PROPOSED REMEDIAL ACTION PLAN
LCP Chemical
Operable Unit No. 2
Town of Geddes, Onondaga County, New York
Site No. 7-34-049

February 2010

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

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SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for the LCP Chemical, Operable Unit 2 Site, which consists of the former Peroxide Plant portion of the LCP Chemical Site. The Department is also proposing a remedy for a neighboring off-site area referred to as the NAKOH Chemical property. The presence of hazardous waste has created significant threats to human health and/or the environment that are addressed by this proposed remedy. As more fully described in Sections 3 and 5 of this document, industrial operations and chemical spills at the site have resulted in the disposal of hazardous wastes, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and mercury. These wastes have contaminated the soil and/or groundwater at the site, and have resulted in:

- a significant threat to human health associated with potential exposure to soil and groundwater.
- a significant environmental threat associated with the potential impacts of contaminants to soil and groundwater.

To eliminate or mitigate these threats, the Department proposes *in-situ* chemical oxidation for on-site soils and groundwater, off-site soil excavation, placement of a 12-inch soil cover on-site and environmental easements with periodic certification.

The proposed remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

This Proposed Remedial Action Plan (PRAP) identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The Department will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The Department has issued this PRAP as a component of the Citizen Participation Plan developed pursuant to the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375. This document is a summary of the information that can be found in greater detail in the September 2004 “Final Remedial Investigation Report

for the LCP Bridge Street Site, Operable Unit 2" (RI), the March 2009 "Final Feasibility Study Report for the LCP Bridge Street Site, Operable Unit 2" (FS), and other relevant documents. The public is encouraged to review the project documents, which are available at the following repositories:

Onondaga County Public Library
Syracuse Branch at the Galleries
447 South Salina Street
Syracuse, New York 13204
Telephone: 315-475-1170
Hours of Operation:
Mon, Thurs, Fri & Sat - 9:00 AM to 5:00 PM
Tue & Wed - 9:00 AM to 8:30 PM
Sunday - Closed

Atlantic States Legal Foundation
658 West Onondaga Street
Syracuse, New York 13204
Telephone: 315-435-1900
(please call for an appointment)

NYSDEC, Region 7 Office
615 Erie Boulevard West
Syracuse, New York 13204
Telephone: 315-426-7400
(please call Gregg Townsend for an appointment)

NYSDEC, Central Office
625 Broadway
Albany, New York 12233-7016
Telephone: 518-402-9676
(please call Rick Mustico for an appointment)

The Department seeks input from the community on all PRAPs. A public comment period has been set from February 16, 2010 through March 18, 2010 to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for March 3, 2010 at the Martha Eddy Room, New York State Fairgrounds, 581 State Fair Blvd., Syracuse beginning at 6:00 pm. An availability session will precede the public meeting from 5:00 pm to 6:00 pm.

At the meeting, the results of the RI/FS will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments may be submitted on the PRAP. Written comments may also be sent to Mr. Mustico at the above address through March 18, 2010.

The Department may modify the proