water flowing into the Tailrace would be bypassed temporarily using dams and flexible hosing. Approximately 1,220 cubic yards of sediment along the entire length of the Tailrace would be removed to a depth of 2.5 feet, which is the average depth required to place the culvert at a 0.5 % gradient as per the request by City of Oneida to maintain the Tailrace's invert upstream and downstream elevations. Excavated sediment would be properly managed off-site at an appropriate location. Since the City of Oneida is interested in making improvements to the Tailrace while maintaining its invert elevations and gradient, a 48-inch diameter culvert would be placed in the ditch at a 0.5% gradient and covered with 1.5 feet of clean fill and six inches of topsoil. The spoils area, consisting of a 5- to 10-foot wide area on either side of the Tailrace, would be covered with six inches of topsoil as well. Both the culvert and the spoils area would be vegetated with a wildflower seed mix.

Overall Protection of Human Health and the Environment

Alternative 1 would provide some protection to human health and the environment. Sediments and spoils with PRG exceedances would remain, but contact with these media would be reduced and risks associated with these exceedances would be controlled with a permeable cover. Groundwater discharging gradually to the Tailrace would be transferred directly through the culvert pipe to Oneida Creek. However, the impact of this groundwater on Oneida Creek would be negligible based on groundwater to surface water flux calculations shown in Appendix F and based on surface water quality monitoring results within the Tailrace.

Compliance with SCGs

This alternative would not meet a majority of the SCGs, particularly the chemical-specific SCGs, because much of the sediment with PRG exceedances would remain in place. The alternative would not meet the off-site soil PRGs either; spoils with PRG exceedances would remain in place. The culvert and permeable cover, though, would help reduce contact with impacted sediment and spoils.

Long-term Effectiveness and Permanence

More than half of the impacted sediment would be removed. Mobility of constituents within the dredge spoils would be considerably reduced by the permeable cover. Although removal of some of the impacted sediment would take place, the permeable cover over remaining sediment and spoils would need to be properly maintained in order to be effective in the long term.

Reduction of Toxicity, Mobility, or Volume

More than half of the volume of sediment with PRG exceedances would be removed, as would the risk of constituent migration. It is unlikely that these residuals could migrate through the bedding and culvert material, and the permeable cover would further reduce constituent mobility.

The volume of impacted spoils would remain, and the placement of a permeable cover would reduce the physical mobility of constituents due to erosion.

Short-term Effectiveness

Alternative 1 would be very effective in the short term, assuming measures were taken to protect the community, the environment, and the workers during sediment excavation. Proper material handling would need to be implemented.

Implementability

This alternative could be easily implemented: Clearing would consist of removing the mostly small brush lining the banks of the Tailrace. Sediment excavation would consist of damming 200-foot segments of the Tailrace, bypassing the water, and excavating the sediments within each dry segment. Damming and sediment excavation of the entire length of the Tailrace at one time would be difficult due to the three inflows into the Tailrace from the culvert northwest of the Site, the Eastern Ditch, and the drainage swale. By excavating in 200-foot segments, water from these sources could be bypassed more easily by damming before or after the points at which they intersect the Tailrace. The impacted sediments would be treated and disposed of off-Site.

Cost

Total Capital Costs	$390,000

Maintenance for the Tailrace following remediation would be conducted by the City of Oneida.

4.4.1.2 Evaluation of Alternative 2 - Sediment Removal and Restoration of Tailrace

Alternative Description

The purpose of this alternative would be to remove, treat, and/or dispose of the impacted sediments, restore the Tailrace, and cap the remaining spoils. The Tailrace surface water would be bypassed temporarily during construction as in Tailrace Alternative 1. Sediments would be removed to 0.5 foot beyond the depth where PRG exceedances have been observed along the entire length of the Tailrace. Excavated sediment would be managed off-site at an appropriate location. Clean fill would replace the excavated sediment and restore the Tailrace according to the City of Oneida's request for improved drainage. Existing intermediate culverts would remain in place. For drainage and costing purposes, the remediated Tailrace was assumed to have the following dimensions: bottom width of 5 feet, side slopes of 1 to 2 (vertical to horizontal), and total width of 15 feet. Approximately 80 cubic yards of bank (spoils) material would be removed to achieve the desired slope of 1:2. A permeable cover of clean fill, topsoil, and wildflowers would be placed over the spoils area.

Overall Protection of Human Health and the Environment

This alternative would provide some protection of human health and the environment. Potential long-term human and environmental exposure to sediment would be eliminated by excavation and disposal. Exposure to impacted spoils would be reduced with the placement of a permeable cover.

Compliance with SCGs

Sediment removal would comply with sediment SCGs. Leaving the spoils in place would not meet soil SCGs, but the permeable cover would reduce contact with these spoils.

Long-term Effectiveness and Permanence

This alternative includes removing and treating impacted sediment and associated risk, making it a permanent remedy. Existing dredge spoils would remain in place. A permeable cover would reduce the risk of exposure to the spoils through inhalation, ingestion, or dermal contact.

Reduction of Toxicity, Mobility, or Volume

This alternative would effectively remove and treat 1,780 cubic yards (i.e., 100 percent) of the sediment exceeding the sediment PRGs, thus reducing the toxicity, mobility, and volume of impacted sediment within the Tailrace. The toxicity or volume of impacted spoils would not be reduced, but the permeable cover would reduce the physical mobility of spoil constituents.

Short-term Effectiveness

The short-term effectiveness of this alternative would be similar to that of Alternative 1 in that proper material handling methods and procedures would need to be implemented to minimize impacts to the community, the environment, and the workers.

Implementability

Overall, implementation of this alternative would not be difficult, but it would require long-term maintenance of the Tailrace, which would entail regular sediment removal within the Tailrace by the City of Oneida as sediments are deposited over time, in order to keep the flow from backing up during storm events.

Cost

Total Capital Costs	$369,000

Maintenance for the Tailrace following remediation would be conducted by the City of Oneida.

4.4.1.3 Evaluation of Alternative 3 - Sediment and Spoils Removal and Restoration of Tailrace and Banks

Alternative Description

The purpose of Alternative 3 is to eliminate sediment and spoils that exceed PRGs based on the investigation results and to restore and improve the Tailrace as a drainageway. The Tailrace surface water would be bypassed temporarily during construction as in Tailrace Alternative 1. Sediments exceeding the PRGs would be removed in the same way as presented for Tailrace Alternative 2. Existing spoils exceeding the PRGs would be removed by excavating to a depth of five feet along the entire length of the Tailrace. Hand auger borings showed PRG exceedances in the spoils to a depth of 3.5 feet, but these borings only reached a final depth of 4 feet. Odors and occasional discontinuous blebs of product were observed at the bottom of these borings, so an additional foot was added to the final sampling depth of 4 feet to obtain an excavation depth. Excavated sediment and spoils would be properly managed off-site at an appropriate location. Clean fill would be brought on-site to replace excavated materials and to restore the Tailrace and its banks to their original grade prior to sediment deposition by the city. The dimensions of this Tailrace would be the same as in Tailrace Alternative 2. Finally, the area where spoils would be removed would be covered with 6 inches of topsoil and revegetated with a wildflower seed mix.

Overall Protection of Human Health and the Environment

Alternative 3 would eliminate potential health and environmental impacts by completely removing sediments and spoils at locations where PRGs have been exceeded, based on investigation results.

Compliance with SCGs

This alternative would meet relevant chemical-specific, action-specific, and location-specific SCGs presented in Section 2.

Long-term Effectiveness and Permanence

With the removal and subsequent off-site treatment and/or disposal of 4,740 cubic yards of sediment and spoils exceeding PRGs, the magnitude of potential risk remaining would be insignificant. These sediment and spoils would be permanently removed and no residuals warranting controls would remain.

Reduction of Toxicity, Mobility, or Volume

Approximately 4,740 cubic yards of sediment and spoils exceeding the PRGs would be removed and treated and/or disposed, so that 100 percent reduction of mobility and volume of sediment and spoils along the Tailrace that exceed PRGs would be achieved. Toxicity reduction would be 100 percent on-site and a somewhat lower percentage overall depending on the extent that the sediment and spoils are treated.

Short-term Effectiveness

The short-term effectiveness of this alternative would be similar to that of Alternative 1 in that proper material handling methods and procedures would need to be implemented to minimize impacts to the community, the environment, and the workers.

Implementability

Alternative 3 can be implemented easily. As in Alternative 2, the Tailrace would have to be regularly maintained by the City of Oneida to accommodate storm water events.

Cost

Total Capital Costs	$798,000

Maintenance for the Tailrace following remediation would be conducted by the City of Oneida.

4.4.2 Evaluation of Soil/Groundwater Alternatives

4.4.2.1 Evaluation of Alternative 1 - Limited Action

Alternative Description

This limited action alternative is evaluated as a baseline to compare the overall effectiveness of each remedial alternative. The current security fence around the site would be maintained and "No Trespassing" signs would be posted to prevent unauthorized access into the property. If necessary, a deed restriction would be obtained to restrict the use of on-site groundwater. Groundwater would be monitored for five years to define more fully groundwater quality over time. Intrinsic bioremediation would be evaluated to determine the need for enhancement. If warranted, enhancement of intrinsic bioremediation would be conducted.

Overall Protection of Human Health and the Environment

Alternative 1 would not contain or eliminate the impacted soils that are most likely contributing to groundwater PRG exceedances. However, the extent of impacted groundwater has been defined and no groundwater users currently exist. Groundwater is not considered a human health exposure pathway for two reasons: (1) the municipal water supply serves the Site and surrounding areas and (2) suitability of a drinking water source downgradient of the Site would need to be demonstrated to the County Health Department.

A potential risk does exist, however, within the Tailrace if groundwater is not controlled. The magnitude of this risk varies depending upon flows of water from upstream that converge with groundwater migrating to the Tailrace from the Site. This risk is shown based on flux calculations within Appendix F to be insignificant (i.e., above applicable surface water quality criteria) once the water reaches Oneida Creek. In addition, concentrations within the Tailrace for metals contributed by on-site groundwater are up to two orders of magnitude lower than metal concentrations contributed by upgradient storm sewers.

Compliance with SCGs

Since no containment or removal of soil would occur as part of this alternative, chemical-specific SCGs for soil and groundwater would not be met.

Long-term Effectiveness and Permanence

This alternative is not considered a permanent remedy. Two test pit samples, each near one of the former gas holder areas, contained PRG exceedances within the top 6 feet of soil. Human health risks through potential ingestion or dermal exposure to surface soil would be somewhat minimized by the existing fences, the posting of signs, and NMPC's acquisition of a deed restriction for on-site NMPC property. No direct engineering controls would be used to prevent exposure to impacted soil and groundwater. The fence is susceptible to wear and vandalism, so annual inspection and repair would be required. Groundwater monitoring would track groundwater quality for five years. Intrinsic bioremediation would be enhanced, as warranted, to improve groundwater quality to the extent reasonably possible. As noted above, no groundwater users currently exist and no risk is anticipated from the impacted groundwater.

Reduction of Toxicity, Mobility, or Volume

A reduction in the toxicity, mobility, or volume of the impacted soil and groundwater would not be achieved.

Short-term Effectiveness

No remedial action would be implemented for groundwater. However, any potential risks would be reduced by preventing unnecessary contact with or use of impacted soil or groundwater. Additionally, no users of or risk associated with the impacted groundwater exist.

Implementability

A deed restriction for NMPC property can be implemented at NMPC's initiative. Short-term groundwater monitoring would require data management and assessment.

Cost

Total Capital Costs	$13,200
Total O&M Present Worth	$84,900
Total Present Worth of Alternative	$98,100

4.4.2.2 Evaluation of Alternative 2 - Containment/Treatment

Alternative Description

A fully-encircling barrier wall would be installed to contain groundwater within the Site. A partial barrier wall was not considered effective as a result of evaluation of hydraulic barrier options using groundwater modeling (see Appendix E). The length of the barrier wall would be approximately 1,280 feet, as shown in Figure 4.4, and the depth to which it would be anchored would be five feet below the top of the clay confining layer, which averages 38 feet BGS. Five feet is a reasonable length for the barrier wall to anchor into so that it is stable. An asphalt cap would be placed on the Site. On-site groundwater would be extracted using a single 2-gpm extraction well, as estimated based on groundwater flow modeling (see Appendix E). For costing purposes, on-site treatment using a prefilter and granular activated carbon treatment system was assumed. Off-site monitoring wells with groundwater that exceeds PRGs would not be addressed for the following reasons:

- ES-12 and ES-13, both more than 300 feet north of the Site, have PRG exceedances of lead only, which is a common urban constituent of groundwater. These wells most likely represent background levels of contamination. The lead levels found in these wells are below the levels found in two upgradient wells, ES-4S and ES-10S, at the southern end of the Site. Furthermore, these monitoring wells are unlikely to have been affected by the Site, considering that the groundwater flow from the site is toward the Tailrace and Eastern Ditch and would not reach these wells to the north (see Appendix E, Figure E-4).
- ES-11, about 250 feet northeast of the Site, contains non-MGP-related PRG exceedances for metals such as aluminum, iron, and manganese. Well ES-11 is also unlikely to have been impacted by groundwater from the site for the same reason as for ES-12 and ES-13. Moreover, the site neighbor who owns the property on which a private well is found has reported that their well is not used as a drinking water source and that an unknown quantity of oil was spilled directly into the well (NMPC, 1997).
- ES-5, located about 70 feet northeast of the Site, does show groundwater with exceedances of groundwater PRGs, specifically for PAHs, BTEX, and various metals. An activity use limitation by the off-site property owner may be appropriate for this area of impacted groundwater if there is any possibility this groundwater would be used in the future. Groundwater is not considered an exposure pathway for two reasons: (1) the municipal water supply serves the Site and surrounding areas, and (2) installation of drinking water wells downgradient of the Site is prohibited by the City of Oneida. Monitoring and, as needed, enhancement of in situ groundwater treatment based on intrinsic bioremediation can be conducted for this off-site groundwater.

Deed restrictions, fence maintenance, and short-term monitoring, as described in Alternative 1, would also be included in this alternative, and groundwater would be monitored to assess intrinsic bioremediation processes.

Overall Protection of Human Health and the Environment

This alternative would reduce potential risks to human health and the environment by minimizing the discharge of impacted groundwater off-site to the Tailrace and to Oneida Creek and areas adjacent to the site by maintaining an inward hydraulic gradient toward the extraction well. Fluxes of MGP residual organics to Oneida Creek are estimated to be reduced by approximately a factor of five (see Section 1 of Appendix F). The asphalt cap would eliminate contact with the impacted groundwater on-site.

Compliance with SCGs

This alternative would not meet the soil or groundwater SCGs on-site, because source materials would remain in place and continue to impact on-site and, to a lesser extent, off-site groundwater. Groundwater off-site at ES-5 would be monitored to assess whether BTEX and PAH concentrations would decrease as a result of source containment and intrinsic bioremediation.

Treated groundwater would have to meet the City of Oneida acceptance criteria for discharge to a sanitary sewer, meet SPDES requirements for a discharge to the Tailrace or to Oneida Creek, or be shipped off-site for proper treatment and disposal. Preliminary discussions with the City of Oneida indicate pretreatment would be required to the lowest detectable limit or to levels equivalent to those found in Oneida Creek (Personal Communication, 1997a).

Long-term Effectiveness and Permanence

Although the groundwater would be contained, long-term collection and treatment of approximately two gpm of groundwater would be required because source materials would remain and continue to be in contact with groundwater. Also, long-term acceptance of the treated effluent by the City of Oneida as inflow to its sanitary sewer system is uncertain. This alternative is not a permanent remedy.

Reduction of Toxicity, Mobility, or Volume

Toxicity, mobility, and volume of the impacted groundwater would be reduced. Toxicity would be gradually reduced as a result of treating extracted groundwater. Estimating a percent reduction in groundwater toxicity would vary with each constituent and with time. Mobility of groundwater would be restricted to within the barrier wall. The volume of groundwater inside the wall would be reduced by pumping.

A small reduction (i.e., less than 10 percent) in the toxicity, mobility, or volume of the impacted soil on-site would also occur with the removal of approximately 1,800 cubic yards of site perimeter soil resulting from installing the barrier wall.

Short-term Effectiveness

No significant short-term impacts from remedial activities are anticipated for remedial workers, residents, or the environment. Temporary moving of operations and of materials stored on-site may be needed to place the wall. Appropriate levels of personal protection and health and safety planning would be required during the excavation and materials handling during the placement of the asphalt cover and barrier wall. Dust suppression measures for controlling fugitive dust generated during the remedial activities, such as use of water sprays and modification of soil handling rates and timing, would be implemented when necessary. Air monitoring would also be conducted during implementation of this alternative to ensure that any potential off-Site migration of the chemical constituents in the form of dust or vapors is within the pre-defined acceptable limits specified in the Site-specific health and safety plan.

Implementability

In the short-term alternate arrangements for vehicle parking would be needed, but neither NMPC crews nor subsurface utilities would need to be temporarily relocated. The asphalt cover is easily implementable. The barrier wall would require excavation of approximately 9,000 yd.^{3} of soil of which approximately 1,800 cubic yards could not be backfilled assuming 20 percent of the excavated soil would be replaced with the wall. A groundwater collection system, capable of handling approximately two gallons per minute, would have to be constructed and would consist of a single extraction well, a pump, pump housing, piping, and a storage tank. An on-site groundwater treatment system with prefilter and granular activated carbon units may also be appropriate to install. This groundwater collection and treatment system would require a relatively small room-size area of heated, enclosed space on-site, depending in part on the size of the storage tank.

Implementability considerations associated with a deed restriction and groundwater monitoring would be the same as in Alternative 1.

Cost

Total Capital Costs	$1,770,000
Total O&M Present Worth	$1,390,000
Total Present Worth of Alternative	$3,160,000

These cost estimates are based on 30 years of groundwater system operation and maintenance. In fact, operation of such a system has no estimated end time.

4.4.2.3 Evaluation of Alternative 3 - Source Removal

Alternative Description

A total of approximately 5,800 cubic yard of soil with PRG exceedances would be excavated and removed from four areas. As shown in Figure 4.5, Soil in the former large and small gas holder areas would be excavated to depths of 8 feet and 16 feet, respectively, both depths the greatest depths at which PRG exceedances were found based on previous investigation efforts. In addition, soil in the area between the Tailrace and large holder and the area in and around the former purifier area would be removed to a depth of 8 to 14 feet and 10 feet, respectively, the greatest depth at which PRG exceedances were found. Excavation of these areas would also be based on the direction of groundwater flow, which is toward the Tailrace in these areas. Finally, a 110-foot by 20-foot area off-site, directly north of the Site, and a section northeast of the site 17 feet by 135 feet would be removed to a depth of 14 feet based on PRG exceedances. All saturated soils would be dewatered as needed because excavation would occur below the water table, which is an average of 6 feet BGS in these excavation areas. The water separated from excavated soil would be properly treated and disposed.

Imported, unclassified fill would be used to backfill the excavated areas. An asphalt cover would be installed on the site that is suitable for continuing to use the site as it is currently. The excavated area along the Tailrace would be revegetated with wildflowers. Off-site groundwater exceedances would be addressed as in Alternative 2. On-site deed restrictions, short-term groundwater monitoring, and the assessment of intrinsic bioremediation would be the same as presented in Alternative 2.

Overall Protection of Human Health and the Environment

This alternative would provide overall protection of human health and the environment by eliminating the identified source materials. Fluxes from MGP residual organics within groundwater currently migrating to the Tailrace would be reduced to the maximum extent realistically possible. Groundwater would be monitored for five years following source removal. As warranted, intrinsic biormediation of groundwater downgradient of the source removal could potentially be enhanced to further reduce groundwater BTEX and PAH concentrations.

Compliance with SCGs

Soil exceeding the PRGs and the source material associated with the holders and purifier slab would be excavated. SCGs would be met on-site, because the sources identified during the previous investigation and, thus, the potential for future impacts on groundwater would be removed. Groundwater off-site at ES-5 would be monitored to assess effects of source removal and intrinsic bioremediation on groundwater BTEX and PAH concentrations.

Long-term Effectiveness and Permanence

Removal of the identified source materials would substantially reduce the magnitude of risk remaining after remediation. The only impacted soil remaining following remediation would be soil that does not have concentrations exceeding PRGs. Groundwater would be monitored for five years to verify the effectiveness of source removal.

Reduction of Toxicity, Mobility, or Volume

Off-Site treatment and/or disposal of the excavated soil would nearly eliminate the on-site toxicity, mobility, and volume of impacted material. The extent of toxicity reduction overall would depend on the extent of treatment provided. Mobility would be restricted to within the off-site disposal area where remedial wastes will be disposed in the future (e.g., a hazardous waste landfill, etc.).

Short-term Effectiveness

Such excavations, which are relatively small in size to proposed depths as much as 10 feet below the water table, can be effectively conducted. Short-term risks associated with this alternative would be minimized as long as worker exposure is controlled and measures are implemented to control storm water runoff, fugitive dust, and odor generation and to minimize spill potential during soil excavation and transportation off Site. Dust and odor suppression controls, such as wintertime excavation, simultaneous backfill with excavation, and tarping of stockpiled excavated materials, would be implemented as warranted. Ambient air monitoring would be performed to monitor particulate emissions during remediation.

Implementability

In the short-term, alternate arrangements for vehicle parking and possibly equipment storage would be needed. NMPC crews would most likely not need to be temporarily relocated. Due to source removal below the water table, installation of sheet piling, dewatering of the excavation, and construction of a dewatering pad would likely be required. A gasoline and a water line west of the Service Center building may need to be temporarily relocated. Wastewater generated from dewatering of the excavation and filtrate generated from the dewatering of saturated soils would be managed on-site or at an off-site treatment facility. Placement of an asphalt cover would be easily implementable.

Cost

Total Capital Costs	$1,576,000
Total O&M Present Worth	$58,000
Total Present Worth of Alternative	$1,634,000

4.5 COMPARISON OF ALTERNATIVES

The Tailrace and soil/groundwater alternatives evaluated for the former Oneida MRP site are summarized in Table 4.1. A comparison of the cost estimates for each alternative is presented in Table 4.2. In the section, Tailrace and soil/groundwater alternatives are compared based on the evaluation criteria.

4.5.1 Comparison of Tailrace Alternatives

Overall Protection of Human Health and the Environment

Tailrace Alternative 1 would provide limited protection of human health and the environment in that some sediment and all of the spoils with PRG exceedances would remain although they would be covered and contact with them would be minimized. Alternative 2 would provide protection similar to that of Alternative 1 because sediment with PRG exceedances would be removed, but spoils exceeding the PRGs would remain and be covered. Alternative 3 provides the most protection because all sediment and spoils with PRG exceedances would be removed, and, thus, any contact with them would be eliminated.

Compliance with SCGs

The alternatives range from minimal compliance (Alternative 1) to partial compliance (Alternative 2) to complete compliance (Alternative 3). While Alternative 2 addresses the sediment with PRG exceedances, Alternative 2 does not effectively address the spoils with soil PRG exceedances as Alternative 3 does.

TABLE 4.2

SUMMARY OF ONEIDA SITE ALTERNATIVE COST ESTIMATES

Remedial Alternative	Estimated Capital Cost	Estimated Total O&M Present Worth	Estimated Present Worth of Alternative
Tailrace Alternatives			
Alternative 1	$390,000	NA	$390,000
Alternative 2	$369,000	NA	$369,000
Alternative 3	$798,000	NA	$798,000
Soil/Groundwater Alternatives			
Alternative 1	$13,200	$84,900	$98,100
Alternative 2	$1,770,000	$1,390,000	$3,160,000
Alternative 3	$1,576,000	$58,000	$1,634,000

Notes:

1. The cost estimates include both capital and operating and maintenance expenses. The present worth cost for each alternative was estimated assuming a project life of 30 years and a 4% discount rate. Unit costs were obtained from vendor quotations, standard cost estimating documents (Means), or from extensive Parsons ES experience with similar projects.

2. NA = Not Applicable because O&M associated with the Tailrace is the responsibility of the City of Oneida.

Long-term Effectiveness

Tailrace Alternatives 1 and 2 would not be effective in the long term because neither completely addresses the impacted spoils. Alternative 3 removes impacted spoils, thereby eliminating the need for future remediation.

Reduction of Toxicity, Mobility, or Volume

Tailrace Alternative 1 would reduce the on-site mobility of constituents in more than half the volume (1,220 cubic yards) of sediment observed to have PRG exceedances and, to a lesser extent, the mobility of the constituents found in the dredge spoils. Instead of removal of the spoils exceeding soil PRGs and a reduction of volume, though, Alternative 1 would reduce the mobility of the constituents with the placement of a permeable cover of topsoil and vegetation. Alternative 2 would reduce the on-site toxicity, volume, and mobility of the approximately 1,780 cubic yards of sediment observed to have PRG exceedances whereas Alternative 3 would reduce the on-site toxicity, volume, and mobility of 1,780 cubic yards of sediment, plus 2,960 cubic yards of spoils with PRG exceedances.

Short-term Effectiveness

None of these alternatives would have serious human or environmental impacts during construction if precautionary measures and proper health and safety procedures are implemented during construction and operation.

Implementability

All three alternatives involve sediment excavation, which is easily implemented. The excavation of spoils in Alternative 3 should not be difficult to implement as well. Erosion control will be important to minimize potential short-term impacts due to storm events.

Cost

Alternative 3 is the most expensive alternative, at an estimated present worth of $798,000, primarily due to the more extensive removal of Tailrace sediments and spoils. Alternatives 1 and 2 have essentially the same cost of $390,000 and $369,000 respectively, excluding operation and maintenance costs that would be handled by the City. These operation and maintenance costs would be higher for Alternative 1 than for Alternative 2.

4.5.2 Comparison of Soil/Groundwater Alternatives

Overall Protection of Human Health and the Environment

Potential exposure to chemical constituents would be substantially reduced with Alternatives 2 and 3. Alternative 3 is more protective than Alternative 2 because source material would be removed to the maximum extent realistically possible. Alternative 1 would leave impacted media essentially unchanged and thus would not be protective.

Compliance with SCGs

While Alternative 2 addresses the soil above the water table and Alternative 1 does not, Alternative 2 does not address the on-site soil PRG exceedances, most of which were observed at or below the water table. Alternative 3, however, would eliminate on-site soil PRG exceedances and meet the remedial action objective of removing or controlling sources of significant impacts.

Long-term Effectiveness

Soil/Groundwater Alternative 1 would not provide long-term effectiveness and permanence. Untreated, impacted soils would be left in place, and monitoring of the groundwater would be required. Alternative 2 would result in groundwater containment, but soils exceeding PRGs would be left in place and continue to be in contact with on-site groundwater. Finally, Alternative 3 would be an effective means of ensuring long-term protection by substantially reducing risk to both human health and the environment because source materials would be excavated from the Site.

Reduction of Toxicity, Mobility, or Volume

Alternative 1 would not reduce the on-site toxicity, mobility, or volume of the constituents in the soil and groundwater. Alternative 2 would reduce the on-site toxicity, mobility, and volume of the constituents in groundwater. Alternative 3 would nearly eliminate the on-site toxicity, mobility, and volume of the constituents in the soil. Alternative 3 would also reduce impacts to groundwater by removing source material that affects the groundwater quality.

Short-term Effectiveness

There would be no significant short-term risks to the community, the environment, NMPC employees, or remediation workers associated with any of these alternatives as long as there is proper handling and monitoring of excavated soils and other source materials. Odor generation and other potential concerns with excavating up to 10 feet below the water table in Alternative 3 would require special precautions, which could include wintertime excavation, dust and odor control, and air monitoring.

Implementability

Alternative 1 would be very easy to implement. Alternatives 2 and 3 are also implementable but would require a significant amount of construction: an asphalt cap or impermeable cover, a barrier wall, a groundwater collection system, and a groundwater treatment system for Alternative 2 and deep soil excavation and the likely associated installation of sheet piling and soil dewatering for Alternative 3. Under Alternatives 2 and 3, temporary alternate arrangements for NMPC vehicle parking and possibly equipment storage would be needed, but NMPC crews would most likely not need to be temporarily relocated.

Cost

The least costly soil/groundwater alternative is Alternative 1 with an estimated present worth of $98,100. The most expensive alternative is Alternative 2 at an estimated present worth of $3,160,000 based on 30 years of groundwater containment. Alternative 3, with an estimated present worth of $1,634,000, is more expensive than Alternative 1, but still significantly less expensive than Alternative 2. The significant O&M effort associated with groundwater management in Alternative 2 contributes to its relatively high present worth cost compared to the other alternatives.

SECTION 5

RECOMMENDED ALTERNATIVES

5.1 DESCRIPTION OF THE RECOMMENDED ALTERNATIVES

From the evaluation presented in Section 4, the recommended alternatives are:

- Tailrace - Alternative 3: Excavation of approximately 4,700 cubic yards of sediment and dredged spoils and restoration of the Tailrace and its banks.
- Soil/Groundwater - Alternative 3: Removal of approximately 7,200 cubic yards of source material, restriction of groundwater use, and short-term groundwater monitoring off-site to the northeast for five years.

Elements of the recommended alternatives incorporate institutional controls, removal, and treatment/disposal. Soil/groundwater would need to be remediated before the Tailrace, because the Tailrace is downgradient of the Site.

Pre-design investigations are needed to confirm the maximum depth of PRG exceedances in the Tailrace, to define the extent of dredge spoils deposition along the Tailrace banks, to further define the extent of PRG exceedances in off-site soil due west of boring B-11, and to assess the source of sheens observed in sediments in the eastern ditch adjacent to the site.

Tailrace

- Temporary re-routing of surface water flowing into the Tailrace using dams (e.g., Portadam) and flexible hose.
- Removal of approximately 1,780 cubic yards of sediments exceeding the PRGs along the entire length of the Tailrace to a depth of 4 feet.
- Removal of approximately 2,960 cubic yards of spoils exceeding the PRGs along the entire length of the banks of the Tailrace to a depth of 5 feet.
- Restoration of the Tailrace and banks to their original grade (prior to Tailrace maintenance and sediment deposition by the City of Oneida) using clean, unclassified fill and re-vegetation of the banks.

Any future maintenance dredging of the Tailrace following remediation would be conducted by the City of Oneida in order to maintain local drainage.

Soil/Groundwater

- Temporary relocation of some vehicle parking and equipment storage area.
- Excavation of approximately 2,270 cubic yards of soil in the former large and small gas holder areas to depths of 8 feet and 16 feet, respectively.
- Excavation of approximately 3,400 cubic yards of soil between the Tailrace and large holder and in the area of the purifier slab, based on PRG exceedances and the direction of groundwater flow, to depths of 8 to 14 feet.
- Excavation of approximately 1,140 cubic yards of soil directly north of the site based on PRG exceedances to a depth of 14 feet.
- Management of excavated material off-site, which could include on-site blending or processing prior to off-site treatment and/or disposal.
- Replacement of excavated material with clean fill, to grade. Low permeability fill is recommended to be used within the source removal areas.
- Re-vegetation of the area along the Tailrace.
- Continued restriction of use of on-site groundwater, if needed.
- Short-term groundwater monitoring for five years and enhancement of intrinsic bioremediation off-site as warranted. Groundwater monitoring wells will also be placed on the western property line to monitor groundwater migrating from the site to the Tailrace.

In addition, an asphalt cover would be placed over the site so NMPC can continue to use the site as it is currently.

5.2 COMPARISON OF THE RECOMMENDED ALTERNATIVES TO EVALUATION CRITERIA

The National Contingency Plan and the USEPA Feasibility Study guidance document describe nine evaluation criteria that should be used to evaluate the suitability of any alternative for a given site (USEPA, 1988). These evaluation criteria are categorized into three groups:

Threshold Criteria

- Overall Protection of Human Health and the Environment
- Compliance with ARARs (or SCGs)

Primary Balancing Criteria

- Long-Term Effectiveness and Permanence

- Reduction of Toxicity, Mobility or Volume
- Short Term Effectiveness
- Implementability
- Cost

Modifying Criteria

- State Acceptance
- Community Acceptance

This section assesses the recommended alternative for the Oneida site under each of these nine evaluation criteria.

5.2.1 Overall Protection of Human Health and the Environment

According to the human health risk assessment performed for the RI, constituents in and around the former MGP site pose potential carcinogenic and non-carcinogenic impacts to current and future off-site residents. The assessment indicates that the risks potentially associated with former MGP operations are due primarily to exposure to PAHs and certain metals in soil and to benzene, PAHs, other SVOCs, and certain metals in sediments. Groundwater is not considered a human health exposure pathway for two reasons: (1) the municipal water supply serves the Site and surrounding areas and (2) the suitability of any new drinking source wells downgradient of the Site would need to be demonstrated to the Madison County Health Department. However, groundwater associated with the Site would nonetheless be monitored for five years to assess impacts of source removal and intrinsic bioremediation.

Ecological receptors impacted by the site are limited to plants and organisms within the Tailrace and spoils along the sides of the Tailrace. On-site groundwater does not reach the ground surface on-site so terrestrial plants and animals on-site are not impacted. Impacts associated with the Tailrace are from past discharges rather than from gradual releases of groundwater.

In addition, the Preliminary site Assessment (PSA) found no chemical-related stress in Oneida Creek. The fish tissue analysis in the RI report showed that several compounds were found at trace levels in the fish, but that only benzene could have been from the former MGP Site. Nonetheless, benzene in Oneida Creek was found at levels well below the TOC-adjusted screening concentrations derived from USEPA threshold values.

The recommended alternatives would mitigate exposure pathways and corresponding risks of the former Oneida MGP site to human health and the environment in the following ways:

- Eliminating source area materials through excavation and appropriate management off-site.
- Removing on-site soils containing PRG exceedances and evidence of NAPL.
- Grading, installing, and maintaining a cover over the entire site to conform to on-site land use.

- Removing Tailrace sediments and spoils containing PRG exceedances.

5.2.2 Compliance with SCGs

A range of SCGs apply to the soil and sediment in and around the Oneida Site. For instance, hydrologic modeling may be required to assess flooding impacts of any cut-and-fill activity within the regulated floodway and flood fringe of Oneida Creek. Also, management and disposal of excavated soil and sediment would be conducted in compliance with appropriate regulations. Finally, removal of much of the soil, sediment, and, as a result, some of the groundwater containing PRG exceedances would comply with the chemical-specific SCGs. Impacted groundwater would be monitored for five years to assess the effectiveness of source removal on local groundwater quality. Groundwater remediation through pumping and treatment is not considered practicable based on the ineffectiveness of the pump and treat system in meeting groundwater PRGs, the lack of an estimated end time for operation and maintenance of such a system, and the current City of Oneida restriction of drinking water well installation downgradient of the Site. At this Site, removal of on-site source materials and intrinsic bioremedation of residual constituents in groundwater off-site to the northeast is a more effective remedy than groundwater containment.

5.2.3 Long-term Effectiveness and Permanence

The long-term effectiveness and permanence of a remedy is based on consideration of the magnitude of risk remaining after remediation, the adequacy and reliability of controls used to manage treatment residuals or untreated waste, and the permanence of the remedy. Removal of much of the impacted soil and sediment and placement of an asphalt cover on the site would provide a long-term solution in that source materials would be removed, and future impacts on the Tailrace sediments from former MGP operations would not occur. Impacts on the sediments appear to have been the result of direct discharges into the Tailrace. Groundwater/sediment partitioning calculations confirm that constituent loading through groundwater flow is a very small contributor, relative to the actual levels of constituents, within the Tailrace sediment (see Appendix F). The recommended alternatives also provide a permanent remedy by removing the most impacted sediment, spoils, and on-site soil from the area.

Implementation of the recommended alternatives would also effectively decrease any residual risk, specifically through the proper management of excavated source material. With the source material excavation, no on-site soil observed to have PRG exceedances would remain. Groundwater monitoring would be conducted for five years at a few selected monitoring wells, specifically those northeast of and on the northwestern edge of the Site. The monitoring would track and assess groundwater quality and the long-term effectiveness of the alternative on adjacent off-site property northeast of the Site.

5.2.4 Reduction of Toxicity, Mobility, and Volume

Excavation of soil and sediment would minimize the volume of impacted material at the Site. Treatment of the excavated soil and sediment is considered a permanent remedy and would reduce the overall toxicity and mobility of constituents, as well as the volume of impacted material on-site.

5.2.5 Short-term Effectiveness

Short-term effectiveness pertains to risks and impacts to the neighboring community, workers, and environment during remedial activities contained in the recommended alternative. Engineering controls and air monitoring would protect the local community during construction. Engineering controls could include, as needed, various dust and odor suppression techniques, and simultaneous excavation and backfilling could be performed. In addition, to minimize odor generation, excavation work could be conducted during cold weather. These techniques are implementable, economical, and very effective in ensuring protection of the workers and community. Air quality and odor monitoring would also be conducted to monitor particulate emissions, soluble airborne constituents, and odors above threshold limits. In addition, no significant short-term impacts from remedial activities are anticipated for remedial workers or site NMPC employees, as long as proper precautions are carefully implemented and alternate short-term parking and equipment storage areas are available. Some underground and above-ground temporary utility relocation may be necessary, but associated costs should not be significant. Subsurface utility locations on-site within and near removal areas need to be confirmed prior to excavation. Remedial construction activities should be straightforward and would not require any unusual or difficult operations for construction workers as long as they are experienced in deep excavations involving the installation of sheet piling and dewatering techniques.

5.2.6 Implementability

Soil and sediment excavation above the water table and capping technologies have been utilized for many years and would be conducted reliably. The deep source material excavation that would be conducted on-site would require experienced construction workers and proper health and safety procedures to avoid potential problems such as odor, dust, excavation trench dewatering, and excavation wall stability. No known technical or administrative concerns have been identified that would present a problem in implementing this remedy. Substantive requirements for activities, such as cut-and-fill construction activities within the regulated floodway and flood fringe of Oneida Creek, would be met.

5.2.7 Cost

The total present worth (PW) for the recommended alternative is approximately $2,432,000. The present worth of remediating the Tailrace is $798,000 while the present worth of remediating the on-site soil and groundwater is $1,634,000. The total present worth is the sum of capital costs and the present worth of operation and maintenance, which is based on a project life for operation and maintenance of 30 years and a 4% discount rate.

5.2.8 State and Community Acceptability

The criteria for state and community acceptability can not yet be fully assessed. The overall Oneida site recommended alternatives will be reviewed by the State of New York and then by the local community. The general public will also be provided an opportunity to comment on the recommended alternative once the NYSDEC issues a Proposed Remedial Action Plan for the Site.

5.2.9 Conformance to Local Stormwater Drainage Plans

The City of Oneida has requested that improvement to the Tailrace be made to accommodate flood events more effectively. Restoration of the Tailrace to a size and shape that would improve its hydraulics is included as the recommended alternative. Maintenance following remediation will be conducted by the City of Oneida.

APPENDIX A

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APPENDIX B

COST ESTIMATE TABLES

NMPC/Oneida Former MGP Site

TAILRACE ALTERNATIVES

ALTERNATIVE 1 - Limited Sediment Removal and Placement of Culvert

CAPITAL COSTS

Item	Unit	Quantity	Unit Cost	Total Cost
1. Clearing of vegetation on banks	ACRE	0.55	$1,750	$1,000
2. Removal of Tailrace Water				
a. Dam and Flexible Hosing Rental for One Month	LS	1	$8,000	$8,000
b. Electric Pump Rental for One Month	LS	1	$1,650	$1,700
3. Removal of Sediments				
a. Excavate Tailrace	CY	1220	$10	$12,200
b. Excavate at 3 crossings	CY	150	$10	$1,500
c. Offsite Management of Excavated Material (assumed nonhazardous)	TONS	2330	$55	$128,000
4. Placement of Culvert				
a. Import bedding material	CY	1330	$21	$27,900
b. Install 48-inch diameter, corrugated metal culvert	LF	1200	$74.50	$89,400
5. Placement of Permeable Cover over Culvert and Spoils Area				
a. Import clean, unclassified fill	CY	1620	$10	$16,200
b. Import topsoil, 6" deep	SY	3240	$4.15	$13,400
c. Seed with wildflower mix	1000 SF	29.2	$38.50	$1,100
6. Subtotal Capital Costs				$300,000
7. Engineering, Design, and Construction Oversight (10%)				$30,000
8. Contingencies (20%)				$60,000
9. TOTAL CAPITAL COSTS				**$390,000**

NMPC/Oneida Former MGP Site

TAILRACE ALTERNATIVES
ALTERNATIVE 2 - Sediment Removal and Restoration of Drainageway

CAPITAL COSTS

Item	Unit	Quantity	Unit Cost	Total Cost
1. Clearing of vegetation on banks -	ACRE	0.55	$1,750	$1,000
2. Removal of Tailrace Water				
a. Dam and Flexible Hose Rental for One Month	LS	1	$8,000	$8,000
b. Electric Pump Rental for One Month	lS	1	$1,650	$1,700
3. Removal of Sediments				
a. Excavate Tailrace	CY	1780	$10	$17,800
b. Excavate at 3 crossings	CY	150	$10	$1,500
c. Excavate banks to achieve desired slope for drainageway	CY	50	$10	$500
c. Offsite Management of Excavated Material (assumed nonhazardous)	TONS	3370	$55	$185,000
4. Restoration of drainageway				
a. Backfill ditch (inc. bedding for intermediate culverts)	CY	1930	$15	$29,000
b. Replacement of 3 Intermediate Culverts	LF	120	$62	$7,400
c. Replacement of Flap Valve	LS	1	$14,000	$14,000
5. Placement of Permeable Cover Over Spoils Area				
a. Import clean, unclassified fill	CY	950	$10	$9,500
b. Import topsoil, 6" deep	SY	1910	$4.15	$7,900
c. Seed with wildflower mix	1000 SF	17.2	$38.50	$700
6. Subtotal Capital Costs				$284,000
7. Engineering, Design, and Construction Oversight (10%)				$28,400
8. Contingencies (20%)				$56,800
9. TOTAL CAPITAL COSTS				**$369,000**

NMPC/Oneida Former MGP Site

TAILRACE ALTERNATIVES
ALTERNATIVE 3 - Sediment and Spoils Removal and Restoration of Drainageway and Banks

CAPITAL COSTS

Item	Unit	Quantity	Unit Cost	Total Cost
1. Clearing of vegetation on banks	ACRE	0.55	$1,750	$1,000
2. Removal of Tailrace Water				
a. Dam and Flexible Hose Rental for One Month	LS	1	$8,000	$8,000
b. Electric Pump Rental for One Month	LS	1	$1,650	$1,700
3. Removal of Sediments and Spoils				
a. Excavate Tailrace and banks	CY	4740	$10	$47,400
b. Excavate at 3 crossings	CY	150	$10	$1,500
c. Offsite Management of Excavated Material (assume nonhazardous)	TONS	8310	$55	$457,000
4. Restoration of Drainageway				
a. Backfill ditch	CY	1780	$15	$26,700
b. Import clean, unclassified fill to recreate banks	CY	2960	$10	$29,600
c. Cut, Fill, and Grade Banks	CY	2960	$4	$11,800
d. Import Topsoil, 6 inches	SY	1770	$4.15	$7,300
e. Seed with wildflower mix	1000 SF	16	$38.50	$600
f. Replacement of Intermediate Culverts	LF	120	$62	$7,400
g. Replacement of Flap Valve	LS	1	$14,000	$14,000
5. Subtotal Capital Costs				$614,000
6. Engineering, Design, and Construction Oversight (10%)				$61,400
7. Contingencies (20%)				$122,800
8. TOTAL CAPITAL COSTS				**$798,000**

NMPC/Oneida Former MGP Site

SOIL/GROUNDWATER ALTERNATIVES
ALTERNATIVE 1 - Limited Action

CAPITAL COSTS

Item	Unit	Quantity	Unit Cost	Total Cost
1. Deed Restrictions by Property Owner	LS	1	$10,000	$10,000
2. Maintenance of Existing Security Fence Around Site (Assumed no capital cost)				
3. Posting of "No Trespassing" Signs	EA	5	$30	$200
4. Subtotal Capital Costs				$10,200
5. Engineering, Design, and Construction Oversight (10%)				$1,020
6. Contingencies (20%)				$2,000
7. TOTAL CAPITAL COSTS				**$13,200**

ANNUAL OPERATING AND MAINTENANCE COSTS

Item	Unit	Quantity	Unit Cost	Total Cost
1. Annual Site Inspection, Administration, Reporting	HRS	40	$60	$2,400
2. Fence Maintenance	LS	1	$350	$400
3. Short-Term Groundwater Monitoring, Annually for Five Years (Via Existing Wells ES-7, 2S, 2, 5, and 3)				
a. Field Effort (labor, equipment, expenses)	HRS	32	$50	$1,600
b. Sample Analyses	TEST	10	$500	$5,000
c. Data Analysis/Reporting (once yearly)	HRS	20	$80	$1,600
Subtotal				$8,200
4. Present Worth of Site Inspection, Administration, Reporting [PW O&M=(P/A, 4%, 30) * Site Inspection Annual O&M]				$41,500
5. Present Worth of Fence Maintenance [PW O&M=(P/A, 4%, 30) * Fence Maintenance]				$6,900
6. Present Worth of Groundwater Monitoring [PW O&M=(P/A, 4%, 5) * Groundwater Monitoring Annual O&M]				$36,500
7. TOTAL O&M PRESENT WORTH				**$84,900**
PRESENT WORTH OF ALTERNATIVE [PW=Total Capital + Total O&M Present Worth Costs]				**$98,100**

NMPC/Oneida Former MGP Site

SOIL/GROUNDWATER ALTERNATIVES
ALTERNATIVE 2 - Containment/Treatment

CAPITAL COSTS

Item	Unit	Quantity	Unit Cost	Total Cost
1. Deed Restrictions by Property Owner	LS	1	$10,000	$10,000
2. Maintenance of Existing Security Fence Around Site (Assumed no capital cost)				
3. Posting of "No Trespassing" Signs	EA	5	$30	$200
4. Barrier Wall (3-ft. thick bentonite slurry wall)				
a. Installation of a 3-ft thick bentonite slurry wall	SF	48,550	$15	$728,000
b. Offsite Management of Excavated Material (assumed nonhazardous) Assumed 20% of soil excavated not backfilled in slurry	TON	3,060	$55	$168,000
5. Placement of Asphalt Cap Onsite				
a. Excavate for Placement of Cap to Maintain Building Elevations	CY	1,290	$10	$12,900
b. Offsite Management of Excavated Material (assumed nonhazardous)	TON	2,190	$55	$120,000
c. Import Subgrade Fill	CY	1,290	$10	$12,900
d. Cut, Fill, and Grade Onsite	CY	2,590	$4	$10,360
e. Installation of Asphalt Cap	SF	69,860	$2.75	$192,000
6. Groundwater Collection				
a. Extraction well	EA	1	$1,000	$1,000
b. Pump	EA	1	$1,000	$1,000
c. Pump housing	EA	1	$500	$500
d. Piping and electrical (frost-protected)	LF	100	$6	$600
e. Storage tank and thermal insulation/heat tracing	EA	1	$2,000	$2,000
7. Groundwater Treatment (prefilter and activated carbon system)	LS	1	$100,000	$100,000
8. Subtotal Capital Costs				$1,360,000
9. Engineering, Design, and Construction Oversight (10%)				$136,000
10. Contingencies (20%)				$272,000
11. TOTAL CAPITAL COSTS				**$1,770,000**

ANNUAL OPERATING AND MAINTENANCE COSTS

Item	Unit	Quantity	Unit Cost	Total Cost
1. Annual Site Inspection, Administration, Reporting	HRS	40	$60	$2,400
2. Fence Maintenance	LS	1	$350	$400
3. Cap Maintenance	HRS	30	$50	$1,500
4. Short-Term Groundwater Monitoring, Annually for Five Years (Via Existing Wells ES-7, 2S, 2, 5, and 3)				
a. Field Effort (labor, equipment, expenses)	HRS	32	$50	$1,600
b. Sample Analyses	TEST	10	$500	$5,000
c. Data Analysis/Reporting (once yearly)	HRS	20	$80	$1,600
Subtotal				$8,200
5. Annual Collected Groundwater Management				
a. Groundwater Treatment O&M	GAL	1,051,200	$0.05	$52,600
b. Monthly Extraction System Monitoring	EA	12	$1,000	$12,000
c. Pump O&M	HRS	104	$50	$5,200
d. Management and Reporting	HRS	60	$70	$4,200
Subtotal				$74,000
6. Present Worth of Site Inspection, Administration, Reporting [PW O&M=(P/A, 4%, 30) * Site Inspection Annual O&M]				$41,500
7. Present Worth of Fence Maintenance [PW O&M=(P/A, 4%, 30) * Fence Maintenance]				$6,900
8. Present Worth of Cap Maintenance [PW O&M=(P/A, 4%, 30) * Cap Maintenance]				$25,900
9. Present Worth of Groundwater Monitoring [PW O&M=(P/A, 4%, 5) * Groundwater Monitoring Annual O&M]				$36,500
10. Present Worth of Extracted Groundwater Management [PW O&M=(P/A, 4%, 30) * Groundwater Management Annual O&M]				$1,280,000
11. TOTAL O&M PRESENT WORTH				**$1,390,000**
PRESENT WORTH OF ALTERNATIVE [PW=Total Capital + Total O&M Present Worth Costs]				**$3,160,000**

NMPC/Oneida Former MGP Site

SOIL/GROUNDWATER ALTERNATIVES
ALTERNATIVE 3
Source Removal

CAPITAL COSTS

Item	Unit	Quantity	Unit Cost	Total Cost
1. Deed Restrictions by Property Owner	LS	1	$10,000	$10,000
2. Installation of Sheet Piling				
a. 15 ft.-deep Sheet Piling around Large Holder and Area to Tailrace	SF	4,650	$9.70	$45,100
b. 20 ft.-deep Sheet Piling around B-15R & B-28	SF	4,800	$10.45	$50,200
c. 25 ft.-deep Sheet Piling around Small Holder	SF	3,750	$11.15	$41,800
d. 15 ft.-deep Sheet Piling around Purifier Slab & B-10R	SF	3,750	$9.70	$36,400
3. Construction of 40 ft. by 40 ft. Dewatering Pad				
a. Berms	LF	160	$2.42	$400
b. Gravel	SF	1,600	$0.38	$600
c. Sand	SF	1,600	$0.38	$600
d. Geotextile	SF	2,500	$1.14	$2,900
e. Sump pump	EA	1	$1,000	$1,000
f. Storage tank	EA	1	$2,000	$2,000
4. Removal of Source Materials				
a. Excavate Large Holder	CY	1,110	$10	$11,100
b. Excavate Small Holder	CY	1,530	$10	$15,300
c. Excavate Area between Tailrace and Large Holder	CY	2,477	$10	$24,770
d. Excavate Purifier Slab	CY	890	$10	$8,900
e. Excavate around B-15R, B-28, & B-10R	CY	1,140	$10	$11,400
f. Offsite Management of Excavated Material (assumed nonhazardous)	TON	12,150	$55	$668,250
5. Offsite Management of Drained Water	GAL	108,280	$1	$108,300
6. Placement of Asphalt Cover Onsite				
a. Import clean, unclassified fill	CY	3,530	$10	$35,300
b. Cut, fill, and grade onsite	CY	2,600	$4	$10,400
c. Installation of Asphalt Cover	SF	69,860	$1.30	$91,000
7. Restoration of Excavated Offsite Areas to Grade				
a. Import clean, unclassified fill	CY	3,617	$10	$36,170
b. Import topsoil, 6" deep	SY	80	$4.15	$300
c. Seed with wildflower mix	1000 SF	2.9	$38.50	$110
8. Subtotal Capital Costs				$1,212,000
9. Engineering, Design, and Construction Oversight (10%)				$121,200
10. Contingencies (20%)				$242,400
11. TOTAL CAPITAL COSTS				$1,576,000

ANNUAL OPERATING AND MAINTENANCE COSTS

Item	Unit	Quantity	Unit Cost	Total Cost
1. Short-Term Groundwater Monitoring, Annually for Five Years (Install 3 new wells along Tailrace and monitor those plus existing wells ES-7, 2S, 2, 5, and 3)				
a. Field Effort (labor, equipment, expenses)	HRS	80	$50	$4,000
b. Sample Analyses	TEST	13	$500	$6,500
c. Data Analysis/Reporting (once yearly)	HRS	30	$80	$2,400
Subtotal				$12,900
2. Present Worth of Groundwater Monitoring [PW O&M=(P/A, 4%, 5) * Groundwater Monitoring Annual O&M]				$57,500
3. TOTAL O&M PRESENT WORTH				$57,500
PRESENT WORTH OF ALTERNATIVE [PW=Total Capital + Total O&M Present Worth Costs]				**$1,634,000**

APPENDIX C

FEASIBILTY CALCULATIONS

ONEIDA
ASSUMPTIONS FOR TAILRACE ALTERNATIVE 1
LIMITED SEDIMENT REMOVAL AND PLACEMENT OF CULVERT

GENERAL

1. The cost estimates include capital costs only. Operating and maintenance expenses associated with the Tailrace are the responsibility of the City of Oneida. In the development of construction cost estimates, unit costs were obtained from vendor quotations, standard cost estimating documents (Means), or from extensive Parsons ES experience with similar projects. Vendor quotes were obtained for key unit costs whenever possible.

2. The back-up documentation is repetitive in many instances as each alternative includes similar work tasks. However, by preparing the back-up material in this manner, a complete cost estimate back-up is available for each remedial option.

3. Values are rounded where appropriate.

CAPITAL COSTS

Item 1 - Clearing of vegetation on banks

1. Assumed a 10-foot width on either side of the Tailrace and a length of 1200 feet.

   Total Area = (20 ft.)(1200 ft.) = 24,000 SF = 0.55 acre

Item 2 - Removal of Tailrace Water

1. Assumed diversion of water and sediment excavation would require a maximum of one month. Removal of Tailrace water would be somewhat limited due to local groundwater discharges to the Tailrace. Excavation is assumed to occur in 200-foot segments along the Tailrace. Two dams, 200 feet of flexible hose, and an electric pump would be needed.

Item 3 - Removal of Sediments

1. Assumed an excavation length of 1200 ft. and an excavation depth of 2.5 feet to place a 48-inch diameter culvert and to maintain the current upstream and downstream elevations and 0.5 % gradient. Assumed a top excavation width of

10 feet based on topography maps and field observations. Assumed a bottom excavation width of 4 feet based on the diameter of the culvert to be placed in the Tailrace. Assumed that the Tailrace bottom is currently sloped upward on the sides so that additional sediments would have to be removed. Assumed 1:1 side slopes.

Volume of excavated sediments
= (0.5 (4 ft. + 10 ft.) x 2.5 ft.) x 1200 ft. = 21,000 ft.^{3}

Volume of additional sediments on sides
= 2(0.5(5 ft. x 2 ft.)) x 1200 ft. = 12,000 ft.^{3}

Total Volume = 33,000 ft.^{3} = 1220 CY

2. Assumed that 50 CY of material would have to be excavated at each of the three paths that cross the Tailrace.

   Total Volume = (3 crossings)(50 CY) = 150 CY

3. Assumed that all of the excavated sediments would not be hazardous and that average recycle/reuse and disposal costs would be $55 per ton. It was assumed that 1 CY of material equals 1.7 tons.

   (1220 CY + 150 CY)(1.7 tons per CY) = 2330 tons

Item 4 - Placement of Culvert

1. Assumed that the bedding would fill the excavated volume and would provide a 0.5-foot layer above and below the culvert.

   Total Volume = 1330 CY

2. Assumed a 48-inch diameter, 1200-foot long, corrugated metal culvert based on calculations using Manning's formula to size a culvert for maximum flow.

Item 5 - Placement of Permeable Cover over Culvert and Spoils Area

1. For the culvert, assumed a length of 1200 feet, a width of 10 feet, and a depth of 1.5 feet for unclassified fill. For the spoils area, assumed the following lengths and widths based on the extent of contamination observed in the soil borings taken in the Tailrace banks:

Length (feet)	Width (feet)
280	6
920	10 (northwest bank), 5 (southeast bank)

Assumed the same depth as that for the culvert: 1.5 ft.

Total Volume
= 1.5 ft. [(1200 ft.)(10 ft.) + (280 ft.) (2 (6 ft.)) + (920 ft.(10 ft. + 5 ft.))]
= 1620 CY

2. Used the same assumptions for topsoil area as for unclassified fill (above), except that the depth of topsoil is assumed to be a minimum of 6 inches (0.5 ft.) to promote healthy vegetative growth.

   Total Area = (1200 ft.)(10 ft.) + (280 ft.)(2 (6 ft.)) + (920 ft. (10 ft. + 5 ft.))
   = 3240 SY

3. Assumed a vegetated area based on the lengths and widths as described in #1 and 2 above.

   Total Area = (1200 ft.)(10 ft.) + (280 ft.)(2 (6 ft.)) + (920 ft. (10 ft. + 5 ft.))
   = 29,200 SF

ONEIDA
ASSUMPTIONS FOR TAILRACE ALTERNATIVE 2
SEDIMENT REMOVAL AND RESTORATION OF DRAINAGEWAY

GENERAL

1. The cost estimates include only capital costs. Operating and maintenance expenses associated with the Tailrace are the responsibility of the City of Oneida. In the development of construction cost estimates, unit costs were obtained from vendor quotations, standard cost estimating documents (Means), or from extensive Parsons ES experience with similar projects. Vendor quotes were obtained for key unit costs whenever possible.

2. The back-up documentation is repetitive in many instances as each alternative includes similar work tasks. However, by preparing the back-up material in this manner, a complete cost estimate back-up is available for each remedial option.

3. Values are rounded where appropriate.

CAPITAL COSTS

Item 1 - Clearing of vegetation on banks

1. Assumed a 10-foot width on either side of the Tailrace and a length of 1200 feet.

   Total Area = (20 ft.) (1200 ft.) = 24,000 SF = 0.55 acre

Item 2 - Removal of Tailrace Water

1. Assumed diversion of water and sediment excavation would require a maximum of one month. Removal of Tailrace water would be somewhat limited due to local groundwater discharges to the Tailrace. Excavation is assumed to occur in 200-foot segments along the Tailrace. Two dams, 200 feet of flexible hose, and an electric pump would be needed.

Item 3 - Removal of Sediments

1. Assumed an excavation length of 1200 feet and an excavation depth of 0.5 feet below the greatest depth at which exceedances were found (3.5 ft. + 0.5 ft. = 4.0

ft.). Assumed a width of 10 feet and that, due to the sloped sides of the bottom of the Tailrace, some additional material would have to be removed as well.

Total Volume = (1200 ft.)(4 ft.)(10 ft.) = 1780 CY

2. Assumed that 50 CY of material would have to be excavated at each of the three paths that cross the Tailrace.

   Total Volume = (3 crossings)(50 CY) = 150 CY

3. Assumed a desired slope of 1:2 based on calculations using Manning's formula to size the Tailrace. Assumed that a length of 180 feet of the upstream, northwestern Tailrace bank would need to be removed. Assumed a total width of 10 feet and depths of 0.5 and 1.0 feet.

   Total Volume = 180 ft.[(5 ft.)(1 ft.) + (5 ft.)(0.5 ft.)] = 50 CY

4. Assumed that all of the excavated sediments would not be hazardous and that average recycle/reuse and disposal costs would be $55 per ton. It was assumed that 1 CY of material equals 1.7 tons.

   (1780 CY + 150 CY + 50 CY)(1.7 tons per CY) = 3370 tons

Item 4 - Restoration of Drainageway

1. Assumed a total volume equal to the volume excavated from the Tailrace and the crossings.

   Total Volume = 1780 CY + 150 CY = 1930 CY

2. Assumed lengths of culverts = 30 ft. + 25 ft. + 62 ft. = 117 ft.

3. Assumed a flap valve with a 48-inch outside diameter.

Item 5 - Placement of Permeable Cover over Spoils Area

1. For the spoils area, assumed the following lengths and widths based on the extent of contamination observed in the soil borings taken in the Tailrace banks:

Length (feet)	Width (feet)
280	6
920	10 (northwest bank), 5 (southeast bank)

Assumed a depth of 1.5 feet for unclassified fill.

Total Volume = 1.5 ft. [(280 ft.) (2 (6 ft.)) + (920 ft.(10 ft. + 5 ft.))]
= 950 CY

2. Used the same assumptions for topsoil area as for unclassified fill (above), except that the depth of topsoil is assumed to be a minimum of 6 inches (0.5 ft.) to promote healthy vegetative growth.

Total Area = 0.5 ft. [(280 ft.)(2 (6 ft.)) + (920 ft. (10 ft. + 5 ft.))]
= 1910 CY

3. Assumed a vegetated area based on the lengths and widths as described in #1 and 2 above.

Total Area = (280 ft.)(2 (6 ft.)) + (920 ft. (10 ft. + 5 ft.)) = 17,200 SF

ONEIDA
ASSUMPTIONS FOR TAILRACE ALTERNATIVE 3 SEDIMENT AND SPOILS REMOVAL AND RESTORATION OF DRAINAGEWAY AND BANKS

GENERAL

1. The cost estimates include only capital costs. Operating and maintenance expenses associated with the Tailrace are the responsibility of the City of Oneida. In the development of construction cost estimates, unit costs were obtained from vendor quotations, standard cost estimating documents (Means), or from extensive Parsons ES experience with similar projects. Vendor quotes were obtained for key unit costs whenever possible.

2. The back-up documentation is repetitive in many instances as each alternative includes similar work tasks. However, by preparing the back-up material in this manner, a complete cost estimate back-up is available for each remedial option.

3. Values are rounded where appropriate.

CAPITAL COSTS

Item 1 - Clearing of vegetation on banks

1. Assumed a 10-foot width on either side of the Tailrace and a length of 1200 feet.

   Total Area = (20 ft.) (1200 ft.) = 24,000 SF = 0.55 acre

Item 2 - Removal of Tailrace Water

1. Assumed diversion of water and sediment excavation would require a maximum of one month. Removal of Tailrace water would be somewhat limited due to local groundwater discharges to the Tailrace. Excavation is assumed to occur in 200-foot segments along the Tailrace. Two dams, 200 feet of flexible hosing, and an electric pump would be needed.

Item 3 - Removal of Sediments and Spoils

1. Assumed a sediment excavation length of 1200 feet and an excavation depth of 0.5 feet below the greatest depth at which exceedances were found. Assumed a

width of 10 feet and that, due to the sloped sides of the bottom of the Tailrace, some additional material would have to be removed as well.

Assumed a spoils excavation depth of 5 feet based on soil boring information. Two segments of Tailrace banks were defined; their lengths and widths are:

	Length (feet)	Width (feet)
Segment 1	180	6
Segment 2	920	10 (northwestern bank), 5 (southeastern bank)

Total Volume = 1780 CY + 2960 CY = 4740 CY

2. Assumed that 50 CY of material would have to be excavated at each of the three paths that cross the Tailrace.

   Total Volume = (3 crossings)(50 CY) = 150 CY

3. Assumed that all of the excavated sediments and spoils would not be hazardous and that average recycle/reuse and disposal costs would be $55 per ton. It was assumed that 1 CY of material equals 1.7 tons.

   (4740 CY + 150 CY)(1.7 tons per CY) = 8310 tons

Item 4 - Restoration of Drainageway

1. Assumed a total volume of clean fill equal to the volume of sediments excavated.

   Total Volume = 1780 CY

2. Assumed a total volume of clean fill equal to the volume of spoils excavated.

   Total Volume = 2960 CY

3. Assumed a total volume equal to the volume of unclassified fill used to replace the excavated spoils will be cut, filled, and graded.

   Total Volume = 2960 CY

4. Assumed a topsoil area equal to the area of spoils and removed at a minimum depth of 6 inches (0.5 ft.) to promote healthy vegetative growth.

   Total Area = [180 ft. x 2(6 ft.) +920 ft. x (10 ft. + 5 ft.)] = 1770 SY

5. Assumed an area equal to 1770 SY converted to SF.

   Total Area = 15,960 SF.

6. Assumed lengths of culverts = 30 ft. + 25 ft. + 62 ft. = 117 ft.

7. Assumed a flap valve with a 48-inch outside diameter.

ONEIDA
ASSUMPTIONS FOR SOIL/GROUNDWATER ALTERNATIVE 1
LIMITED ACTION

GENERAL

1. The cost estimates include both capital and operating and maintenance expenses. The present worth cost for each alternative was estimated assuming a project life of 30 years and a 4% discount rate (refer to page C-21). In the development of construction cost estimates, unit costs were obtained from vendor quotations, standard cost estimating documents (Means), or from extensive Parsons ES experience with similar projects. Vendor quotes were obtained for key unit costs whenever possible.

2. The back-up documentation is repetitive in many instances as each alternative includes similar work tasks. However, by preparing the back-up material in this manner, a complete cost estimate back-up is available for each remedial option.

3. Values are rounded where appropriate.

CAPITAL COSTS

Item 1 - Deed Restrictions

1. Project variable. Assumed to be a lump sum of $10,000.

Item 2 - Maintenance of Existing Security Fence Around the Site

1. Assumed to have no capital cost.

Item 3 - Posting of "No Trespassing" Signs

1. Assumed materials and labor for posting 5 signs along the fence.

ANNUAL O&M COSTS

Item 1 - Annual Inspection, Administration, Reporting

1. Assumed quarterly site inspections (2 hours), preparation of quarterly reports and associated paperwork (4 hours), and administration performed quarterly (4 hours).

(10 hours) (4 times per year) = 40 hours

Item 2 - Fence Maintenance

1. Assumed a 10-foot section of fence would require repairs each year and that yearly repairs would take 4 hours.

   (10 feet)($15/LF) = $150
   (4 hours)($50/hour) = $200

   Total Cost = $350

Item 3 - Short-term Groundwater Monitoring

1. Assumed that 5 wells (ES-7, 2S, 2, 5, and 3) would require 2 people 2 days at $50 an hour to sample.

   (2 people)(2 days)(8 hours/day) = 32 hours

2. Assumed laboratory analyses to be $500 per sample for target parameters.

3. Assumed a total of 5 monitoring points and 5 quality control samples taken in conjunction with the groundwater samples. Quality control samples would consist of: 1 duplicate (DUP), 1 matrix spike (MS), 1 matrix spike duplicate (MSD), 1 equipment blank (EB), and 1 trip blank (TB).

ONEIDA
ASSUMPTIONS FOR SOIL/GROUNDWATER ALTERNATIVE 2 CONTAINMENT/TREATMENT

GENERAL

1. The cost estimates include both capital and operating and maintenance expenses. The present worth cost for each alternative was estimated assuming a project life of 30 years and a 4% discount rate (refer to page C-21). In the development of construction cost estimates, unit costs were obtained from vendor quotations, standard cost estimating documents (Means), or from extensive Parsons ES experience with similar projects. Vendor quotes were obtained for key unit costs whenever possible.

2. The back-up documentation is repetitive in many instances as each alternative includes similar work tasks. However, by preparing the back-up material in this manner, a complete cost estimate back-up is available for each remedial option.

3. Values are rounded where appropriate.

CAPITAL COSTS

Item 1 - Deed Restrictions

1. Project variable. Assumed to be a lump sum of $10,000.

Item 2 - Maintenance of Existing Security Fence Around the Site

1. Assumed to have no capital cost.

Item 3 - Posting of "No Trespassing" Signs

1. Assumed materials and labor for posting 5 signs on the fence.

Item 4 - Barrier Wall

1. Based on groundwater modeling results, a fully-encircling barrier wall was assumed necessary to prevent the migration of impacted groundwater. Assumed a fully-encircling bentonite slurry wall following the property boundary.
   Total Length = 80 ft. + 450 ft. +360 ft. + 390 ft. = 1280 ft.

Assumed a depth of 5 feet below the average depth at which the confining layer begins so that the wall can be "keyed in": average depth + 5 ft. = 37.9 ft.

Total Area = (1280 ft.)(37.9 ft.) = 48,550 SF

2. Assumed a 3-foot thick wall and a 1-foot allowance on either side of the wall: total thickness = 5 ft.

   Total Volume = (48,550 SF)(5 ft.) = 8990 CY

   Assumed that 20% of the excavated soil could not be backfilled. Thus, 20% of the 8990 CY would be recycled/reused or disposed offsite at $55 per ton. It was assumed that 1 CY of material equals 1.7 tons.

   (8990 CY)(1.7 tons per CY)(0.1) = 3060 tons

Item 5 - Placement of Asphalt Cover Onsite

1. Assumed a cover area equal to the area of the entire site minus the area on which the buildings stand: 82,600 SF - 12,738 SF = 69,862 SF. Assumed that 0.5 feet of onsite soil would have to be excavated in order to maintain building elevations. Total Volume = (69,862 SF)(0.5 ft.) = 1290 CY

2. Assumed that none of the excavated materials would be hazardous and that average recycle/reuse and disposal costs would be $55 per ton. It was assumed that 1 CY of materials equals 1.7 tons.

   (1290 CY)(1.7 tons per CY)(0.1) = 2190 tons

3. Assumed that a volume of subgrade fill equivalent to the amount excavated would be imported: 1290 CY.

4. Assumed 1 foot cut/fill/grade across total cover area.

   (69,862 SF)(1 ft.) = 2590 CY

5. Assumed a cover area as described in #1: 69,860 SF.

Item 6 - Groundwater Collection

1. Assumed one extraction well with one 2-gpm pump and one pump housing.

2. Assumed 100 feet of frost-protected piping and electrical equipment and one storage tank.

Item 7 - Groundwater Treatment

1. Assumed a prefilter and activated carbon system for onsite groundwater treatment based on a 2-gpm pumping rate.

Total Volume = (2 gals./min.)(60 min./hr.)(24 hrs./day)(365 days/year)
= 1,051,200 gals./year

ANNUAL O&M COSTS

Item 1 - Annual Inspection, Administration, Reporting

1. Assumed quarterly site inspections (2 hours), preparation of quarterly reports and associated paperwork (4 hours), and administration performed quarterly (4 hours).

(10 hours) (4 times per year) = 40 hours

Item 2 - Fence Maintenance

1. Assumed a 10-foot section of fence would require repairs each year and that yearly repairs would take 4 hours.

(10 feet)($15/LF) = $150
(4 hours)($50/hour) = $200

Total Cost = $350

Item 3 - Cap Maintenance

1. Assumed cap maintenance would require 30 hours per year at $50 per hour.

(30 hours)($50/hour) = $1,500

Item 4 - Short-term Groundwater Monitoring

1. Assumed that 5 wells (ES-7, 2S, 2, 5, and 3) would require 2 people 2 days at $50 an hour to sample.

(2 people)(2 days)(8 hours/day) = 32 hours

2. Assumed laboratory analyses to be $500 per sample for target parameters.

3. Assumed a total of 5 monitoring points and 5 quality control samples taken in conjunction with the groundwater samples. Quality control samples would consist of: 1 duplicate (DUP), 1 matrix spike (MS), 1 matrix spike duplicate (MSD), 1 equipment blank (EB), and 1 trip blank (TB).

Item 5 - Annual Collected Groundwater Management

1. Assumed a 2-gpm pumping rate for one year, which would yield 1,051,20 gallons of groundwater.

2. Assumed monthly extraction system monitoring at $1000 per month.

3. Assumed pump O&M at 2 hours per week.

   (1 pump)(2 hrs./week)(52 weeks/year) = 104 hours

4. Assumed 5 hours of management and reporting per month.

   (5 hours/month)(12 months) = 60 hours

ONEIDA
ASSUMPTIONS FOR SOIL/GROUNDWATER ALTERNATIVE 3 SOURCE REMOVAL

GENERAL

1. The cost estimates include both capital and operating and maintenance expenses. The present worth cost for each alternative was estimated assuming a project life of 30 years and a 4% discount rate (refer to page C-21). In the development of construction cost estimates, unit costs were obtained from vendor quotations, standard cost estimating documents (Means), or from extensive Parsons ES experience with similar projects. Vendor quotes were obtained for key unit costs whenever possible.

2. The back-up documentation is repetitive in many instances as each alternative includes similar work tasks. However, by preparing the back-up material in this manner, a complete cost estimate back-up is available for each remedial option.

3. Values are rounded where appropriate.

CAPITAL COSTS

Item 1 - Deed Restrictions

1. Project variable. Assumed to be a lump sum of $10,000.

Item 2 - Installation of Sheet Piling

1. Assumed 3 different lengths of sheet piling corresponding to the following excavation depths needed (actual depth of excavation plus 5 feet to anchor the sheet piling):

	excavation depth	anchoring depth	depth of available sheet piling
Large Holder and area to Tailrace	8	13	15
B-15R & B-28	14	19	20
Small Holder	16	21	25
Purifier Slab and B-10R	10	15	15

Item 3 - Construction of Dewatering Pad

Item 3 - Construction of Dewatering Pad

1. Assumed that the dewatering pad would consist of a 40 ft. by 40 ft. area covered with a 6-inch layer of gravel and a 6-inch layer of sand and enclosed by 6-inch wide and 12-inch high asphalt berms. A 50 ft. by 50 ft. geotextile cover would be placed over the sand.

3. Assumed a $1000 pump and a $2000 storage tank for storing the drained water prior to offsite treatment.

Item 4 - Removal of Source Materials

Assumptions:

- PRG exceedances used to determine excavation areas.
- Visual observations of evidence of contamination and of structural materials (e.g., pipes, foundations) from the test pit sampling were also used to define excavation areas.

1. Assumed a 5-foot buffer zone around the diameter (59 feet) of the large holder and a depth of 8 feet.

   Total Volume = (3739 SF)(8 ft.) = 1110 CY

2. Assumed a 5-foot buffer zone around the diameter (40 feet) of the small holder and a depth of 16 feet. Assumed an excavation depth of 10 feet around the area immediately northeast of the small holder to include exceedances found there.

   Total Volume = (1963 SF)(16 ft.) + (1000 SF)(10 ft.)= 1530 CY

3. Assumed excavation depths of 8 feet and 14 feet from the large holder to the Tailrace, and upstream along the Tailrace.

   Total Volume = (2950 SF)(14 ft.) = 1530 CY = Total 2477 CY
   (3195 SF)(8 ft.) = 947 CY

4. Assumed an excavation depth of 10 feet in the purifier slab area.

   Total Volume = (2400 SF)(10 ft.) = 890 CY

5. Assumed an excavation depth of 14 feet around the samples B-15R and B-28, which are between the northern tip of the site and the Tailrace.

   Total Volume = (2200 SF)(14 ft.) = 1140 CY

6. Assumed that all of the excavated materials would not be hazardous and that average recycle/reuse and disposal costs would be \$55 per ton. It was assumed that 1 CY of material equals 1.7 tons.

   (7147 CY)(1.7 tons per CY) = 12,150 tons

Item 5 - Offsite Management of Drained Water

1. Based on a 23% porosity for high density silty sand and assuming that the 2331 CY of soil excavated from below the water table is completely saturated, the total volume of drained water = (0.23)(2331 CY) = 536 CY = 108,284 gallons. Assumed a \$1-per-gallon cost for offsite management of the drained water.

Item 6 - Placement of Asphalt Cover Onsite

1. Assumed that a volume of clean, unclassified fill equivalent to the amount excavated (except for the volume between the Tailrace and the large holder and the volume just north of the site near the Tailrace) would be imported.

   Total Volume = 1110 CY + 1530 CY + 890 CY = 3530 CY

2. Assumed a 1 foot cut/fill/grade volume over entire area of cover.

   Area = 82,600 SF - 12,738 SF (area on which buildings stand) = 69,862 SF
   Total Volume = 69,862 SF x 1 ft. = 2590 CY

3. Assumed a cover area equal to the entire site area minus the area on which the buildings stand: 69,860 SF.

Item 7 - Restoration of Excavated Offsite Areas to Grade

1. Assumed that a volume of clean, unclassified fill equal to the amount excavated between the Tailrace and the large holder and north of the site would be imported

   Total Volume = 2477 CY + 1140 CY = 3617 CY

2. Assumed a minimum of 6 inches of topsoil to be placed over the portion of the excavated area along the Tailrace in order to promote healthy vegetative growth.

   Total Area = (700 ft.)(10 ft.) = 700 SF = 80 SY

3. Assumed a vegetated area equal to the area described in #2: 700 SF.

ANNUAL O&M COSTS

Item 1 - Short-term Groundwater Monitoring

1. Assumed that 8 wells (3 new wells plus ES-7, 2S, 2, 5, and 3) would require 2 people 2 days at $50 an hour to sample, plus 5 days for one person to install the new wells, develop the wells and prepare documentation.

   (2 people)(2 days)(10 hours/day) = 40 hours
   (1 person)(5 days) (8 hours/day) = 40 hours
2. Assumed laboratory analyses to be $500 per sample for target parameters.

3. Assumed a total of 8 monitoring points and 5 quality control samples taken in conjunction with the groundwater samples. Quality control samples would consist of: 1 duplicate (DUP), 1 matrix spike (MS), 1 matrix spike duplicate (MSD), 1 equipment blank (EB), and 1 trip blank (TB).

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Discount Rate Calculation

In accordance with NYSDEC TAGM 4030, a discount rate equivalent to the 30-year U.S. Treasury bond rate before taxes and after inflation should be used in determining the present worth of an alternative.

As of 6/13/97: 30-year Treasury Bond = 6.76% (Wall St. Journal, 6/13/97
Inflation ≈ 3 %
Discount Rate = 3.76%

The discount rate is equal to the Treasury Bond rate minus the inflation rate. A 4% discount rate was assumed for use in the cost estimates to be conservative and to allow for slight variations in bond and inflation rates.

The equal series present worth formula was used to develop the present worth factors for O&M items that occur in a sequential, annual pattern, i.e., site maintenance, groundwater monitoring, Tailrace dredging, and groundwater management.

$$\text{Equal Series PW} = \frac{(1+i)^n - 1}{i(1+i)^n}$$

where i = discount rate
n = years

Page 3 is a table of standard cost rate factors for an interest rate of 4% from the Engineer-in-Training Reference Manual (1992). Present worth (P/F) and equal series present worth (P/A) factors are shown in the first two columns.

TREASURY BONDS, NOTES & BILLS

Thursday, June 12, 1997

Representative and Indicative Over-the-Counter quotations based on $1 million or more.

Treasury bond, note and bill quotes are as of mid-afternoon. Colons in bond and note bid-and-asked quotes represent 32nds; 101:01 means 101 1/32. Net changes in 32nds. Treasury bill quotes in hundredths, quoted in terms of a rate discount. Days to maturity calculated from settlement date. All yields are based on a one-day settlement and calculated on the offer quote. Current 13-week and 26-week bills are boldfaced. For bonds callable prior to maturity, yields are computed to the earliest call date for issues quoted above par and to the maturity date for issues quoted below par. n-Treasury note. i-Inflation-indexed. wi-When issued. iw-Inflation-indexed when issued; daily change is expressed in basis points.

Source: Dow Jones/Cantor Fitzgerald.

U.S. Treasury strips as of 3 p.m. Eastern time, also based on transactions of $1 million or more. Colons in bid-and-asked quotes represent 32nds; 99:01 means 99 1/32. Net changes in 32nds. Yields calculated on the asked quotation. ci-stripped coupon interest. bp-Treasury bond, stripped principal. np-Treasury note, stripped principal. For bonds callable prior to maturity, yields are computed to the earliest call date for issues quoted above par and to the maturity date for issues below par.

Source: Bear, Stearns & Co. via Street Software Technology Inc.

GOVT. BONDS & NOTES

Rate	Maturity Mo/Yr	Bid	Asked	Chg.	Ask Yld.
5 5/8	Jun 97n	99:31	100:01	....	4.83
6 3/8	Jun 97n	100:00	100:02	....	4.90
8 1/2	Jul 97n	100:08	100:10	....	4.78
5 1/2	Jul 97n	99:31	100:01	− 1	5.16
5 7/8	Jul 97n	100:01	100:03	....	5.05
6 1/2	Aug 97n	100:05	100:07	....	5.12
8 5/8	Aug 97n	100:17	100:19	+ 1	5.04
5 5/8	Aug 97n	100:00	100:02	+ 1	5.25
6	Aug 97n	100:03	100:05	+ 1	5.17
5 1/2	Sep 97n	100:00	100:02	+ 1	5.23
5 3/4	Sep 97n	100:02	100:04	+ 1	5.26
8 3/4	Oct 97n	101:01	101:03	....	5.39
5 5/8	Oct 97n	100:01	100:03	+ 1	5.34
5 3/4	Oct 97n	100:02	100:04	+ 1	5.38
7 3/8	Nov 97n	100:22	100:24	....	5.52
8 7/8	Nov 97n	101:10	101:12	....	5.50
5 3/8	Nov 97n	99:28	99:30	+ 1	5.50
6	Nov 97n	100:05	100:07	+ 1	5.50
5 1/4	Dec 97n	99:26	99:28	+ 2	5.48
6	Dec 97n	100:07	100:09	+ 2	5.46
7 7/8	Jan 98n	101:09	101:11	+ 2	5.51
5	Jan 98n	99:17	99:19	+ 1	5.65
5 5/8	Jan 98n	99:30	100:00	+ 2	5.61
7 1/4	Feb 98n	100:30	101:00	....	5.70
8 1/8	Feb 98n	101:17	101:19	+ 1	5.66
5 1/8	Feb 98n	99:21	99:23	+ 5	5.52
5 1/8	Mar 98n	99:17	99:19	+ 2	5.64
6 1/8	Mar 98n	100:10	100:12	+ 2	5.62
7 7/8	Apr 98n	101:22	101:24	+ 2	5.69
5 1/8	Apr 98n	99:14	99:16	+ 2	5.71
5 7/8	Apr 98n	100:02	100:04	+ 1	5.72
6 1/8	May 98n	100:09	100:11	+ 2	5.73
9	May 98n	102:26	102:28	+ 1	5.74
5 3/8	May 98n	99:18	99:20	+ 2	5.78
6	May 98n	100:05	100:07	+ 2	5.76
5 1/8	Jun 98n	99:11	99:13	+ 3	5.71
6 1/4	Jun 98n	100:14	100:16	+ 3	5.75
8 1/4	Jul 98n	102:16	102:18	+ 3	5.78
5 1/4	Jul 98n	99:11	99:13	+ 3	5.79
6 1/4	Jul 98n	100:13	100:15	+ 3	5.81
5 7/8	Aug 98n	99:30	100:00	+ 2	5.87
9 1/4	Aug 98n	103:23	103:25	+ 3	5.86
4 3/4	Aug 98n	98:21	98:23	+ 3	5.85
6 1/8	Aug 98n	100:09	100:11	+ 4	5.82
4 3/4	Sep 98n	98:18	98:20	+ 3	5.86
6	Sep 98n	100:03	100:05	+ 3	5.87
7 1/8	Oct 98n	101:17	101:19	+ 4	5.86
4 3/4	Oct 98n	98:13	98:15	+ 3	5.92
5 7/8	Oct 98n	99:28	99:30	+ 3	5.92
3 1/2	Nov 98	98:30	99:30	....	3.54
5 1/2	Nov 98n	99:12	99:14	+ 4	5.92
8 7/8	Nov 98n	103:29	103:31	+ 4	5.92
5 1/8	Nov 98n	98:28	98:30	+ 5	5.89
5 5/8	Nov 98n	99:18	99:20	+ 5	5.89
5 1/8	Dec 98n	98:25	98:27	+ 5	5.92
5 3/4	Dec 98n	99:22	99:24	+ 4	5.92
6 3/8	Jan 99n	100:20	100:22	+ 5	5.91
5	Jan 99n	98:15	98:17	+ 5	5.95
5 7/8	Jan 99n	99:26	99:28	+ 5	5.95
5	Feb 99n	98:12	98:14	+ 4	5.99
8 7/8	Feb 99n	104:16	104:18	+ 5	5.96
5 1/2	Feb 99n	99:05	99:07	+ 5	5.98
5 7/8	Feb 99n	99:25	99:27	+ 5	5.97
5 7/8	Mar 99n	99:24	99:26	+ 6	5.98
6 1/4	Mar 99n	100:12	100:14	+ 6	5.98
7	Apr 99n	101:20	101:22	+ 5	6.01
6 3/8	Apr 99n	100:18	100:20	+ 6	6.01
6 1/2	Apr 99n	100:25	100:27	+ 6	6.01
6 3/8	May 99n	100:17	100:19	+ 6	6.04
9 1/8	May 99n	105:14	105:16	+ 6	6.04
6 1/4	May 99n	100:11	100:12	+ 6	6.04
6 3/4	May 99n	101:07	101:09	+ 6	6.05
6 3/4	Jun 99n	101:10	101:12	+ 7	6.02
6 3/8	Jul 99n	100:19	100:21	+ 7	6.03
6 7/8	Jul 99n	101:16	101:18	+ 7	6.08
6	Aug 99n	99:24	99:26	+ 6	6.09
8	Aug 99n	103:25	103:27	+ 7	6.08
6 7/8	Aug 99n	101:17	101:19	+ 6	6.09
7 1/8	Sep 99n	102:04	102:06	+ 7	6.08
6	Oct 99n	99:23	99:25	+ 4	6.10
7 1/2	Oct 99n	102:30	103:00	+ 7	6.12
5 7/8	Nov 99n	99:12	99:14	+ 8	6.13
7 7/8	Nov 99n	103:26	103:28	+ 8	6.12
7 3/4	Nov 99n	103:19	103:21	+ 8	6.13
7 3/4	Dec 99n	103:22	103:24	+ 9	6.13
6 3/8	Jan 00n	100:16	100:18	+ 9	6.13
7 3/4	Jan 00n	103:24	103:26	+ 9	6.15
5 7/8	Feb 00n	99:08	99:10	+ 9	6.15
8 1/2	Feb 00n	105:19	105:21	+ 9	6.17
7 1/8	Feb 00n	102:09	102:11	+ 9	6.17
6 7/8	Mar 00n	101:22	101:24	+ 8	6.18
5 1/2	Apr 00n	98:06	98:08	+ 8	6.18
6 3/4	Apr 00n	101:12	101:14	+ 9	6.19
6 3/8	May 00n	100:15	100:16	+10	6.18
8 7/8	May 00n	107:03	107:05	+10	6.16
6 1/4	May 00n	100:03	100:05	+ 9	6.19
5 7/8	Jun 00n	99:02	99:04	+10	6.19
6 1/8	Jul 00n	99:23	99:25	+11	6.20
8 3/4	Aug 00n	107:04	107:06	+10	6.21
6 1/4	Aug 00n	100:01	100:03	+10	6.21
11 7/8	Nov 03	128:06	128:12	+18	6.41
5 7/8	Feb 04n	97:04	97:06	+14	6.40
7 1/4	May 04n	104:16	104:18	+15	6.42
12 3/8	May 04	132:18	132:24	+20	6.43
7 1/4	Aug 04n	104:15	104:19	+17	6.44
13 3/4	Aug 04	141:06	141:12	+21	6.45
7 7/8	Nov 04n	108:06	108:08	+18	6.46
11 5/8	Nov 04	129:27	130:01	+19	6.46
7 1/2	Feb 05n	106:04	106:06	+18	6.46
6 1/2	May 05n	100:03	100:05	+15	6.47
8 1/4	May 00-05	104:26	104:29	+10	6.38
12	May 05	133:16	133:22	+20	6.49
6 1/2	Aug 05n	100:01	100:03	+18	6.48
10 3/4	Aug 05	126:14	126:20	+20	6.50
5 7/8	Nov 05n	96:00	96:02	+18	6.49
5 5/8	Feb 06n	94:06	94:08	+16	6.50
9 3/8	Feb 06	118:29	119:01	+18	6.47
6 7/8	May 06n	102:13	102:15	+19	6.50
7	Jul 06n	103:06	103:08	+18	6.52
6 1/2	Oct 06n	99:27	99:29	+18	6.51
3 3/8	Jan 07i	98:16	98:18	+ 2	3.55
6 1/4	Feb 07n	98:10	98:12	+15	6.48
7 5/8	Feb 02-07	104:09	104:12	+14	6.52
6 5/8	May 07n	101:03	101:04	+18	6.47
7 7/8	Nov 02-07	106:24	106:27	+14	6.36
8 3/8	Aug 03-08	109:26	109:29	+17	6.40
8 3/4	Nov 03-08	111:08	111:12	+16	6.55
9 1/8	May 04-09	114:00	114:04	+18	6.55
10 3/8	Nov 04-09	121:29	122:03	+17	6.56
11 3/4	Feb 05-10	130:26	131:00	+20	6.54
10	May 05-10	120:24	120:30	+18	6.57
12 3/4	Nov 05-10	139:10	139:16	+20	6.57
13 7/8	May 06-11	148:13	148:19	+21	6.58
14	Nov 06-11	151:07	151:13	+22	6.59
10 3/8	Nov 07-12	127:11	127:17	+21	6.67
12	Aug 08-13	141:06	141:12	+23	6.68
13 1/4	May 09-14	153:00	153:06	+25	6.70
12 1/2	Aug 09-14	147:17	147:23	+26	6.70
11 3/4	Nov 09-14	142:01	142:07	+24	6.69
11 1/4	Feb 15	145:22	145:28	+29	6.76
10 5/8	Aug 15	139:18	139:24	+28	6.79
9 7/8	Nov 15	131:28	132:02	+27	6.80
9 1/4	Feb 16	125:15	125:21	+27	6.80
7 1/4	May 16	104:21	104:23	+22	6.80
7 1/2	Nov 16	107:08	107:10	+23	6.82
8 3/4	May 17	120:20	120:26	+25	6.82
8 7/8	Aug 17	122:03	122:09	+26	6.82
9 1/8	May 18	125:06	125:12	+27	6.83
9	Nov 18	124:01	124:07	+28	6.83
8 7/8	Feb 19	122:22	122:28	+27	6.83
8 1/8	Aug 19	114:13	114:17	+25	6.84
8 1/2	Feb 20	118:26	118:30	+26	6.84
8 3/4	May 20	121:23	121:29	+27	6.84
8 3/4	Aug 20	121:26	122:00	+27	6.84
7 7/8	Feb 21	111:26	111:30	+26	6.85
8 1/8	May 21	114:25	114:29	+26	6.85
8 1/8	Aug 21	114:26	114:30	+25	6.85
8	Nov 21	113:14	113:18	+26	6.85
7 1/4	Aug 22	104:23	104:26	+24	6.84
7 5/8	Nov 22	109:08	109:11	+24	6.84
7 1/8	Feb 23	103:10	103:13	+23	6.84
6 1/4	Aug 23	92:27	92:30	+21	6.83
7 1/2	Nov 24	108:07	108:10	+24	6.83
7 5/8	Feb 25	109:27	109:30	+25	6.82
6 7/8	Aug 25	100:22	100:25	+23	6.81
6	Feb 26	89:24	89:27	+21	6.81
6 3/4	Aug 26	99:04	99:06	+18	6.81
6 1/2	Nov 26	96:03	96:05	+21	6.80
★6 5/8	Feb 27	98:06	98:08	+22	6.76

U.S. TREASURY STRIPS

Mat.	Type	Bid	Asked	Chg.	Ask Yld.
Aug 97	ci	99:05	99:05	+ 2	5.08
Aug 97	np	99:05	99:05	+ 2	5.10
Nov 97	ci	97:25	97:25	+ 2	5.48
Nov 97	np	97:25	97:25	+ 2	5.48
Feb 98	ci	96:12	96:12	+ 3	5.62
Feb 98	np	96:11	96:12	+ 3	5.65
May 98	ci	94:31	94:31	+ 4	5.72
May 98	np	95:00	95:00	+ 4	5.70
Aug 98	ci	93:16	93:17	+ 5	5.82
Aug 98	np	93:16	93:16	+ 5	5.85
Nov 98	ci	92:03	92:04	+ 6	5.90
Nov 98	np	92:02	92:03	+ 6	5.91
Feb 99	ci	90:20	90:21	+ 7	5.98
Feb 99	np	90:21	90:21	+ 7	5.97
May 99	ci	89:07	89:08	+ 7	6.04
May 99	np	89:06	89:07	+ 7	6.05
Aug 99	ci	87:27	87:29	+ 8	6.05
Aug 99	np	87:25	87:26	+ 8	6.09
Nov 99	ci	86:13	86:14	+ 9	6.13
Nov 99	np	86:12	86:14	+ 9	6.14
Feb 00	ci	85:00	85:02	+ 9	6.17
Feb 00	np	84:31	85:00	+ 9	6.19
May 00	ci	83:23	83:24	+ 10	6.18
May 00	np	83:23	83:25	+ 10	6.17
Aug 00	ci	82:11	82:13	− 10	6.21
Aug 00	np	82:09	82:10	− 10	6.24
Nov 05	ci	57:31	58:03	+ 13	6.56
Nov 05	bp	58:05	58:09	+ 13	6.52
Feb 06	ci	56:27	57:00	+ 13	6.59
Feb 06	bp	57:07	57:12	+ 14	6.51
May 06	ci	55:28	56:01	+ 14	6.61
Aug 06	ci	54:30	55:03	+ 14	6.61
Nov 06	ci	54:01	54:06	+ 14	6.62
Feb 07	ci	53:01	53:05	+ 14	6.64
May 07	ci	52:03	52:08	+ 14	6.66
Aug 07	ci	51:07	51:12	+ 14	6.66
Nov 07	ci	50:11	50:16	+ 14	6.67
Feb 08	ci	49:12	49:17	+ 13	6.70
May 08	ci	48:17	48:22	+ 13	6.71
Aug 08	ci	47:22	47:27	+ 13	6.71
Nov 08	ci	46:26	46:31	+ 14	6.73
Feb 09	ci	45:30	46:03	+ 13	6.75
May 09	ci	45:04	45:09	+ 13	6.76
Aug 09	ci	44:11	44:16	+ 13	6.77
Nov 09	ci	43:18	43:23	+ 13	6.78
Nov 09	bp	43:04	43:09	+ 13	6.86
Feb 10	ci	42:24	42:29	+ 12	6.80
May 10	ci	42:00	42:05	+ 12	6.80
Aug 10	ci	41:07	41:12	+ 12	6.82
Nov 10	ci	40:16	40:21	+ 12	6.82
Feb 11	ci	39:24	39:29	+ 12	6.84
May 11	ci	39:01	39:06	+ 11	6.85
Aug 11	ci	38:11	38:16	+ 11	6.86
Nov 11	ci	37:21	37:26	+ 11	6.86
Feb 12	ci	36:31	37:04	+ 11	6.87
May 12	ci	36:10	36:15	+ 11	6.88
Aug 12	ci	35:21	35:26	+ 11	6.89
Nov 12	ci	35:01	35:06	+ 11	6.89
Feb 13	ci	34:12	34:17	+ 11	6.91
May 13	ci	33:25	33:30	+ 11	6.91
Aug 13	ci	33:05	33:10	+ 11	6.91
Nov 13	ci	32:19	32:24	+ 11	6.92
Feb 14	ci	32:00	32:04	+ 11	6.93
May 14	ci	31:14	31:18	+ 11	6.93
Aug 14	ci	30:27	31:00	+ 11	6.94
Nov 14	ci	30:10	30:15	+ 11	6.94
Feb 15	ci	29:25	29:30	+ 11	6.95
Feb 15	bp	30:03	30:08	+ 13	6.88
May 15	ci	29:08	29:13	+ 11	6.95
Aug 15	ci	28:23	28:28	+ 11	6.95
Aug 15	bp	28:27	29:00	+ 12	6.93
Nov 15	ci	28:07	28:12	+ 11	6.96
Nov 15	bp	28:10	28:14	+ 12	6.95
Feb 16	ci	27:23	27:28	+ 11	6.97
Feb 16	bp	27:25	27:29	+ 12	6.95
May 16	ci	27:07	27:12	+ 11	6.97
May 16	bp	27:16	27:21	+ 11	6.91
Aug 16	ci	26:24	26:29	+ 11	6.97
Nov 16	ci	26:10	26:15	+ 11	6.97
Nov 16	bp	26:13	26:18	+ 11	6.95
Feb 17	ci	25:27	25:31	+ 11	6.97
May 17	ci	25:12	25:17	+ 11	6.98
May 17	bp	25:12	25:17	+ 10	6.97
Aug 17	ci	24:30	25:02	+ 11	6.98
Aug 17	bp	24:30	25:02	+ 10	6.98
Nov 17	ci	24:16	24:21	+ 11	6.98
Feb 18	ci	24:01	24:06	+ 10	6.99
May 18	ci	23:20	23:25	+ 10	6.99
May 18	bp	23:21	23:25	+ 9	6.99
Aug 18	ci	23:07	23:11	+ 9	6.99
Nov 18	ci	22:26	22:31	+ 9	6.99
Nov 18	bp	22:27	22:31	+ 9	6.99
Feb 19	ci	22:13	22:17	+ 9	6.99
Feb 19	bp	22:14	22:18	+ 9	6.99
May 19	ci	22:01	22:05	+ 9	6.99
Aug 19	ci	21:21	21:25	+ 9	6.99
Aug 19	bp	21:22	21:26	+ 9	6.99
Nov 19	ci	21:10	21:14	+ 8	6.99
Feb 20	ci	20:29	21:02	+ 9	6.99
Feb 20	bp	20:29	21:02	+ 8	6.99
May 20	ci	20:18	20:22	+ 9	6.99
May 20	bp	20:18	20:22	+ 8	6.99
Aug 20	ci	20:07	20:11	+ 9	6.99
Aug 20	bp	20:07	20:11	+ 8	6.99
Nov 20	ci	19:30	20:02	+ 9	6.98
Feb 21	ci	19:17	19:22	+ 8	6.99
Feb 21	bp	19:17	19:22	+ 8	6.99
May 21	ci	19:07	19:11	+ 8	6.99
May 21	bp	19:07	19:11	+ 8	6.99
Aug 21	ci	18:29	19:01	+ 8	6.99
Aug 21	bp	18:28	19:01	+ 8	6.99
Nov 21	ci	18:19	18:23	+ 8	6.98
Nov 21	bp	18:19	18:23	+ 8	6.98
Feb 22	ci	18:08	18:13	+ 8	6.98
May 22	ci	18:01	18:05	+ 7	6.97
Aug 22	ci	17:23	17:28	+ 7	6.96
Aug 22	bp	17:24	17:28	+ 7	6.96
Nov 22	ci	17:14	17:18	+ 7	6.96
Nov 22	bp	17:15	17:19	+ 7	6.95
Feb 23	ci	17:07	17:12	+ 7	6.94
Feb 23	bp	17:08	17:12	+ 7	6.93
May 23	ci	16:30	17:02	+ 7	6.94
Aug 23	ci	16:22	16:26	+ 7	6.93
Aug 23	bp	16:28	17:00	+ 7	6.89
Nov 23	ci	16:14	16:18	+ 7	6.93
Feb 24	ci	16:06	16:10	+ 7	6.92
May 24	ci	15:31	16:03	+ 7	6.91
Aug 24	ci	15:23	15:27	+ 7	6.90
Nov 24	ci	15:17	15:21	+ 7	6.88
Nov 24	bp	15:17	15:21	+ 7	6.88
Feb 25	ci	15:10	15:14	+ 7	6.87
Feb 25	bp	15:10	15:14	+ 7	6.87
Aug 25	ci	14:30	15:02	+ 7	6.84
Aug 25	bp	14:30	15:02	+ 7	6.84
Feb 26	ci	14:13	14:17	+ 7	6.84
Feb 26	bp	14:16	14:20	+ 7	6.82
Aug 26	ci	14:02	14:06	+ 7	6.81
Aug 26	bp	14:02	14:06	+ 7	6.81
Nov 26	ci	13:29	14:01	+ 7	6.79
Nov 26	bp	13:30	14:02	+ 7	6.78

TREASURY BILLS

Maturity	Days to Mat.	Bid	Asked	Chg.	Ask Yld.
Jun 19 '97	6	4.76	4.72	−0.06	4.79
Jun 26 '97	13	4.70	4.66	−0.15	4.73
Jul 03 '97	20	4.59	4.49	−0.04	4.56

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APPENDIX 13.C (continued)
Factor Tables

$I = 4.00\%$

N	(P/F)	(P/A)	(P/G)	(F/P)	(F/A)	(A/P)	(A/F)	(A/G)	N
1	.9615	0.9615	-0.0000	1.0400	1.0000	1.0400	1.0000	-0.0000	1
2	.9246	1.8861	0.9246	1.0816	2.0400	0.5302	0.4902	0.4902	2
3	.8890	2.7751	2.7025	1.1249	3.1216	0.3603	0.3203	0.9739	3
4	.8548	3.6299	5.2670	1.1699	4.2465	0.2755	0.2355	1.4510	4
5	.8219	4.4518	8.5547	1.2167	5.4163	0.2246	0.1846	1.9216	5
6	.7903	5.2421	12.5062	1.2653	6.6330	0.1908	0.1508	2.3857	6
7	.7599	6.0021	17.0657	1.3159	7.8983	0.1666	0.1266	2.8433	7
8	.7307	6.7327	22.1806	1.3686	9.2142	0.1485	0.1085	3.2944	8
9	.7026	7.4353	27.8013	1.4233	10.5828	0.1345	0.0945	3.7391	9
10	.6756	8.1109	33.8814	1.4802	12.0061	0.1233	0.0833	4.1773	10
11	.6496	8.7605	40.3772	1.5395	13.4864	0.1141	0.0741	4.6090	11
12	.6246	9.3851	47.2477	1.6010	15.0258	0.1066	0.0666	5.0343	12
13	.6006	9.9856	54.4546	1.6651	16.6268	0.1001	0.0601	5.4533	13
14	.5775	10.5631	61.9618	1.7317	18.2919	0.0947	0.0547	5.8659	14
15	.5553	11.1184	69.7355	1.8009	20.0236	0.0899	0.0499	6.2721	15
16	.5339	11.6523	77.7441	1.8730	21.8245	0.0858	0.0458	6.6720	16
17	.5134	12.1657	85.9581	1.9479	23.6975	0.0822	0.0422	7.0656	17
18	.4936	12.6593	94.3498	2.0258	25.6454	0.0790	0.0390	7.4530	18
19	.4746	13.1339	102.8933	2.1068	27.6712	0.0761	0.0361	7.8342	19
20	.4564	13.5903	111.5647	2.1911	29.7781	0.0736	0.0336	8.2091	20
21	.4388	14.0292	120.3414	2.2788	31.9692	0.0713	0.0313	8.5779	21
22	.4220	14.4511	129.2024	2.3699	34.2480	0.0692	0.0292	8.9407	22
23	.4057	14.8568	138.1284	2.4647	36.6179	0.0673	0.0273	9.2973	23
24	.3901	15.2470	147.1012	2.5633	39.0826	0.0656	0.0256	9.6479	24
25	.3751	15.6221	156.1040	2.6658	41.6459	0.0640	0.0240	9.9925	25
26	.3607	15.9828	165.1212	2.7725	44.3117	0.0626	0.0226	10.3312	26
27	.3468	16.3296	174.1385	2.8834	47.0842	0.0612	0.0212	10.6640	27
28	.3335	16.6631	183.1424	2.9987	49.9676	0.0600	0.0200	10.9909	28
29	.3207	16.9837	192.1206	3.1187	52.9663	0.0589	0.0189	11.3120	29
30	.3083	17.2920	201.0618	3.2434	56.0849	0.0578	0.0178	11.6274	30
31	.2965	17.5885	209.9556	3.3731	59.3283	0.0569	0.0169	11.9371	31
32	.2851	17.8736	218.7924	3.5081	62.7015	0.0559	0.0159	12.2411	32
33	.2741	18.1476	227.5634	3.6484	66.2095	0.0551	0.0151	12.5396	33
34	.2636	18.4112	236.2607	3.7943	69.8579	0.0543	0.0143	12.8324	34
35	.2534	18.6646	244.8768	3.9461	73.6522	0.0536	0.0136	13.1198	35
36	.2437	18.9083	253.4052	4.1039	77.5983	0.0529	0.0129	13.4018	36
37	.2343	19.1426	261.8399	4.2681	81.7022	0.0522	0.0122	13.6784	37
38	.2253	19.3679	270.1754	4.4388	85.9703	0.0516	0.0116	13.9497	38
39	.2166	19.5845	278.4070	4.6164	90.4091	0.0511	0.0111	14.2157	39
40	.2083	19.7928	286.5303	4.8010	95.0255	0.0505	0.0105	14.4765	40
41	.2003	19.9931	294.5414	4.9931	99.8265	0.0500	0.0100	14.7322	41
42	.1926	20.1856	302.4370	5.1928	104.8196	0.0495	0.0095	14.9828	42
43	.1852	20.3708	310.2141	5.4005	110.0124	0.0491	0.0091	15.2284	43
44	.1780	20.5488	317.8700	5.6165	115.4129	0.0487	0.0087	15.4690	44
45	.1712	20.7200	325.4028	5.8412	121.0294	0.0483	0.0083	15.7047	45
46	.1646	20.8847	332.8104	6.0748	126.8706	0.0479	0.0079	15.9356	46
47	.1583	21.0429	340.0914	6.3178	132.9454	0.0475	0.0075	16.1618	47
48	.1522	21.1951	347.2446	6.5705	139.2632	0.0472	0.0072	16.3832	48
49	.1463	21.3415	354.2689	6.8333	145.8337	0.0469	0.0069	16.6000	49
50	.1407	21.4822	361.1638	7.1067	152.6671	0.0466	0.0066	16.8122	50
51	.1353	21.6175	367.9289	7.3910	159.7738	0.0463	0.0063	17.0200	51
52	.1301	21.7476	374.5638	7.6866	167.1647	0.0460	0.0060	17.2232	52
53	.1251	21.8727	381.0686	7.9941	174.8513	0.0457	0.0057	17.4221	53
54	.1203	21.9930	387.4436	8.3138	182.8454	0.0455	0.0055	17.6167	54
55	.1157	22.1086	393.6890	8.6464	191.1592	0.0452	0.0052	17.8070	55
60	.0951	22.6235	422.9966	10.5196	237.9907	0.0442	0.0042	18.6972	60
65	.0781	23.0467	449.2014	12.7987	294.9684	0.0434	0.0034	19.4909	65
70	.0642	23.3945	472.4789	15.5716	364.2905	0.0427	0.0027	20.1961	70
75	.0528	23.6804	493.0408	18.9453	448.6314	0.0422	0.0022	20.8206	75
80	.0434	23.9154	511.1161	23.0498	551.2450	0.0418	0.0018	21.3718	80
85	.0357	24.1085	526.9384	28.0436	676.0901	0.0415	0.0015	21.8569	85
90	.0293	24.2673	540.7369	34.1193	827.9833	0.0412	0.0012	22.2826	90
95	.0241	24.3978	552.7307	41.5114	1012.7846	0.0410	0.0010	22.6550	95
100	.0198	24.5050	563.1249	50.5049	1237.6237	0.0408	0.0008	22.9800	100

APPENDIX D

PRELIMINARY REMEDIATION GOALS FOR GROUNDWATER AND ON-SITE SOIL

APPENDIX D
PRELIMINARY REMEDIATION GOALS FOR GROUNDWATER AND ONSITE SOIL

The purpose of this appendix is to provide preliminary remediation goals (PRGs) for groundwater and onsite soil, as requested by the New York State Department of Environmental Conservation (NYSDEC). This appendix is also a supplement to Section 6.3 of the Remedial Investigation (RI) report. Details on PRGs may be found in Section 6.3 of the RI.

Table 1 presents the potential PRGs for groundwater based on New York State Class GA standards and guidance values. Table 2 presents the potential PRGs for onsite soil. These potential PRGs are based on commercial/industrial land use values, TAGM HWR-94-4046 (NYSDEC, 1994), and site-specific background values.

Table 3 presents the final PRGs for groundwater and onsite soil to be used at the site. The PRGs listed in Table 3 for groundwater are identical to those listed in Table 1. The PRGs listed in Table 3 for onsite soil were the most appropriate values from Table 2. In those cases where the TAGM 4046 value is based on protection of groundwater rather than direct contact the TAGM 4046 value was selected as the PRG. However, in cases where the TAGM 4046 value for PAHs is based on direct contact, the higher of the risk-based value or the site-specific background was selected, as long as the higher value was less than or equal to 50 ppm. In the case of inorganics, the higher of the risk-based value or site-specific background was selected, since the TAGM 4046 values for inorganics are not based on protection of groundwater.

The selection of PRGs for onsite soil is protective of human health and the environment. Since the TAGM 4046 values based on direct contact associated with residential risk, it is more appropriate at the Oneida (Sconondoa Street) site to use values based on commercial/industrial risk.

REFERENCES

NYSDEC, 1993. Ambient Water Quality Standards and Guidance Values. Technical and Operations Guidance Series (TOGS) 1.1.1. Division of Water, New York State Department of Environmental Conservation. October 1993.

NYSDEC, 1994. Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels. Revised. Division of Hazardous Waste Remediation, New York State Department of Environmental Conservation. HWR-94-4046. January 24, 1994.

USEPA, 1996. Risk-Based Concentration Table, June - December 1996. USEPA Region 3.

TABLE D.1
POTENTIAL PRGS FOR GROUNDWATER (MG/L) (1)

MGP-Related Residual(2)	Risk-based PRG	SCG-based PRG(3) NYS Class GA Standard(4)	SCG-based PRG(3) NYS Class GA Guidance Value(4)	Background Upper Tolerance Limit
Volatiles				
Benzene	-	0.0007	-	-
Ethylbenzene	-	0.005	-	-
Toluene	-	0.005	-	-
Xylenes	-	0.005	-	-
Semivolatiles				
Acenaphthene	-	-	0.020	-
Acenaphthylene	-	-	0.020 (a)	-
Benzo(a)anthracene	-	-	2.0E-06	-
Benzo(a)pyrene	-	2.0E-06	-	-
Benzo(b)fluoranthene	-	-	2.0E-06	-
Benzo(k)fluoranthene	-	-	2.0E-06	-
Fluorene	-	-	0.050	-
Indeno(1,2,3-cd)pyrene	-	-	2.0E-06	-
2-Methylnaphthalene	-	-	0.010 (b)	-
Naphthalene	-	-	0.010	-
Phenanthrene	-	-	0.050	-
Pyrene	-	-	0.050	-
Pesticides/PCBs				
Heptachlor*	-	1.0E-06	-	-
Inorganics				
Aluminum*	-	-	0.2 (c)	-
Arsenic	-	0.025	-	-
Copper*	-	0.20	-	-
Iron*	-	0.25	-	-
Lead	-	0.025	-	-
Manganese*	-	0.25	-	-

(1) PRG = preliminary remediation goal. A dash (" - ") indicates that the item is not applicable or that no value is available.

(2) An asterisk ("*") indicates that the chemical is not MGP-related.

(3) SCG = standard, criterion, or guideline.

(4) From NYSDEC, 1993. (a) Value for acenaphthene. (b) Value for naphthalene. (c) Secondary maximum contaminant level (USEPA, 1996)

TABLE D.2
POTENTIAL PRGS FOR ONSITE SOIL (MG/KG) (1)

MGP-Related Residual(2)	Risk-based PRG		SCG-based PRG(4)	Background Upper Tolerance Limit(5)
	Human Health(3)	Ecological		
Volatiles				
Benzene	8.7	-	0.28	-
Ethylbenzene	3,600	- -	25	-
Toluene	5,200	-	6.9	-
Xylenes	75,000	-	5.5	-
Semivolatiles				
Benzo(a)anthracene	7.2	-	0.224	19
Benzo(a)pyrene	0.72	-	0.061	18
Benzo(b)fluoranthene	7.2	-	5.1	18
Benzo(k)fluoranthene	72	-	5.1	16
Chrysene	724	-	1.8	23
Dibenzo(a,h)anthracene	0.73	-	0.014	-
Fluoranthene	15,000	-	50	55
Fluorene	13,000	-	50	5.7
Indeno(1,2,3-c,d)pyrene	7.3	-	15	4.3
2-Methylnaphthalene	6,900	-	50	0.39
Naphthalene	6,900	-	50	0.33
Pyrene	11,000	-	50	28
Pesticides/PCBs				
none				
Inorganics				
Arsenic	3.2	-	7.5 *	15
Copper*	16,000	-	25 *	90
Mercury	110	-	0.1	0.15
Zinc	120,000	-	20 *	93

(1) PRG = preliminary remediation goal. A dash (" - ") indicates that the item is not applicable or that no value is available.

(2) An asterisk ("*") indicates that the chemical is not MGP-related.

(3) The risk-based PRGs are based on a hazard quotient = 0.2 or a 10-6 cancer risk, whichever produces the lower PRG. Values are based on commercial-industrial land use.

(4) SCG = standard, criterion, or guideline. The values listed are recommended soil cleanup objectives from TAGM HWR-94-4046 based on residential exposure or protection of groundwater and on the measured organic carbon concentration of 4.6% (NYSDEC, 1994). The SCG for total semivolatile organic compounds is < 500 ppm. An asterisk ("*") indicates that the cleanup objective presented is the value presented or site background.

(5) Background upper tolerance limits (BUTLs) for surface soil (see Appendix L of the RI report).

TABLE D.3
INTERIM PRGS FOR GROUNDWATER AND SOIL(1)

Coal-Related Residual(2)	Groundwater (mg/L)	Onsite Soil (mg/kg)
Volatiles		
Benzene	0.0007	0.028
Ethylbenzene	0.005	25
Toluene	0.005	6.9
Xylenes	0.005	5.5
Semivolatiles		
Acenaphthene	0.020	-
Acenaphthylene	0.020	-
Benzo(a)anthracene	2.0E-06	19
Benzo(a)pyrene	2.0E-06	18
Benzo(b)fluoranthene	2.0E-06	18
Benzo(k)fluoranthene	2.0E-06	16
Chrysene	-	23
Dibenzo(a,h)anthracene	-	0.73
Fluoranthene	-	50
Fluorene	0.050	50
Indeno(1,2,3-c,d)pyrene	2.0E-06	15
2-Methylnaphthalene	0.010	50
Naphthalene	0.010	50
Phenanthrene	0.050	-
Pyrene	0.050	50
Pesticides/PCBs		
Heptachlor*	1.0E-06	-
Inorganics		
Aluminum*	0.20	-
Arsenic	0.025	15
Copper*	0.20	16,000
Iron*	0.25	-
Lead	0.025	-
Manganese*	0.25	-
Mercury	-	110
Zinc	-	93

(1) PRG = preliminary remediation goal. A dash ("-") indicates that the chemical is not of concern in this medium.

(2) An asterisk ("*") indicates that the chemical is not MGP-related.

APPENDIX E

EVALUATION OF HYDRAULIC BARRIER OPTIONS

APPENDIX E
EVALUATION OF HYDRAULIC BARRIER OPTIONS

SUMMARY

A groundwater hydraulic evaluation was conducted to evaluate containment options for the Oneida site. The goal of the evaluation was to characterize the effectiveness of capping in combination with partial and full barrier walls, and to calculate the groundwater pumping rates necessary to maintain a hydraulic gradient towards the site. In addition, groundwater fluxes to the Tailrace and the Eastern Ditch were calculated with and without the barrier wall.

The groundwater hydraulic evaluation was conducted using the MODFLOW three-dimensional groundwater flow model. The model parameters were based upon data collected during remedial site investigations. Model assumptions include the following: (1) homogeneous and isotropic hydraulic conductivity, (2) a lower, impermeable clay boundary, and (3) Oneida Creek as a hydraulic boundary.

It was calculated that a fully-encircling slurry wall would reduce groundwater fluxes from the site to the Tailrace from approximately 4 gpm to approximately 0.5 gpm, and from the site to the Eastern Ditch from approximately 7 gpm to approximately 0.6 gpm. A pumping rate of 2 gpm within the slurry wall would be required to maintain an inward hydraulic gradient. A partial wall enclosure was found to result in groundwater mounding within and upgradient of the site and was ineffective in maintaining hydraulic control.

MODEL PARAMETERS AND ASSUMPTIONS

The model grid and boundaries are shown on Figures E-1 and E-2. The model was constructed with 105 columns and 100 rows with a uniform grid spacing of 10 feet at the site. This spacing allowed a reasonable delineation of the streams and the barrier walls. The grid was expanded, using a factor of 1.5, to 100 feet and the model boundaries. The grid was oriented parallel with the assumed regional hydraulic gradient towards Oneida Creek.

Groundwater flow in the glaciolacustrine sand, silt, and gravel was simulated assuming a single layer with a uniform hydraulic conductivity of 13 feet/day. The hydraulic conductivity for the layer was increased from the average value of 4 feet/day, calculated from slug tests. It was assumed that the slug tests would underestimate the average hydraulic conductivity of the glaciolacustrine unit. However, the hydraulic conductivity was well within the measured range of 0.02 ft/day to 58.32 ft/day.

The saturated thickness and transmissivity of the glaciolacustrine sand, silt, and gravel unit was dependent on the elevation of the water table surface and the elevation of the top of the underlying clay layer. Elevation data points of the clay layer surface were obtained from geologic logs from boring and well installation.

It was assumed that recharge to groundwater was mainly from infiltration. Since recharge was the least known parameter, hydraulic conductivity was held constant and the model was calibrated by varying recharge in four zones. The final recharge values for the four zones ranged from 5.75 to 14 inches per year (see following table and Figure E-3).

MODEL RECHARGE ZONE	AREA	RECHARGE (IN/YR)	RECHARGE (FT/DAY)
1	NON-SITE	7	1.597E-03
2	CITY AREAS	5.75	1.282E-03
3	SITE - UNPAVED	7	1.597E-03
3	SITE - PAVED	0	0
3	SITE - PAVED 85% EFFECTIVE	1.05	2.396E-04
4	FLAT FIELDS/WETLANDS	14	3.194E-03

Oneida Creek, the Tailrace and the Eastern Ditch were all simulated using the MODFLOW river package. The stage and bottom elevations of the river nodes were based on elevations from a topographic map and each was assigned a uniform depth across the modeled area. The bottom of Oneida Creek was conservatively assumed to be conductive and the Tailrace and Eastern Ditch were assumed to be much less conductive. Based on the size, location and depth of Oneida Creek, it was assumed that the creek was a hydraulic boundary. Therefore, no attempt was made to include areas east of the creek in the model and all of the model cells east of the creek were made inactive (see Figure E-1).

CALIBRATION

Target water levels were calculated by averaging all water levels measured in monitoring wells. It was assumed that these average water levels better represented long-term, average water levels across the site than any single set of water levels. To match observed water levels, the recharge was varied in each zone until both the best match was made, and the residuals between observed and calculated water levels were at a minimum.

The calibrated steady-state water levels are shown on Figure E-4, and the comparison of observed water levels with calculated water levels is shown on Figure E-5. The calibrated residual mean was 0.01 feet, and the calibrated absolute residual mean was

1.43 feet. As seen on Figure E-5, where the calculated water levels were biased, they were biased high.

PREDICTIVE SIMULATIONS

Groundwater fluxes from the site to the Tailrace and the Eastern Ditch were calculated from the steady-state starting head simulation. The MODFLOW cell-by-cell flow file was examined, and groundwater fluxes adjacent to both the site and the streams were added. The calculated groundwater discharge was 3.7 gpm from the site to the Tailrace and 7.2 gpm from the site to the Eastern Ditch.

A slurry wall surrounding the site was simulated using the MODFLOW horizontal flow barrier package. The slurry wall was assumed to be one foot thick with a hydraulic conductivity of 3×10^{-3} ft/day (1×10^{-6} cm/sec). Recharge within the slurry wall was set to a value of zero, assuming that areas not currently covered by buildings or pavement would be paved. The results are shown on Figure E-6. Groundwater levels within the slurry wall are flat. The water levels within the slurry wall are at an elevation intermediate between the upgradient and downgradient water levels outside of the wall, indicating a small groundwater flux across the site. The cell-by-cell flow files indicate that groundwater fluxes from the site to the Tailrace and the Eastern Ditch are reduced to 0.5 and 0.6 gpm, respectively. Most of the former groundwater flow through the site is directed around the slurry wall.

The MODFLOW well package was used to simulate a well pumping inside the slurry wall to maintain an inward hydraulic gradient. The pumping rate of the simulated well was increased until all flow within the wall was towards the well. It was calculated that a pumping rate of approximately 2 gpm was required to maintain an inward hydraulic gradient.

A wall partially enclosing the site was also simulated. The upgradient side of the site, adjacent to Sconondoa street, was left open. This resulted in mounding of groundwater within and upgradient of the site. Groundwater entered the site from the upgradient direction, then flowed around the edges of slurry walls. Therefore, this wall configuration was considered ineffective.

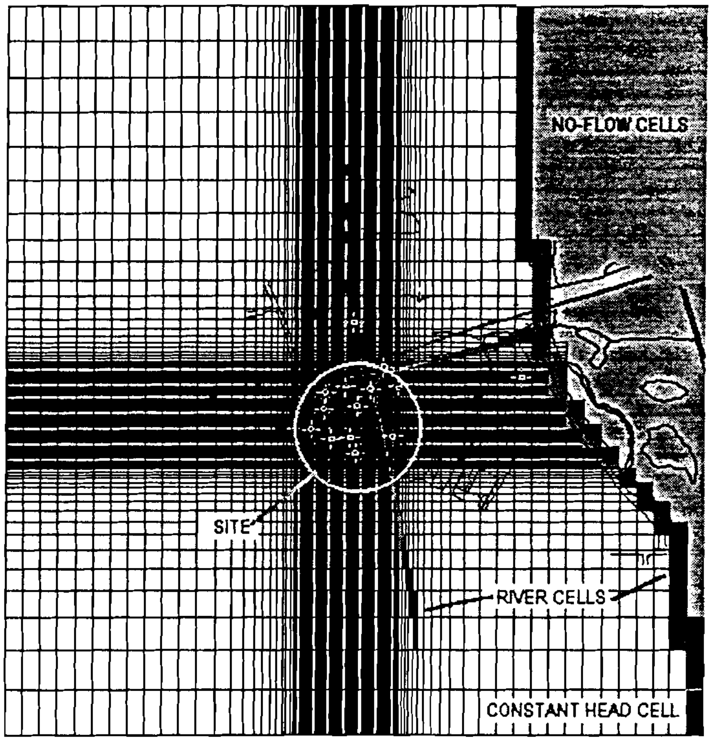


Figure E-1. Model grid, entire model.

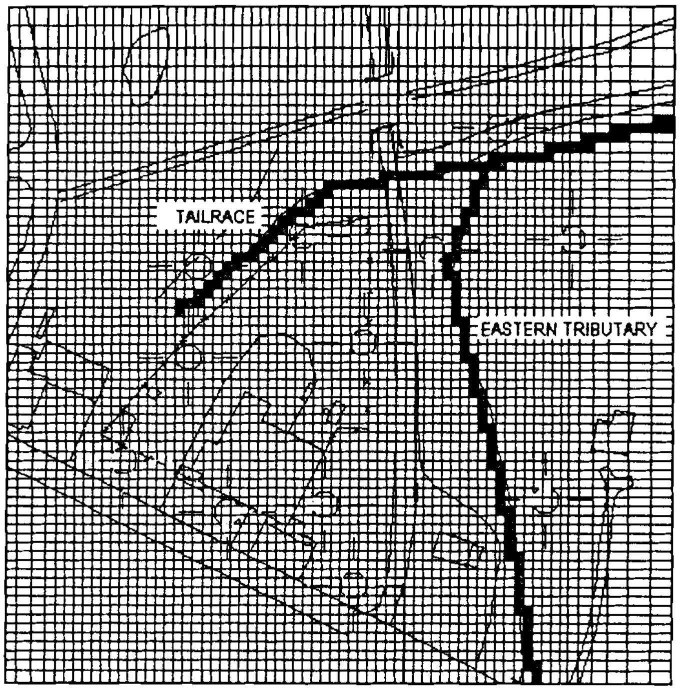
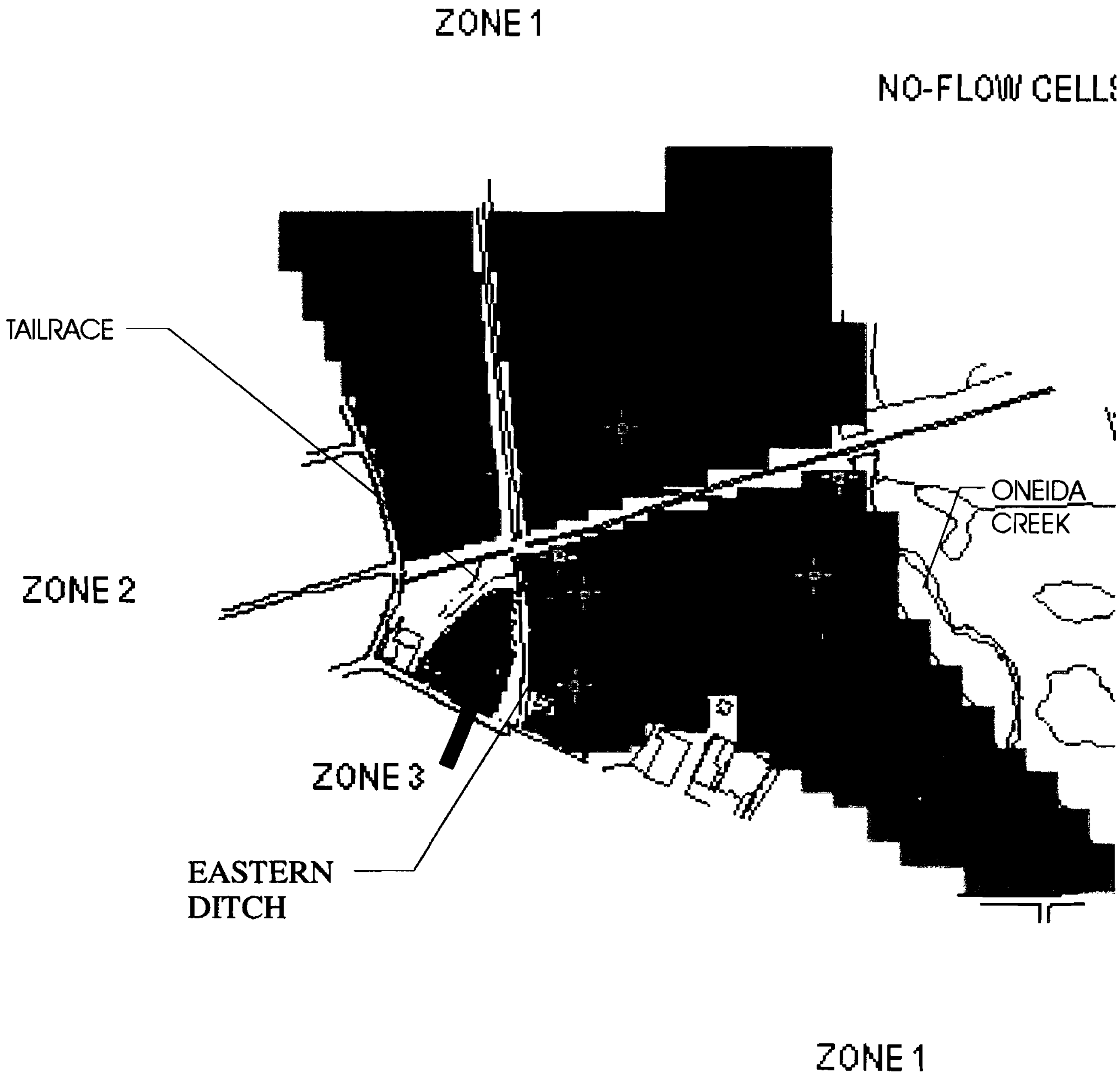


Figure E-2. Model grid, site only.

Figure E-3
MODEL RECHARGE ZONES



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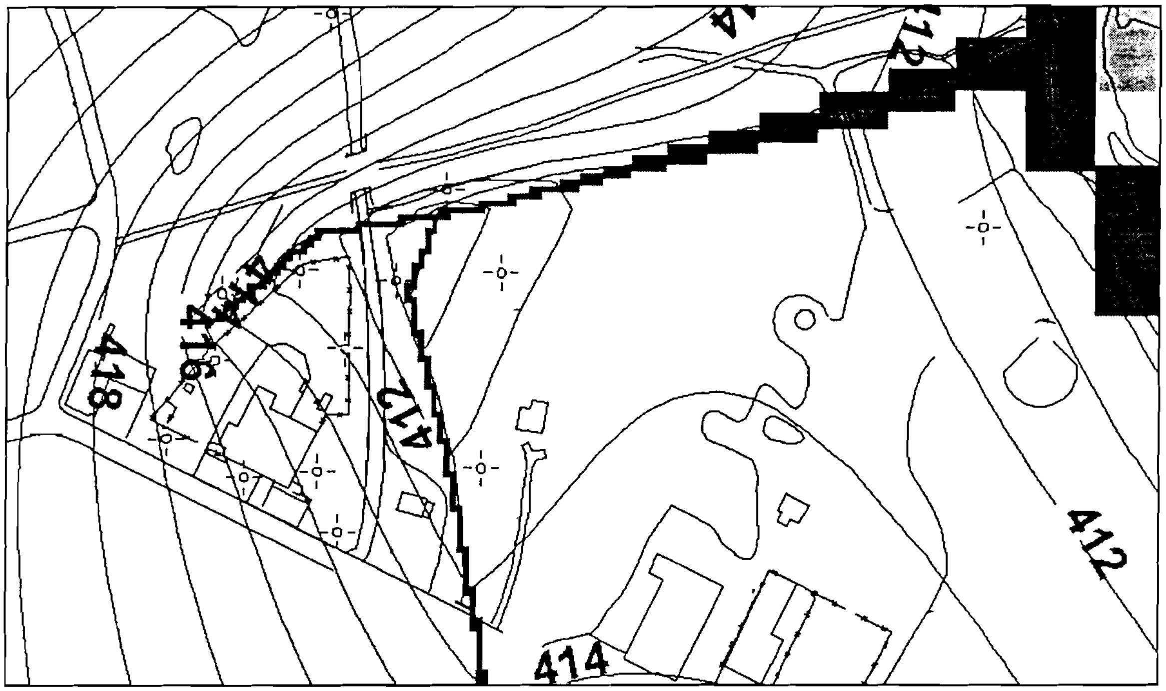

Figure E-4. Steady-state starting heads.

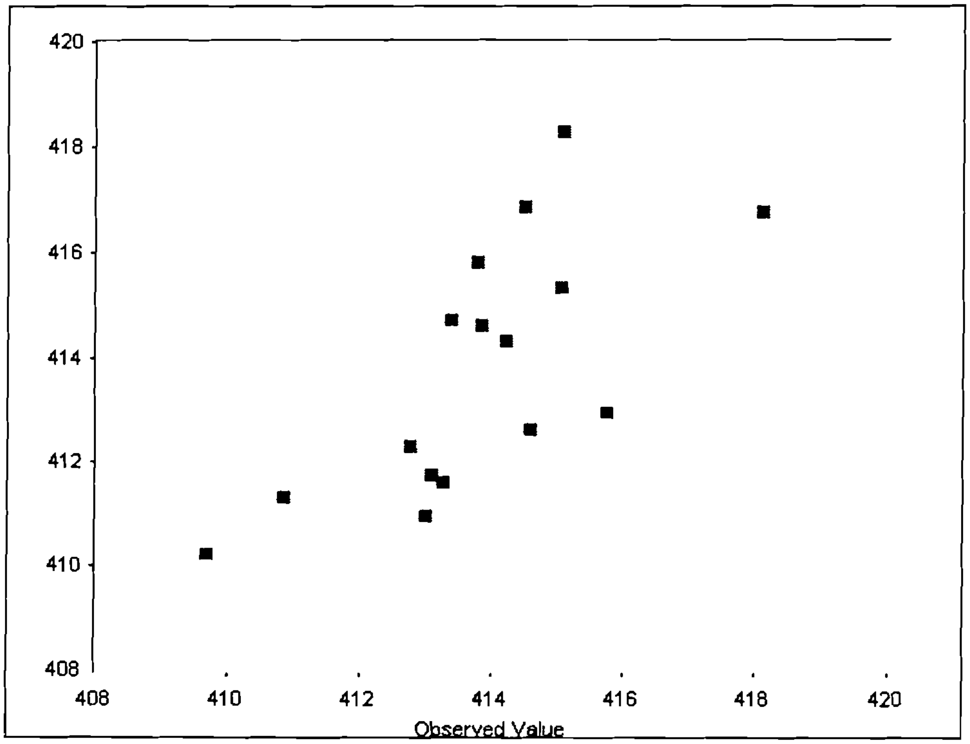

Figure E-5. Observed vs computed heads.

Figure E-6. Simulated heads with slurry wall.

APPENDIX F

FLUX, PARTITIONING, AND NAPL MOBILITY CALCULATIONS

1. FLUX CALCULATIONS

As shown in the mass loading table on the page 25 of this appendix, groundwater discharging from the site to the Tailrace does not appear to be impacting the surface water in Oneida Creek.

1. Surface water measurements taken in Oneida Creek during the RI show no detectable levels of BTEX, total PAHs, or total cyanide. Obviously, groundwater infiltrating to the Tailrace is not impacting the surface water in Oneida Creek. The flux calculations predict measurable levels of benzene, total PAHs, and total cyanide in the creek, but the benzene level falls below the NYS Class C surface water standard of 6 µg/L. No standards exist for total PAHs and total cyanide, but the fact that the calculated PAH and cyanide values are in the tens of micrograms per liter while the actual measured values are non-detect indicates that these flux calculations may be significantly overestimating the impact of groundwater to Oneida Creek.
2. Onsite groundwater contributions of metals to the Tailrace, and ultimately to Oneida Creek, are up to two orders of magnitude less than the contributions of metals from sewers upgradient of the site and from overland flow over the site and areas north and east of the site (about 40 acres total) directly to the Tailrace. This is true for the onsite groundwater even without installation of a barrier wall (see "no wall" values for groundwater mass loading). Mass loading from groundwater in the absence of a barrier wall is still relatively small compared to mass loading from the sewers and overland flow. Furthermore, the flux calculations were based on groundwater concentrations equivalent to those found in monitoring wells, ES-2S and ES-7, and on the assumption that the impacted groundwater would not be addressed. ES-2S, in particular, has the highest groundwater PRG exceedances found on the site. Therefore, even with heavily impacted groundwater and no barrier wall, groundwater contributions of metals to Oneida Creek are insignificant when compared to contributions from upgradient and overland sources.

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Sheet 2 of
Subject Flow [illegible] - Excess precipitation
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Rev. 3/20/97

Excess Precipitation

Ref. Hjelmfelt, A.T. and C.J. Cassidy, Hydrology for Engineers and Planners, Ames, Iowa: Iowa State University Press, 1975.

U.S. Soil Conservation Service (SCS) Method for [illegible]

Avg. annual precipitation in Oneida, NY = 40 inches (Fig. 4.1)

Probable maximum 24-hr. precipitation for Oneida, NY = 19 inches (Fig. 4.26)

Assume:
U.S. SCS Soil Group = C (clay loams, shallow sandy loam, soils low in organic content & soils usually high in clay) (Table 5.1)

Minimum Infiltration Rate = 0.05 - 0.15 in/hr (Table 5.[illegible])

Assume:
Antecedent Moisture Condition = Condition II (avg. case for [illegible]

Assume:
Hydrologic Condition of Soil-cover Complex = Good (lightly grazed, has plant cover on more than 3/4 of area)

Assume:
Land use = woods, [illegible], meadow, wetlands, park (Table 5.2)

Curve Number = 70 (for soil Group C and good hydrologic soil condition) (Table 5.2)

From Fig. 5.3, for an annual precipitation of 40 inches on site, 34 inches will occur as runoff (excess precipitation).

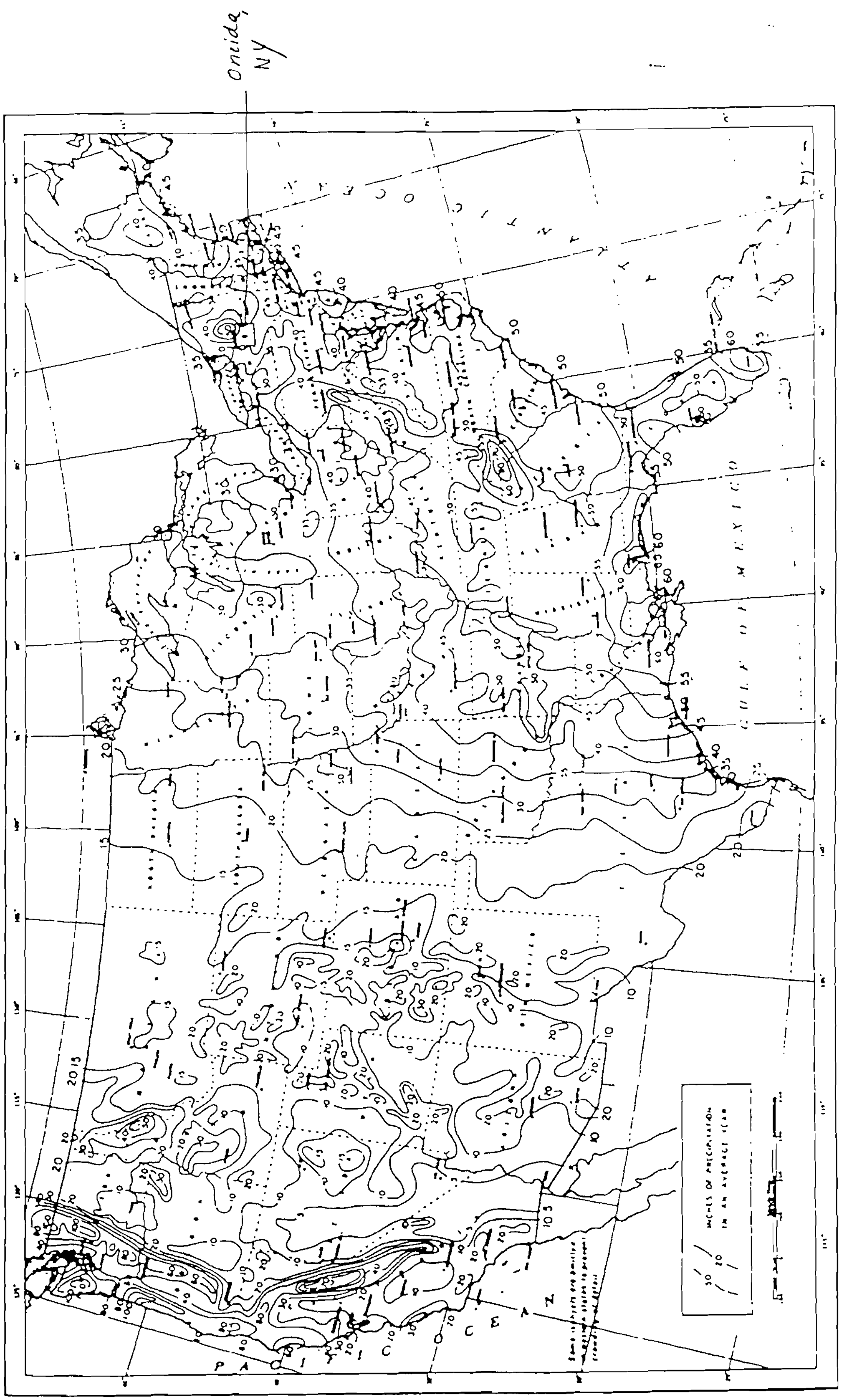

FIG. 4.1. Average annual precipitation of the United States (3).

Ref: Hjelmfelt Jr., A.T. and J. J. Cassidy, 1975, Hydrology for Engineers and Planners.

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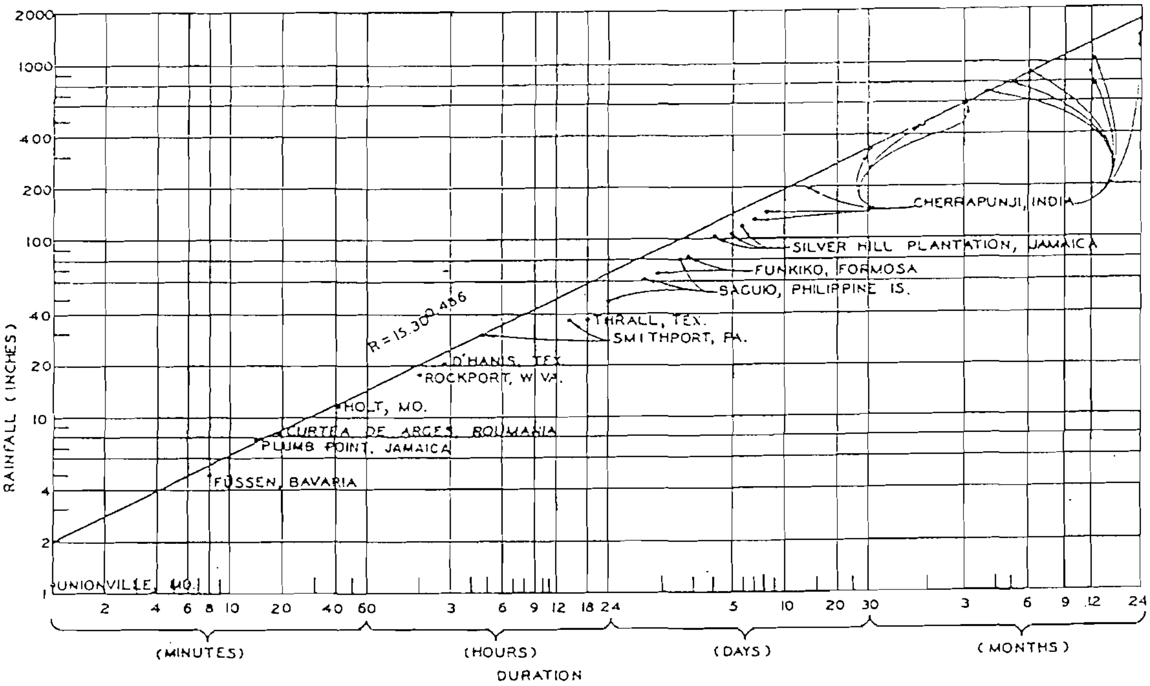

FIG. 4.25 The world's record point rainfall values (18).

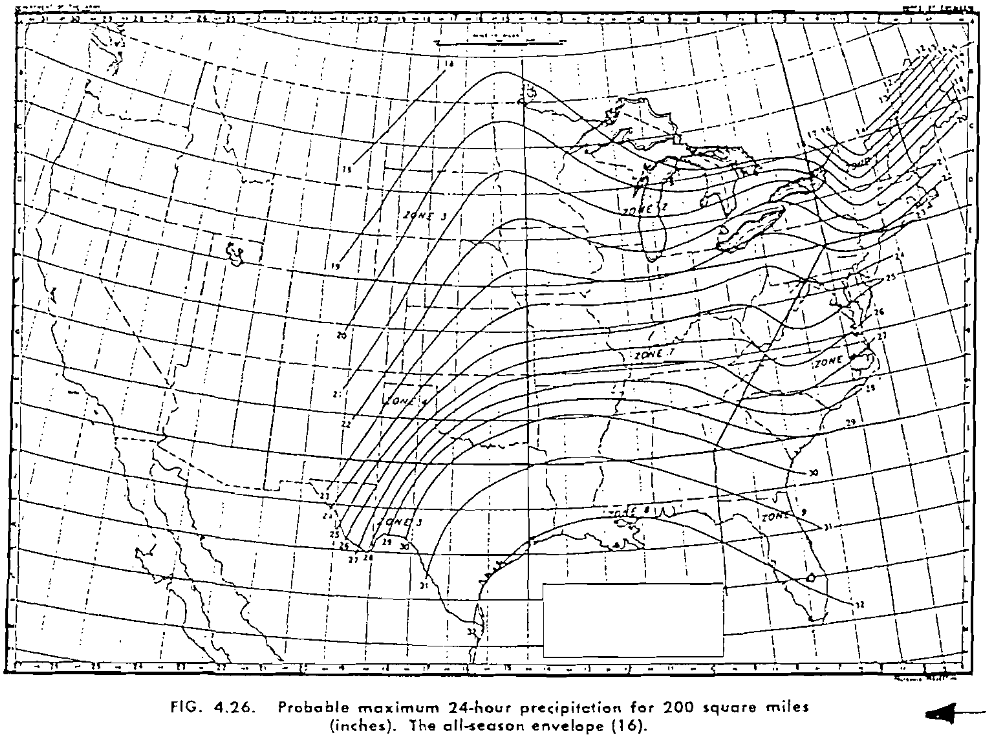

FIG. 4.26. Probable maximum 24-hour precipitation for 200 square miles (inches). The all-season envelope (16).

[illegible]

TABLE 5.1. Soil groupings

Group	Minimum infiltration rate (in./hr)	Soils
A	0.30–0.45	deep sand, deep loess, aggregated silts
B	0.15–0.30	shallow loess, sandy loam
C	0.05–0.15	clay loams, shallow sandy loam, soils low in organic content and soils usually high in clay
D	0–0.05	soils which swell significantly when wet, heavy plastic clays, and certain saline soils

Source: U.S. Soil Conservation Service (2).

At this point it is obvious that the parameter S is unknown and must be established from the soil-cover complex. The soil alone is classified initially in the form shown in Table 5.1. A detailed list in which named soil types are associated with the groups in the table is given in the SCS National Engineering Handbook (2).

It is necessary to include the soil cover in the description of the soil-cover complex. This is done through Table 5.2 (2). Using the soil group and the cover existing in the drainage basin, we read a curve number CN. This curve number is related to S, which was to be determined by the equation

$$\boxed{CN = 1000/(10 + S) \qquad (5.13)}$$

The hydrologic condition of the soil-cover complex must be estimated. As an example consider pasture or range:

Poor—Heavily grazed, no mulch or less than ½ of area with plant cover.
Fair—Moderately grazed. Has plant cover on ½ to ¾ of area.
Good—Lightly grazed. Has plant cover on more than ¾ of area.

Obviously, management practice is an index of the hydrologic condition, especially for row crops and small grains.

The discussion of the exponential decay curve for infiltration indicates that the antecedent moisture conditions have considerable influence on infiltration in the initial portion of the storm. In order to estimate this influence, the following antecedent moisture conditions are defined:

Condition I—Soils are dry but not to the wilting point, and satisfactory cultivation has taken place.

Ref.: Hjelmfelt Jr., A.T. and J.J. Cassidy, 1975.
Hydrology for Engineers and Planners.

TABLE 5.2. Curve numbers for hydrologic soil-cover complexes, antecedent moisture condition II, $I_a = 0.2S$

Cover						
Land use	Treatment or practice	Hydrologic condition	Hydrologic soil group A	B	C	D
Fallow	straight row	. . .	77	86	91	94
Row crops	straight row	poor	72	81	88	91
	straight row	good	67	78	85	89
	contoured	poor	70	79	84	88
	contoured	good	65	75	82	86
	contoured and terraced	poor	66	74	80	82
	contoured and terraced	good	62	71	78	81
Small grain	straight row	poor	65	76	84	88
	straight row	good	63	75	83	87
	contoured	poor	63	74	82	85
	contoured	good	61	73	81	84
	contoured and terraced	poor	61	72	79	82
	contoured and terraced	good	59	70	78	81
Close-seeded legumes* or rotation meadow	straight row	poor	66	77	85	89
	straight row	good	58	72	81	85
	contoured	poor	64	75	83	85
	contoured	good	55	69	78	83
	contoured and terraced	poor	63	73	80	83
	contoured and terraced	good	51	67	76	80
Pasture or range		poor	68	79	86	89
		fair	49	69	79	84
		good	39	61	74	80
	contoured	poor	47	67	81	88
	contoured	fair	25	59	75	83
	contoured	good	6	35	70	79
Meadow		good	30	58	71	78
Woods [illegible]		poor	45	66	77	83
		fair	36	60	73	79
		good	25	55	70	77
Farmsteads		. . .	59	74	82	86
Roads						
dirt†		. . .	72	82	87	89
hard surface†		. . .	74	84	90	92

Source: U.S. Soil Conservation Service (2).

* Close-drilled or broadcast-seeded.

† Including right-of-way.

Condition II—Average case for annual floods, i.e., an average of conditions that have preceded the occurrence of maximum annual floods on numerous watersheds.

Condition III—Heavy rainfall or light rainfall and low temperatures have occurred during the five days preceding the storm, and the soil is nearly saturated.

Ref: Hjelmfelt Jr., A.T. and J.J. Cassidy, 1975. Hydrology for Engineers and Planners.

CV = [illegible]

[illegible] ZERO.

TABLE 5.4. Example rainfall excess computation

(Curve number = 80)
(Antecedent moisture condition = II)

Time (hrs)	Rainfall sequence (in.)	Accumulated rainfall depth (in.)	Accumulated rainfall excess (in.)	Rainfall excess increments (in.)
(1)	(2)	(3)	(4)	(5)
0		0	0	
	0.09			
2		0.09	0	
	0.19			
4		0.28	0	
	0.28			
6		0.56	0	
	0.37			0.09
8		0.93	0.09	
	3.61			2.41
10		4.54	2.50	
	0.74			0.60
12		5.28	3.10	
	0.28			0.30
14		5.56	3.40	
	0.19			0.15
16		5.75	3.55	
	0.19			0.15
18		5.94	3.70	
	0.14			0.15
20		6.08	3.85	
	0.14			0.15
22		6.22	4.00	
	0.09			0.10
24		6.31	4.10	

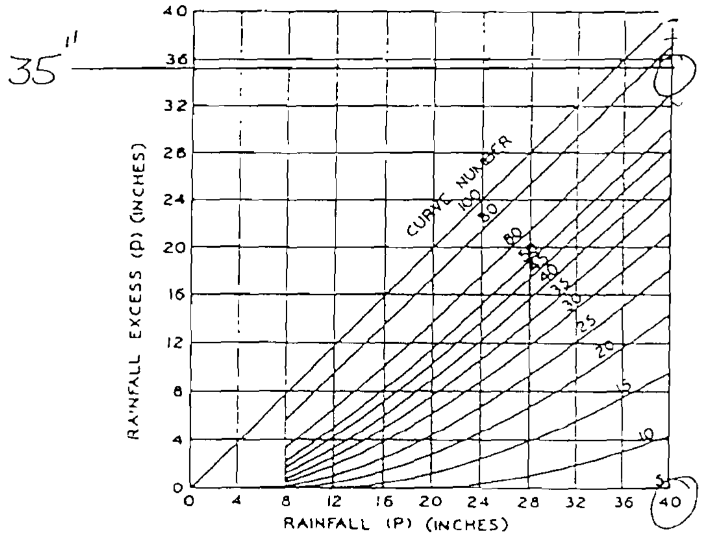

FIG. 5.3. Solution of Eq. (5.12) for P = 8 to 40 inches and p = 0 to 40 inches (2).

REF: Lehrfelt Jr. A.T. and J.J. Cassidy, 1975.
Hydrology for Engineers and Planners. [illegible]

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Sewer Drainage Areas

① Western Sewer Drainage Area

Dimensions	Area (ft.²)
½(50' × 200')	5000
½(62.5' × 225')	7031.25
½(625' × 225')	70,312.5
225' × 375'	84,375
62.5' × 1125'	70,312.5
50' × 2375'	118,750
½(175' + 1100') 2225'	1,148,437.5
½(1750' × 200')	175,000
½(875' × 75')	32,812.5
½(750' × 50')	13,750
½(175' × 200')	17,500
½(250' × 175')	21,875
½(-75 + 775') 500'	312,500
½(50' × 775')	19,375
½(150' × 825')	61,875
½(600' + 875') 50'	36,875

Σ = 2,200,781.25 ft.² = 50.5 acres

② Madison/Linden/Cedar St. Sewer Drainage Area

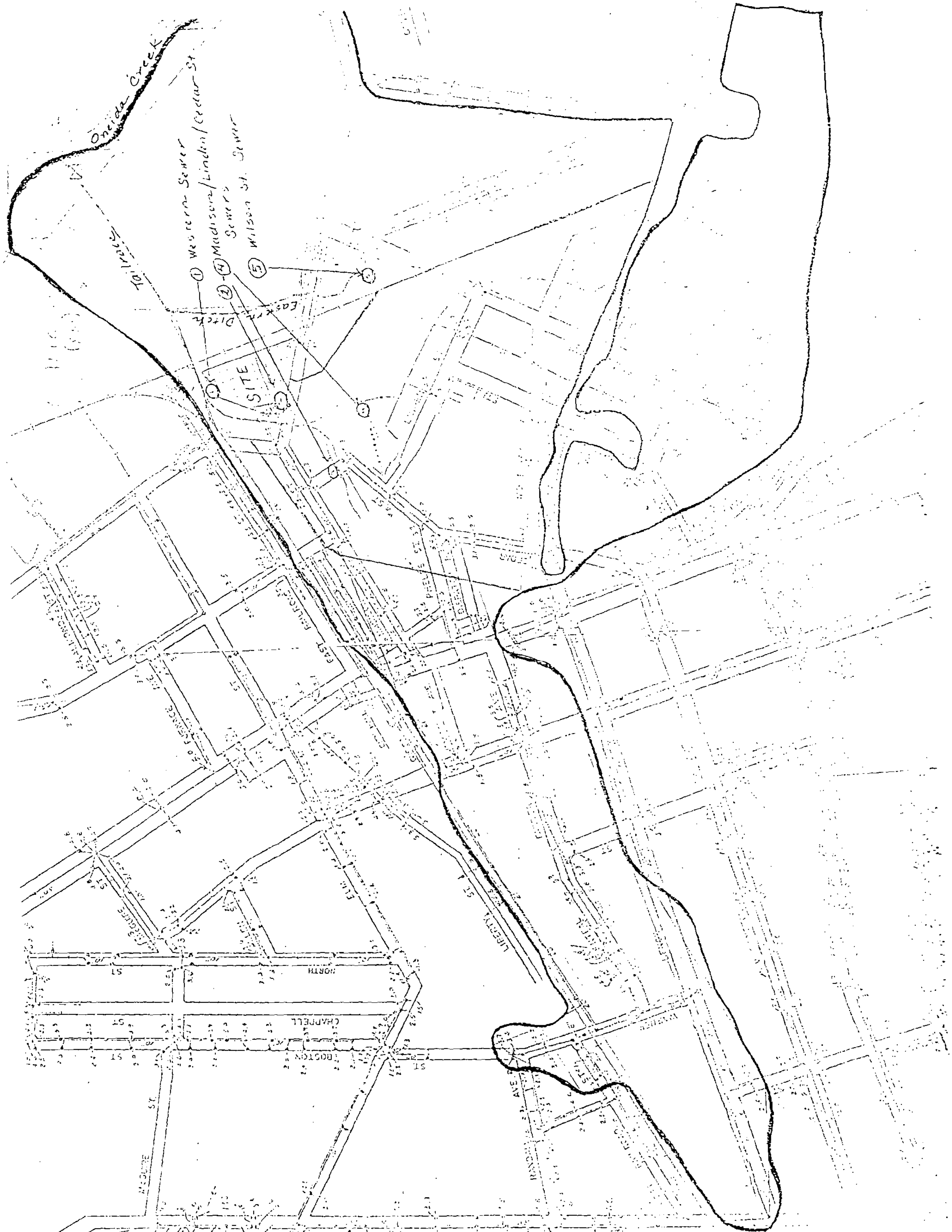
Dimensions	Area (ft.²)
½(1225' × 625')	382,812.5 ✓
1350' × 700'	945,000
½(1200' × 700')	420,000
625' × 1250'	781,250
½(1950' × 800')	780,000

Σ = 3,309,062.5 ft.² = 76 acres

③ Wilson St. Sewer Drainage Area

½(875' × 2250') = 984,375 ft.² = 22.6 acres

PESI-COR-8 (12/94)


Oneida Creek
Tailrace
① Western Sewer
④ Madison/Lincoln/Cedar St. Sewers
②
⑤ Wilson St. Sewer
Eastern Ditch
SITE
NORTH
ST
CHAPPELL
ST
BOSTON
ST
ELM ST
LIBERTY ST

Client NMPC-Oneida Job No. 726521 04000 Sheet 10 of

Subject [illegible] Storm Sewer Flow to Tailrace By JTP Date 7/29/97

Checked [illegible] Rev. 8/25/97

Storm Sewer Flow to Tailrace

Ref. Hjelmfelt, A.T. and J.J. Cassidy. Hydrology for Engineers and Planners. Ames, Iowa: Iowa State University Press, 1975.

Modified Rational Method

Given: Avg. annual precipitation in Oneida, NY = 40 inches (Fig. 4.1)
Assume C = runoff coefficient = 0.60 (avg value for business neighborhood, Table 6.4)

Western Sewer Drainage Area

$Q = CPA$
$= (0.60)(40 \frac{in}{yr.} \times \frac{1 ft.}{12 in.})(50.5 acres \times \frac{43,560 ft^2}{1 acre})(\frac{7.4805 gal}{ft^3})$
$= 32,910,929$ gal/yr. ✓

Madison/Union/Cedar St. Sewers Drainage Area

$Q = CPA$
$= (0.60)(40 \frac{in}{yr.} \times \frac{1 ft}{12 in.})(76 acres \times \frac{43,560 ft^2}{acre})(\frac{7.4805 gal}{ft^3})$
$= 49,529,233$ gal/yr. ✓

Wilson St. Sewer Drainage Area

$Q = CPA$
$= (0.60)(40 \frac{in}{yr.} \times \frac{1 ft}{12 in})(22.6 acres \times \frac{43,560 ft^2}{acre})(\frac{7.4805 gal}{ft^3})$
$= 14,728,446$ gal/yr. ✓

PESI-COR-8 (12/94)

in which

t_c = time of concentration (hours)
L = stream length (miles)
h = difference in elevation in feet between upper and lower limits of the drainage basin

Equation (6.11) is due to Kirpich (9). Hathaway (10) proposed the equation

$$t_c^{2.14} = 2Ln/3\sqrt{S} \qquad (6.12)$$

in which

t_c = time of concentration (minutes)
L = channel length (feet)
S = mean slope of the basin
n = Manning's roughness coefficient

Manning's n varies mainly with the channel material and construction. Some representative values are as follows:

Channel	n
Clean, straight banks	0.025–0.033
Same but weeds	0.030–0.040
Winding, some pools	0.33–0.045
Sluggish reaches	0.050–0.080
Very weedy reaches	0.075–0.150

LIMITATIONS OF THE UNIT HYDROGRAPH

At the beginning of the discussion of unit hydrographs three assumptions relative to the concept were set forth. In the subsequent development only storm duration was considered as a variable.

If the storm actually occurs with uniform intensity over the entire drainage basin, as is assumed, its orientation is immaterial. In actuality, a storm virtually never occurs in such a fashion. Storms generally move across a basin, and their direction of movement will play a role in determining the nature of runoff. The larger the drainage basin, the less the chance that any storm will satisfy the condition of uniform intensity. Therefore, unit hydrographs are considered to be applicable only to drainage basins having an area of less than 1000 square miles and preferably smaller if accuracy is quite important. On a large drainage basin substantial variations in soil conditions may also exist.

EQUATIONS FOR DETERMINATION OF PEAK FLOW

Before collection of hydrologic data was begun on the present scale, it was still necessary for engineers to design drainage structures. As a result a multitude of empirical equations for estimating flood flows were formulated and used extensively. Mead (11) lists many of these equations. The most commonly encountered of these formulas include

$$\text{Meyers equation } Q_p = bA^{0.6} \qquad (6.13)$$
$$\text{Talbot equation } a = cA^{0.75} \qquad (6.14)$$
$$\text{Burkli-Ziegler equation } Q_p = Ami(S/A)^{0.5} \qquad (6.15)$$

where

A = drainage area
a = culvert area
S = stream slope
i = rainfall intensity
Q_p = peak discharge

The constants b and c must account for all the parameters of rainfall-runoff relations, frequencies, and the factors that control hydrograph shape. In the Burkli-Ziegler equation m has the same broad significance except that rainfall intensity and duration are incorporated in i. Because these equations have been used primarily for small drainage areas, they probably cannot be blamed for any spectacular failures. However, their continued use is inadvisable with the more dependable methods available today as a result of several decades of data collection and analysis.

THE RATIONAL METHOD

The so-called rational equation

$$Q_p = CiA \qquad (6.16)$$

has been in use for more than 200 years and in England is known as the Lloyd-Davies equation (12). The definition of the terms is as follows:

Q_p = peak runoff rate (acre-inches/hour)
i = average rainfall intensity (inches/hour)
A = drainage area (acres)
C = runoff coefficient depending upon the characteristics of the drainage area

Since peak flow rate is computed, the rational method assumes that rainfall duration is greater than the time of concentration. It also tacitly

Farmland .05-.3
Pasture .05-.3

Forested .05-.2
[illegible] .3-.95
Driveways/walks .75-.85

TABLE 6.4. Runoff coefficients for use in the rational equation

Description of area	C
Business	
Downtown	0.70–0.95
Neighborhood	0.50–0.70
Residential	
Single-family	0.30–0.50
Multiunits, detached	0.40–0.60
Multiunits, attached	0.60–0.75
Residential suburban	0.25–0.40
Apartment	0.50–0.70
Industrial	
Light	0.50–0.80
Heavy	0.60–0.90
Parks, cemeteries	0.10–0.25
Playgrounds	0.20–0.35
Railroad yard	0.20–0.35
Unimproved	0.10–0.30
Character of surface	
Pavement	
Asphalt and concrete	0.70–0.95
Brick	0.70–0.85
Roofs	0.75–0.95
Lawns, sandy soil	
Flat, up to 2% grade	0.05–0.10
Average, 2%–7% grade	0.10–0.15
Steep, over 7%	0.15–0.20
Lawns, heavy soil	
Flat, up to 2% grade	0.13–0.17
Average, 2%–7% grade	0.18–0.22
Steep, over 7%	0.25–0.35

← AVG = 0.70

← for vegetated area

assumes that the rate of runoff does not increase after the time of concentration is reached (infiltration is constant). This approximation is probably valid for a small area if the time of concentration is accurately known. In any event, the rational formula is in use by 90% of all state highway departments (13).

Coefficients for use in Eq. (6.16) are given in Table 6.4 (14). The lower portion of the table is used when it is desirable to find an average value for *C* based on the percentage of different types of surface in the drainage area. These coefficients are applicable for storms of 5- to 10-year return periods. Storms of longer return periods (higher intensity) will require the use of larger coefficients because infiltration and other losses are proportionately less.

Any desired frequency of storm can be constructed and used with the rational equation. In determining the peak value of runoff, the largest value of *i* (having a duration at least equal to the time of concentration) is used. A curve of average intensity versus duration is constructed for the desired storm frequency as discussed in Chapter 4. The

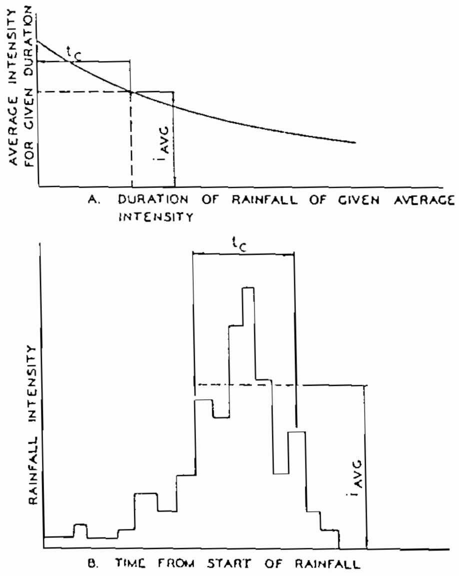


FIG. 6.14. Average intensity as determined from a given storm for use in the rational equation.

average intensity for a duration equal to the time of concentration is read directly from that graph. Figure 6.14 shows the location of this period of average intensity within the storm actually considered as well as an illustration of an average-intensity duration curve. The time of concentration can be determined using one of the procedures discussed earlier in this chapter.

CONCLUSION

Many relatively complex hydrologic problems can be considered, and many of the subleties of rainfall and runoff problems can be explored with the concepts developed thus far. The hydrologic analysis associated with spillway design is discussed in a series of papers by the American Society of Civil Engineers, Task Force on Spillway Design Floods (15, 16, 17, 18). Application of hydrologic analysis to culvert design is detailed by Chow (19), whereas application to design of storm

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Subject [illegible] - Surface runoff [illegible] overland flow
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Date 7-2-97
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Rev. 5/20/97

Surface Runoff Areas & Overland Flow into Tailrace

Areas:

Site + Surrounding Areas 108,275 ft² = 4.1 acres
Area north of site 117,135 ft² = 2.7 acres
Wetland area east of site 1,567,500 ft² = 36 acres

Modified Rational Method

Annual Excess precipitation (runoff) = 34 inches/yr.
Assume c = runoff coefficient = 0.70 for site + surrounding areas (business, downtown + neighborhood)
= 0.10 for area north + east of site (unimproved areas, wetlands, park) (Table 6.4)

Site and Surrounding Areas

$Q = CPA$
$= (0.70)\left(34\frac{in}{yr} \times \frac{1\,ft}{12\,in.}\right)(108,275\,ft^2)\left(\frac{7.4805\,gal}{ft^3}\right)$
$= 1,606,403$ gal/yr.

Undeveloped Areas North and East of Site

$Q = CPA$
$= (0.10)\left(34\frac{in}{yr} \times \frac{1\,ft}{12\,in.}\right)(117,135 + 1,567,500)ft^2\left(\frac{7.4805}{ft^3}\right)$
$= 3,570,654$ gal/yr.

PESI-COR-8 (12/94)

F-13

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Client NMPC - Oneida
Job No. 726521.0-000 [illegible]
Sheet 14 of
Subject Flux Calculation - groundwater infiltration
By JHP
Date [illegible]
Checked JHP/ [illegible]
Rev. [illegible]

Groundwater Infiltration

① No wall (see attached graphic)

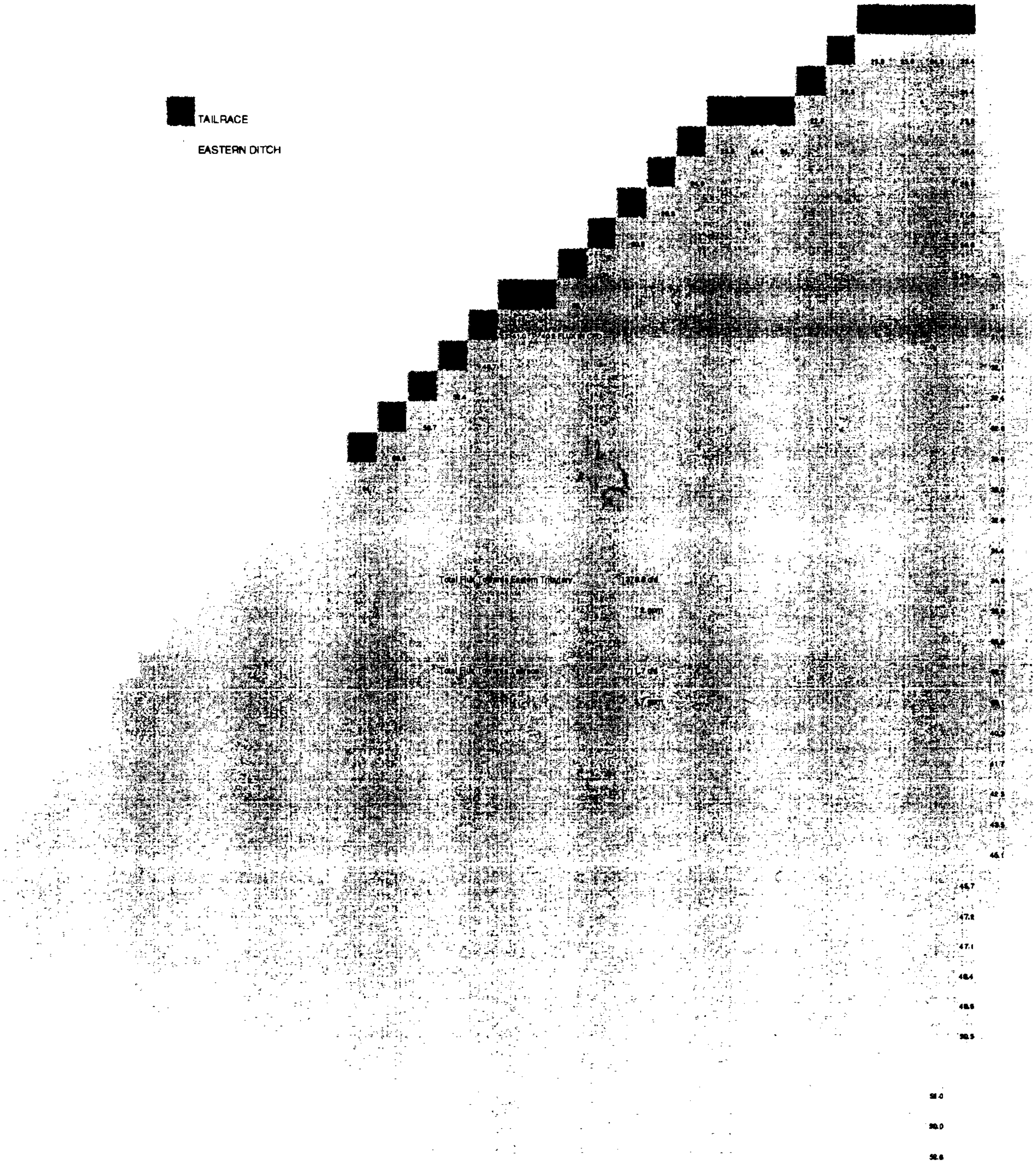
Tailrace was divided into segments, and a groundwater model (see App. E) was used to calculate groundwater flux and all the fluxes were added together to determine groundwater infiltration = 3.7gpm ✓

② With wall, no pumping

The same procedure as above was used.
Groundwater infiltration = 0.5 gpm ✓

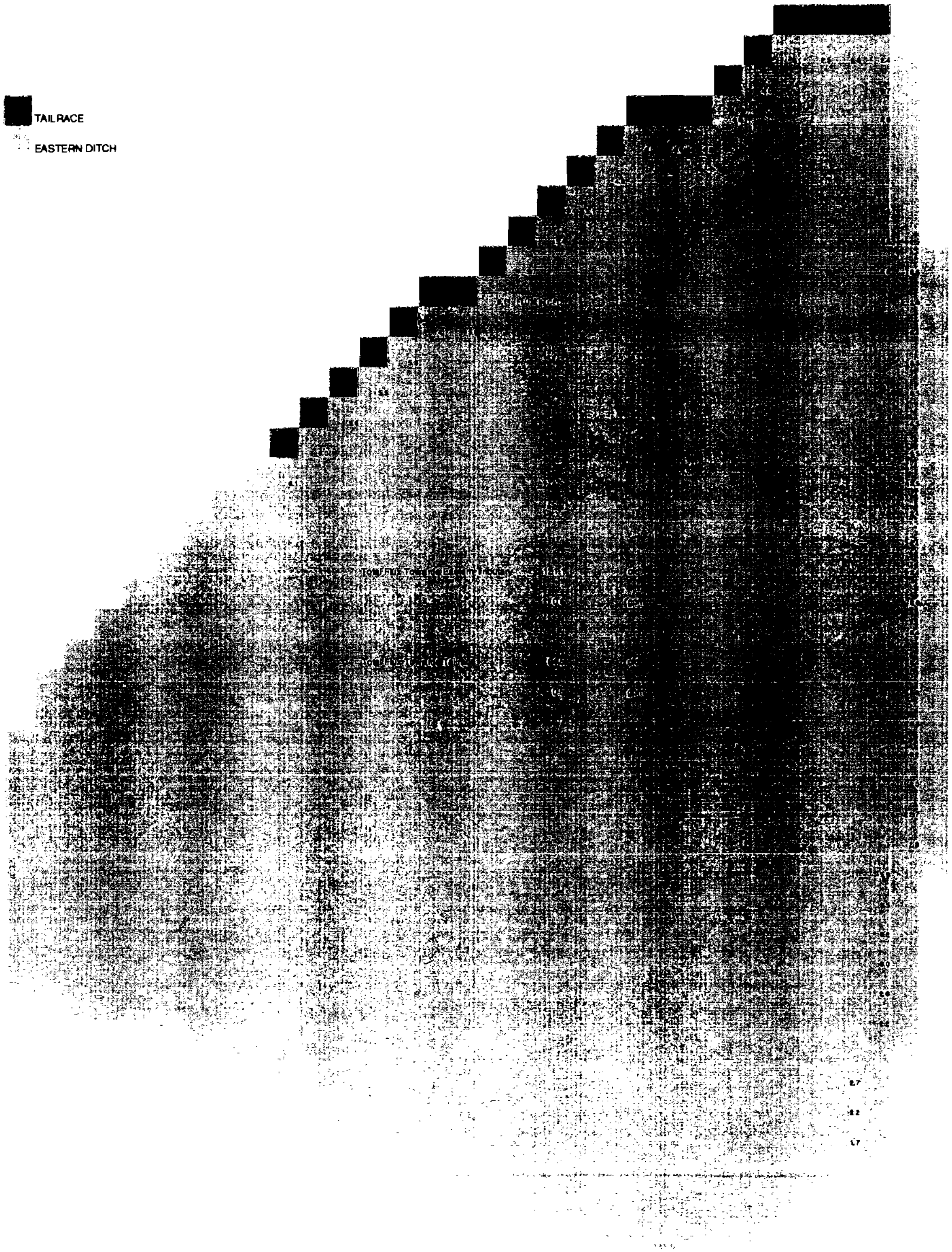
GROUNDWATER FLUX TO THE TAILRACE AND EASTERN DITCH

(BASELINE CONDITIONS)



GROUNDWATER FLUX TO THE TAILRACE AND EASTERN DITCH

(WITH BARRIER WALL)



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Client [illegible] Job No. [illegible] Sheet 17 of
Subject [illegible] By [illegible] Date [illegible]
[illegible] Checked [illegible] Rev. [illegible]

Mass Loading Through Madison/Cedar/Linden St. Sewer

Assumptions: ① Use of Parsons ES surface water analytical data during low flow (October 1993), PSA/IRM, Table 4-9, p. 4-43.
② Use of dry weather flow = 49,529,233 gal/yr based on storm runoff and storm sewer drainage area (p 9 of this appendix)

Two upstream Tailrace surface water samples were analyzed. For each chemical below, the sample with the higher concentration was used:

Benzene

$$\left(0.003\ \frac{mg}{L}\right)\underbrace{\left(49{,}529{,}233\ \frac{gal}{yr}\right)\left(\frac{1g}{1000mg}\right)\left(\frac{3.785L}{gal}\right)\left(\frac{2.205\times10^{-3}lbs}{g}\right)}_{413.37 ✓}$$

$$= 1.24\ ^{lbs}/_{yr} ✓$$

Total PAHs

$$\left(0\ \frac{mg}{L}\right) \rightarrow 0\ ^{lbs}/_{yr}$$

Total Cyanide

$$\left(0.0[illegible]0\ \frac{mg}{L}\right)(413.37) = 3.27\ ^{lbs}/_{yr}$$

Arsenic

$$\left(0.0125\ \frac{mg}{L}\right)(413.37) = 5.29\ ^{lbs}/_{yr}$$

Zinc

$$\left(0.795\ \frac{mg}{L}\right)(413.37) = 329\ ^{lbs}/_{yr}$$

Lead

$$\left(0.513\ \frac{mg}{L}\right)(413.37) = 214\ ^{lbs}/_{yr}$$

Mercury

$$\left(0.000[illegible]\ \frac{mg}{L}\right)(413.37) = 0.40\ ^{lbs}/_{yr}$$

PESI-COR-8 (12/94)

chemical and hydraulic parameters within their known or estimated ranges until hydrocarbon and oxygen concentrations measured in the field were closely reproduced by the model.

Results

Following calibration, predictive runs were made to simulate the movement and degradation of hydrocarbons with time. As stated previously, two scenarios were modeled to predict movement in the future (with and without an active source). Both scenarios assume that the BTEX source (presumably coal tar) has been active for the past 50 years.

Figure 4.12 shows the movement of BTEX from the present time to 50 years in the future if the BTEX source is not removed. The BTEX front is represented by the 0.1 mg/l (100 ug/l) contour line. The results indicate that the BTEX front will move about 500 feet beyond the property boundary in 50 years.

The second scenario, in which the source is assumed to be removed, is portrayed in Figure 4.13. It can be seen that without an active source present, the concentrations dissipate with time. After 35 years, the BTEX front (0.1 mg/l contour line) has moved only 240 feet northeast of the property line. The area of groundwater in which concentrations exceed 0.1 mg/l is only about 200 feet long by 80 feet wide. Under this scenario, biodegradation and retardation processes continue to reduce the BTEX concentrations. Without any continued input from a source area, the concentrations are prone to dissipate prior to migrating significant distances beyond the property boundaries.

4.3.8 Surface Water Contamination Assessment

Tailrace Creek is an unclassified surface water body which is primarily a storm water discharge route originating from the city's downtown section. Tailrace Creek receives storm water run-off from a 96 acre area bounded by Walnut Street on the south, Stephen Street on the east and Main Street on the west. Within this area are past and present industrial and commercial operations including used car dealerships, a former shingle factory, machine shops, paint shops, furniture and sleigh manufacturing. Surface water analytical results were compared to Class D surface water standards as a conservative bench mark. Class D standards are not directly applicable to Tailrace Creek.

Volatile organic compounds were not detected above Class D surface water standards in the nine surface water samples collected. Benzene is the only detected MGP related volatile organic compound having a Class D standard. BTEX concentrations ranged from not detected in six samples to 0.076 ppm in SW-09A. Samples which had detectable BTEX concentrations were not located adjacent to the site. SW-09A was collected upstream of the site from below the Paul Building in the old sewer system arch. SW-04 was collected in the small tributary east of the site. SW-05 was collected from Tailrace Creek downstream of the site and tributary. 1,2-Dichlorethene was detected at low concentrations in SW-01 and SW-02. Four additional volatile organic compounds were only detected in upstream sample SW-09.

Ref. Parsons ES. PSA/IRM Study: Oneida (Sconondoa Street)
Former MGP Site, Sept. 1994.

TABLE 4.9
NIAGARA MOHAWK ONEIDA MGP SITE
ONEIDA, NEW YORK
SURFACE WATER RESULTS (mg/l)

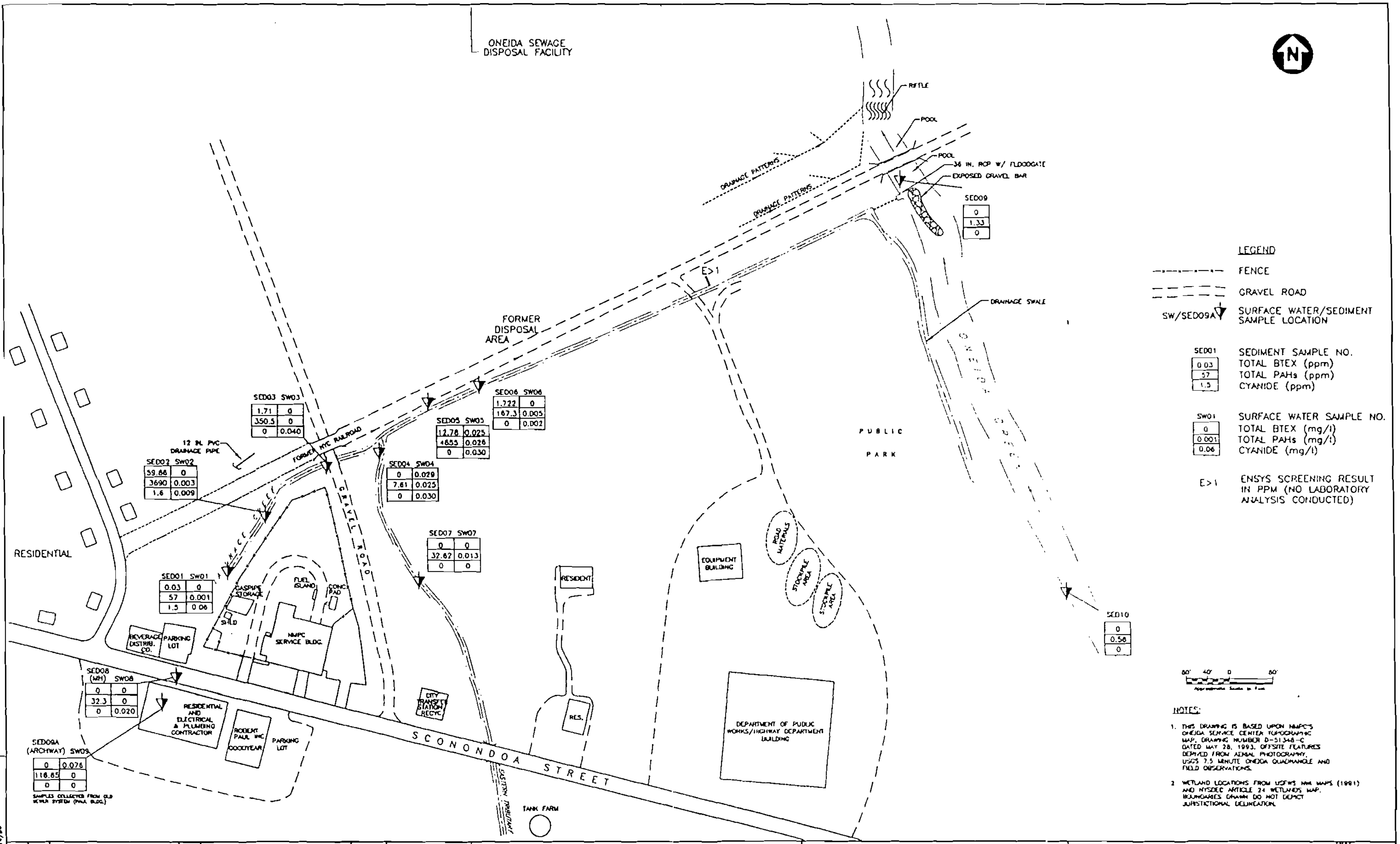
Compound	NYS Class D Standards (mg/l)	SW-01 10/12/93	SW-02 10/12/93	SW-03 10/12/93	SW-04 10/12/93	SW-05 10/12/93	SW-06 10/12/93	SW-07 10/12/93	SW-08^ 10/13/93	SW-09A^ (Archway) 10/13/93
VOLATILE ORGANICS										
Methylene Chloride	NS	0.014 B	0.011 B	0.012 B	0.003 BJ	0.004 BJ	0.002 BJ	0.003 BJ	0.008 BJ	0.02 B
Acetone	NS	–	–	–	–	–	–	–	0.01	0.063
1,2-Dichloroethene	NS	0.002 J	0.001 J	–	–	–	–	–	–	–
2-Butanone	NS	–	–	–	–	–	–	–	–	0.005 J
Trichloroethene	0.011(a)	–	–	–	–	–	–	–	–	0.001 J
Styrene	NS	–	–	–	–	–	–	–	–	0.002 J
BTEX										
Benzene	0.006(a)	–	–	–	0.003 J	0.004 J	–	–	–	0.003 J
Toluene	NS	–	–	–	–	–	–	–	–	0.01
Ethylbenzene	NS	–	–	–	0.021	0.012	–	–	–	0.024
Total Xylenes	NS	–	–	–	0.005 J	0.009 J	–	–	–	0.039
Total BTEX		0	0	0	0.029	0.025	0	0	0	0.076
SEMIVOLATILES										
2-Methylnaphthalene	NS	–	–	–	–	0.003 J	–	–	–	–
Bis(2-EH)phthalate	NS	0.001 J	–	0.001 J	–	–	0.002 J	0.003 J	–	–
PAHs										
Naphthalene	NS	–	0.002 J	–	0.004 J	–	–	–	–	–
Acenaphthylene	NS	–	–	–	0.002 J	0.001 J	–	–	–	–
Acenaphthene	NS	0.001 J	0.001 J	–	0.014	0.011	0.005 J	–	–	–
Fluorene	NS	–	–	–	0.004 J	0.004 J	–	–	–	–
Phenanthrene	NS	–	–	–	0.001 J	0.004 J	–	0.002 J	–	–
Anthracene	NS	–	–	–	–	0.001 J	–	–	–	–
Fluoranthene	NS	–	–	–	–	0.003 J	–	0.006 J	–	–
Pyrene	NS	–	–	–	–	0.002 J	–	0.003 J	–	–
Chrysene ©	NS	–	–	–	–	–	–	0.002 J	–	–
Total PAHs		0.001	0.003	0	0.025	0.026	0.005	0.013	0	0
Total PCBs		–	–	–	–	–	–	–	–	–
METALS & Cn-										
Aluminum	NS	0.819	1.760	0.544	1.390	1.410	41.1	8.930	1.760	3.380
Antimony	NS	0.0345 B	–	–	–	–	–	–	–	0.0329 B
Arsenic	0.36	–	0.0057 B	–	–	–	0.0469	0.0129	–	0.0128
Barium	NS	0.240	0.313	0.142 B	0.258	0.315	1.9	0.48	0.204	0.622
Beryllium	NS	–	–	–	–	–	0.0028 B	–	–	–
Cadmium	0.016*	–	–	–	0.0044 B	–	0.0171	0.0059	–	–
Calcium	NS	154	181	135	153	156	744	226	104	223
Chromium	0.0085*	–	0.0081 B	–	–	–	0.158	0.034	0.0108	0.0124
Cobalt	0.11(a)	–	–	–	–	–	0.0507	–	–	–
Copper	0.00407*	0.0204 B	0.0398	0.0272	0.0581	0.0501	0.973	0.144	0.0553	0.107
Iron	0.300	5.070	14.700	2.140	6.190	8.470	149	23.2	12.3	35.2
Lead	0.006*	0.0478	0.11	0.0369	0.096	0.0993	1.630	0.589	0.141	0.518
Magnesium	NS	28	31	23.1	29.2	30.1	97.5	39.2	23.2	42.3
Manganese	NS	0.409	0.589	0.203	0.371	0.441	3.950	1.02	0.568	2.53
Mercury	0.002(a)	0.002	.00032	–	0.0034	.0003	0.0035	0.002	0.00036	0.00096
Nickel	0.0085*	–	–	–	–	–	0.189	0.0317 B	–	–
Potassium	NS	7.350	6.820	5.490	4.710 B	5.33	10.7	6.2	5.460	9.76
Selenium	NS	–	–	–	–	–	–	–	–	–
Silver	0.0036*	–	–	–	–	–	0.0068 B	–	–	–
Sodium	NS	104	100	111	91.800	91.7	74.9	66.6	145	225
Thallium	0.020	–	–	–	–	–	–	–	–	–
Vanadium	0.19	0.0076 B	0.012 B	–	–	0.0077 B	0.149	0.0359 B	0.0123 B	0.015 B
Zinc	0.0068*	0.154	0.337	0.128	0.259	0.213	4.2	0.724	0.293	0.795
Total Cyanide	0.022	0.06	0.009	0.040	0.030	0.030	0.02	–	0.020	–

Qualifiers

NA: Sample was not analyzed
– : Analyte was not detected
©: Carcinogenic PAH
a: Guidance Value
NS: No Standard
^ : Sample collected upgradient of site

Organic
J: Indicates the presence of a compound that meets the Identification criteria but the result is less than the specified detection limit but greater than zero
B: Analyte found in the blank, as well as a sample

Metals
B: Reading was less than the CRDL, but greater than the IDL
*. Standard based on hardness of SW-08, which has the lowest value (355 mg/l)



NOTES:

1. THIS DRAWING IS BASED UPON NMPC'S ONEIDA SERVICE CENTER TOPOGRAPHIC MAP, DRAWING NUMBER D-51348-C DATED MAY 28, 1993. OFFSITE FEATURES DERIVED FROM AERIAL PHOTOGRAPHY, USGS 7.5 MINUTE ONEIDA QUADRANGLE AND FIELD OBSERVATIONS.
2. WETLAND LOCATIONS FROM USFWS NWI MAPS (1991) AND NYSDEC ARTICLE 24 WETLANDS MAP. BOUNDARIES DRAWN DO NOT DEPICT JURISTICTIONAL DELINEATION.

FILE NAME: M:\CAD\723829\02380G05.DWG
DATE PLOTTED: 4/14/94

NO.	DATE	REVISION	BY

		DATE
PROJECT NUMBER	723829.03000	DATE
DESIGNED BY	R.W. YOUNGMAN	3/24/94
DRAWN BY	J.H. GOLDTHWAIT	4/13/94
CHECKED BY	S.B. DILLMAN	4/14/94

ENGINEER NA
REGISTRATION NUMBER NA DATE NA

ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
[illegible]
OFFICES IN PRINCIPAL CITIES

NIAGARA MOHAWK

CITY OF ONEIDA
MADISON COUNTY, NEW YORK STATE

SEDIMENT/SURFACE WATER ANALYTICAL RESULTS

SCALE AS SHOWN
4.9

Client WMPC - [illegible] Job No. 725521.04000 Sheet 21 of

Subject Flux [illegible] - mass By CHP Date 1/24/97

loading through Western, Wilson Ct. Sewers & overland flow Checked CHP / [illegible] Rev. 2/20/97

Mass Loading through Western and Wilson Ct. Sewers

Assumptions: ① Use of Urban Runoff [illegible]

② Use of site median EMC values for median urban site (Ref: Results of the Nationwide Urban Runoff Program, Dec. 1983, Executive Summary, USEPA/841/S-83-01):

$$Pb = 144\ \mu g/L$$

$$Zn = 160\ \mu g/L$$

Western Sewer

$$Pb = (144\tfrac{\mu g}{L})\overbrace{(32{,}910{,}909\tfrac{gal}{yr})(\tfrac{1\,g}{10^6\mu g})(\tfrac{3.785\,L}{gal})(\tfrac{2.205\times10^{-3}\,lbs}{g})}^{\cancel{0.00027}\ 0.27} = \overset{39.6}{\cancel{0.040}}\ lbs/yr$$

$$Zn = (160\tfrac{\mu g}{L})(0.27) = \underset{43.9}{\cancel{0.044}}\ lbs/yr$$

Wilson Ct. Sewer

$$Pb = (144\tfrac{\mu g}{L})\overbrace{(14{,}728{,}446\tfrac{gal}{yr})(\tfrac{1\,g}{10^6\mu g})(\tfrac{3.785\,L}{gal})(\tfrac{2.205\times10^{-3}\,lbs}{g})}^{\cancel{0.00012}\ 0.12} = \underset{17.7}{\cancel{0.018}}\ lbs/yr$$

$$Zn = (160\tfrac{\mu g}{L})(\overset{0.12}{\cancel{0.00012}}) = \underset{19.7}{\cancel{0.020}}\ lbs/yr$$

Overland Flow Areas

$$Pb = (144\tfrac{\mu g}{L})\overbrace{(\overset{5{,}178{,}710}{\cancel{5{,}245{,}942}}\tfrac{gal}{yr})(\tfrac{1\,g}{10^6\mu g})(\tfrac{3.785\,L}{gal})(\tfrac{2.205\times10^{-3}\,lbs}{g})}^{\overset{4.32}{\cancel{4.35}}\times10^{-3}} = \underset{6.2}{\cancel{0.006}}\ lbs/yr$$

$$Zn = (160\tfrac{\mu g}{L})(4.3\overset{2}{\cancel{8}}\times10^{\overset{-2}{\cancel{-5}}}) = \underset{6.9}{\cancel{0.007}}\ lbs/yr$$

- A more useful method of reporting data than the use of ranges: one which is less subject to misinterpretation

- A framework for examining "transferability" of data in a quantitative manner

Conclusions

1. Heavy metals (especially copper, lead and zinc) are by far the most prevalent priority pollutant constituents found in urban runoff. End-of-pipe concentrations exceed EPA ambient water quality criteria and drinking water standards in many instances. Some of the metals are present often enough and in high enough concentrations to be potential threats to beneficial uses.

   All 13 metals on EPA's priority pollutant list were detected in urban runoff samples, and all but three at frequencies of detection greater than 10 percent. Most often detected among the metals were copper, lead, and zinc, all of which were found in at least 91 percent of the samples.

   Metal concentrations in end-of-pipe urban runoff samples (i.e., before dilution by receiving water) exceeded EPA's water quality criteria and drinking water standards numerous times. For example, freshwater acute criteria were exceeded by copper concentrations in 47 percent of the samples and by lead in 23 percent. Freshwater chronic exceedances were common for lead (94 percent), copper (82 percent), zinc (77 percent), and cadmium (48 percent). Regarding human toxicity, the most significant pollutants were lead and nickel, and for human carcinogenesis, arsenic and beryllium. Lead concentrations violated drinking water criteria in 73 percent of the samples.

   It should be stressed that the exceedances noted above do not necessarily imply that an actual violation of standards will exist in the receiving water body in question. Rather, the enumeration of exceedances serves a screening function to identify those heavy metals whose presence in urban runoff warrants high priority for further evaluation.

   Based upon the much more extensive NURP data set for total copper, lead, and zinc, the site median EMC values for the median urban site are: Cu = 34 ug/l, Pb = 144 ug/l, and Zn = 160 ug/l. For the 90th percentile urban site the values are: Cu = 93 ug/l, Pb = 350 ug/l, and Zn = 500 ug/l. These values are suggested to be appropriate for planning level screening analyses where data are not available.

   Some individual NURP project sites (e.g., at DC1, MD1, NH1) found unusually high concentrations of certain heavy metals (especially copper and zinc) in urban runoff. This was attributed by the projects to the effect of acid rain on materials used for gutters, culverts, etc.

REF: USEPA, 1983. Results of the Nationwide Urban Runoff Program, Executive Summary, December. USEPA/841/S83109

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Client [illegible] Job No. [illegible] Sheet 23 of

Subject [illegible] By [illegible] Date [illegible]-24-97

[illegible] Checked [illegible] Rev. [illegible]

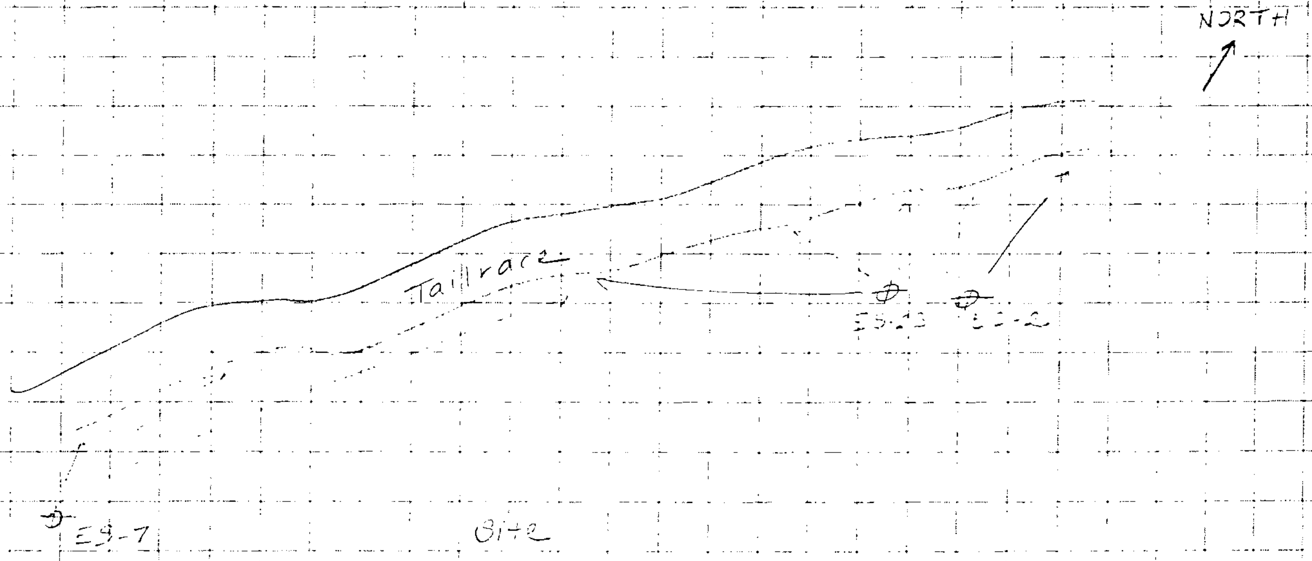
Mass Loading Through Groundwater Infiltration

Segmentation of flow to Tailrace at wall

Assume ES-7 flows through Segments 1-10 and
ES-2S + ES-2 flow through Segments 11-20.

	w/o wall	w/ wall
Segments 1-10	469.6 ft³/day = 3513 gal/day	56 ft³/day = 419 gal/day
11-20	241.9 ft³/day = 1810 gal/day	38.5 ft³/day = 288 gal/day

1 ft.³ = 7.4805 gals.



PARSONS ENGINEERING SCIENCE, INC.

Client NMPC - Oneida
Job No. 726521.04000
Sheet 24 of
Subject Flux Calculations - mass loading through groundwater infiltration (cont.)
By CHP
Date 3/5/97
Checked CHP/SH
Rev. 3/20/97

Mass Loading Through Groundwater Infiltration (cont.)

CHEMICAL	CONCENTRATION Segment 1-10 (ES-7)	DISCHARGE (mg/L) Segment 11-20 (ES-25, ES-2)	GW DISCHARGE (gal/day)	CHEMICAL FLUX (g/day)	
			N/o wall	w/o wall	w/ wall
Benzene	0.069	0.35	Segment 1-10: 3513	3.32 ✓	0.49 ✓
Total PAHs	0.732	8.119	Segment 11-20: 1810	65.34 ~~55.62~~	10.09 ✓
Total Cyanide	0.169	0.94		8.69 ✓	1.29 ✓
Arsenic	–	0.0174	W/ wall Segment 1-10: 419	0.12 ✓	0.02
Lead	0.0122	0.301	Segment 11-20: 238	2.22 ✓	0.35 ✓
Mercury	–	0.0022		0.02 ✓	0.002 ✓
Zinc	0.0369	0.254		2.23 ~~1.77~~	0.36 ✓

ex. Benzene $(0.069 \frac{mg}{L})(3513 \frac{gal}{day})(\frac{g}{1000 mg})(\frac{3.785 L}{gal}) = 0.92 g/day$ ✓

$(0.35 \frac{mg}{L})(1810 \frac{gal}{day})(\frac{g}{1000 mg})(\frac{3.785 L}{gal}) = 2.40 g/day$ ✓

$\Sigma = 3.32 g/day$ ✓

Client [illegible]
Job No. [illegible]
Sheet 25 of
Subject [illegible]
By [illegible]
Date [illegible]
[illegible]
Checked SHR
Rev.

$\frac{lbs}{yr} \times \left(\frac{1000 g}{2.2 lbs}\right)\left(\frac{1 yr}{365 day}\right) = \frac{g}{day}$

CHEMICAL	MASS LOADING (g/day)							TOTAL WATER INFLOW[1] (gal/day)	CALC. CONC. IN ONEIDA CREEK (μg/L) = $\frac{\text{Total mass loading}}{\text{Total water flow}}$[2]		NYSDEC CLASS C SURFACE WATER STD. (μg/L)	ACTUAL MAX. SURF. WATER MEASUREMENT[3]
	Madison/Cedar/Linden Sts Sewer	Western Sewer	Wilson St. Sewer	Overland Flow	Groundwater Infiltration		TOTAL					
					no wall	wall			no wall	wall		
Benzene	1.54	–	–	–	3.32	0.49	4.86, 2.03	no wall: 285,727	4.49	1.91	6	ND
Total PAHs	0	–	–	–	66.02	10.07	66.02, 10.09	wall: 281,119	61.05	9.48	NS	ND
Total Cyanide	10.30	–	–	–	8.69	1.27	18.99 11.59		17.56	10.89	NS	ND
Arsenic	6.57	–	–	–	0.12	0.02	6.69, 6.59		6.19	6.19	190	N/A
Lead	266.05	49.24	22.04	115.53	2.22	0.35	455.1, 453.2		420.8	425.9	16[4] ?	N/A
Mercury	0.49	–	–	–	0.02	0.002	0.51 0.492		0.47	0.46	NS [illegible]	N/A
Zinc	408.32	54.67	24.53	8.59	2.23	0.36	498.3, 496.5		460.8	466.6	30	N/A

[1] Σ of sewer flows, overland flow, gw infiltration

[2] $\frac{\left(\frac{g}{day}\right)}{\left(\frac{gal}{day}\right)} \times \left(\frac{10^6 \mu g}{g}\right) \times \left(\frac{gal}{3.785 L}\right) = \frac{\text{total mass loading}}{\text{total water flow}}$

[3] in Oneida Creek (SW-10, SW-11, SW-12; SW-11 - [illegible] samples in [illegible])

[4] standard for Pb
= exp[1.266 (ln [illegible]) [illegible]]
[illegible] 357 mg/L (at SW-08)
= 16 μg/L

2. GROUNDWATER/SEDIMENT PARTITIONING CALCULATIONS

Maximum BTEX and PAH concentrations due to groundwater/sediment partitioning were estimated for the Tailrace sediment based on groundwater concentrations found in monitoring well, ES-2S, located near the former large gas holder area. Standard values for molecular weight, density, solubility, and the octanol-water partition coefficient of each of the 16 compounds were used in the calculations. Three different values of organic carbon were used to predict the maximum concentrations in the sediment.

Except for 2-methylnaphthalene and naphthalene, none of the predicted values were above 10 mg/kg, and the values for 2-methylnaphthalene and naphthalene were all below 100 mg/kg. These concentrations were relatively small, though, when compared to the measured concentrations of the two compounds in the Tailrace sediments: up to 2700 mg/kg and 9600 mg/kg, respectively. Thus, it does not appear that partitioning from groundwater to sediment is significantly impacting the Tailrace sediments.

Groundwater/Sediment Partitioning Calculations

								f_{oc}		
								0.04	0.05	0.09
Name	Molecular Weight	Density gm/cm^3	Solubility (mg/L)	LOG(K_{OW})	CONC. (mg/L)	Molar Concentration (moles/L)	Percent total molar concentration	Estimated maximum soil concenration (mg/Kg)		
Benzene	78.11	0.8765	1780	2.13	0.35	4.4809E-03	4.65%	0.16	0.20	0.36
Ethylbenzene	106.2	0.867	152	3.15	0.9	8.4746E-03	8.80%	3.13	3.92	7.05
Toluene	92.13	0.8669	515	2.69	0.53	5.7527E-03	5.98%	0.74	0.92	1.66
Total Xylenes	106.2	0.875167	178	3.16	1.1	1.0358E-02	10.76%	3.92	4.90	8.82
Acenaphthene	154.2	1.05	3.93	4.03	0.068	4.4099E-04	0.46%	1.24	1.55	2.78
Acenaphthylene	152.2	0.899	16.1	3.55	0.28	1.8397E-03	1.91%	1.71	2.14	3.84
Anthracene	178.24	1.26	0.073	4.54	0.005	2.8052E-05	0.03%	0.25	0.32	0.57
Benzo(a)anthracene	228.3	1.2544	0.014	5.91	0.002	8.7604E-06	0.01%	1.86	2.33	4.19
Chrysene	228.3	1.28	0.002	5.91	0.001	4.3802E-06	0.00%	0.93	1.16	2.10
Fluoranthene	202.26	1.252	0.26	5.22	0.005	2.4721E-05	0.03%	1.07	1.34	2.42
Fluorene	166.23	1.203	1.98	4.18	0.08	4.8126E-04	0.50%	1.91	2.38	4.29
2-Methylnapthalene	142.19	1.03	25.4	4.11	1	7.0328E-03	7.31%	23.72	29.65	53.36
Napthalene	128.18	1.16	31.7	3.36	7.3	5.6951E-02	59.16%	34.15	42.69	76.84
Phenanthrene	178.24	1.17	1.29	4.57	0.066	3.7029E-04	0.38%	3.60	4.50	8.10
Pyrene	202.26	1.271	0.135	5.18	0.004	1.9777E-05	0.02%	0.78	0.98	1.76
Benzo(a)pyrene	252.32	NV	0.0038	6.5	ND					
			total molar concentration:			9.6268E-02	100.00%			

K_{ow} = octanol-water partition coefficient

f_{oc} = fraction of organic carbon, as measured in sediment samples

Estimated maximum sediment concentration = 0.63*(K_{ow})(f_{oc})(percent total molar concentration)

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3. DNAPL MOBILITY

The mobility of DNAPL was evaluated by calculating organic compound saturations and comparing those values with published retention factors for DNAPL. None of the 109 soil and sediment samples containing detectable organic compounds had organic compound saturations greater than a retention factor of 1% of soil porosity. Soils with a DNAPL volume greater than approximately 10 to 20% are considered to contain potentially mobile DNAPL. Therefore, potentially mobile DNAPL was not detected in any of the samples.

The organic compound saturation was calculated by summing BTEX and PAH compound concentrations, calculating the organic compound volume using the an estimated density for DNAPL, and then calculating the volume of organic compounds as a percent of the soil porosity. BTEX and PAH concentrations were measured in 109 samples above detection limits. The organic compound concentrations of these samples were summed, and the mass in grams was calculated by assuming a 1 kg mass of soil. The volume of organic compounds was calculated by dividing the mass of organic compounds by the density, 1.0588 g/cm^3, calculated for similar DNAPL. The organic compound saturation was calculated for each of four soil total porosity measurements by dividing the porosity expressed as volume of the voids by the volume of organic compounds. The calculated saturations ranged from zero (less than 0.01 percent) to 0.11 percent.

Organic compounds are potentially mobile as DNAPL when the organic compound saturation exceeds the DNAPL retention factor. Retention factors have been measured and published for "coal tar" in unsaturated siltstone (1% to 3%) and unsaturated sandstone (17% to 24%) (Cohen and Mercer, 1993). Retention factors for other DNAPLS (primarily chlorinated solvents) in unsaturated soils are on the order of 20%. Cohen and Mercer also note that retention factors for saturated media are larger than retention factors for unsaturated media; the examples presented in Cohen and Mercer use saturated retention factors three times the value of unsaturated retention factors.

POTENTIAL MOBILITY OF NAPL
ONEIDA

							SOIL POROSITY			
							0.10	0.20	0.30	0.40
							VOLUME of VOIDS IN SOIL(cm^3)(3)			
							42	94	162	252
SAMPLE ID	BTEX CONC. (ug/Kg)	SEMI VOA CONC. (ug/Kg)	PAH CONC. (ug/Kg)	ORGANIC COMPOUND CONC. (percent by weight)	ORGANIC COMPOUND MASS grams(1)	ORGANIC COMPOUND VOLUME (cm^3)(2)	ORGANIC COMPOUND SATURATION (percent of soil porosity)			
SED-21B	130.9		46694	0.00%	0.05	0.04	0.11%	0.05%	0.03%	0.02%
SED-21C	130.8		43112	0.00%	0.04	0.04	0.10%	0.04%	0.03%	0.02%
SB02	278		22995.7	0.00%	0.02	0.02	0.05%	0.02%	0.01%	0.01%
SED-21A	1.682		16208	0.00%	0.02	0.02	0.04%	0.02%	0.01%	0.01%
SB04	0.672		7158.6	0.00%	0.01	0.01	0.02%	0.01%	0.00%	0.00%
SED05	12.78	86	5108	0.00%	0.01	0.00	0.01%	0.01%	0.00%	0.00%
SED02	59.96	67	4355.7	0.00%	0.00	0.00	0.01%	0.00%	0.00%	0.00%
SED-20D	171.5		2821.4	0.00%	0.00	0.00	0.01%	0.00%	0.00%	0.00%
SS02	0.002		2030	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-02SD	789		2017.47	0.00%	0.00	0.00	0.01%	0.00%	0.00%	0.00%
SED-18B	166		1272.6	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-20B	15.922		1183.5	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-10RE	82.23		1132.3	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-15RG	181.8	12.6	1062.61	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-20C	34.36		854.1	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-7E	60.81		569.8	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-02SF	169.6		510.2	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-19C	0.65		484.2	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-28G	37.2		441	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-19B	0.148		363.4	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED03	1.71	10.77	350.5	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-01RE	11.66	8	333.3	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-22A	0.012		298.66	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-20	-	11.7	253.2	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED06	1.722	11.7	203.99	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS03	0.054		199	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-24B	0.418		189.12	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-18A(	0.239		185.2	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-06RG(M	0.03	3.53	175.57	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-01RH	8		167.54	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SB16	0.062		146.45	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-24A	0.155		141.84	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SB17	0.451	0.37	126.9	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED09A	-	9.95	117.58	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-26A	0.021		97.5	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-29H	2.5		93.28	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-23B(M	0.099		84.11	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-20A	2.223		76.49	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS06	-	0.65	59.37	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-25A	0.047		53.04	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED01	0.03	80.25	44.48	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-7G	0.507		39.13	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-26F	0.002		39.1	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-16	-		35.238	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED07	-	0.35	32.62	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED08	-	1.2	32.3	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SB20	-		27.6	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS04	0.003		23.1	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-19A	0.045		17.56	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS05	-	0.15	17.4	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-12	1		17.35	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%

POTENTIAL MOBILITY OF NAPL
ONEIDA

							SOIL POROSITY			
							0.10	0.20	0.30	0.40
							VOLUME of VOIDS IN SOIL$(cm^3)^{(3)}$			
							42	94	162	252
SAMPLE ID	BTEX CONC. (ug/Kg)	SEMI VOA CONC. (ug/Kg)	PAH CONC. (ug/Kg)	ORGANIC COMPOUND CONC. (percent by weight)	ORGANIC COMPOUND MASS grams$^{(1)}$	ORGANIC COMPOUND VOLUME $(cm^3)^{(2)}$	ORGANIC COMPOUND SATURATION (percent of soil porosity)			
SS-14	-		17.332	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SB18	-		14.502	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-06RK(M	0.14		12.17	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-25J	0.015		11.74	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-28A	-		11.13	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-4SD	0.01		10.12	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-21	-	0.4	10.11	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-15(MAX	-	0.238	8.98	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-13	-		7.955	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED04	-		7.61	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-19	-		5.12	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-23A	0.019		4.94	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SB13	-		4.82	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-03SI	0.006	0.127	4.814	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-30H	-		4.712	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-09	-		4.55	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-18	-		4.294	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-17	-		3.929	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-07 (MA	-		3.92	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-10E(MA	-		3.856	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-10	-		3.82	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-24D	0.112		2.88	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-08	-		2.73	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-27A	-		2.28	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-8D	-		2.178	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SB22	-		1.647	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-11	0.003		1.365	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED09	-		1.33	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SS-12	-		1.311	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-4SH	0.002		1.29	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-03SE	0.099		1.15	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-13	-		1.046	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-22	-		0.951	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-17	-		0.923	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-03RJ	0.027		0.88	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-29D	-		0.824	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED-16(M	-		0.8	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-11G	-		0.772	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-10RD	0.036		0.77	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-27K	-		0.63	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SED10	-		0.56	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-23	-		0.315	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-03RG	-		0.17	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
ES-12K	-		0.133	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
SB25	-		0.096	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%
B-21	-		0.065	0.00%	0.00	0.00	0.00%	0.00%	0.00%	0.00%

(1) Assuming 1 kg sample.,

(2) Based on NAPL density of 1.0588 g/cm^3.

(3) Base on specific gravity of soils of 2.65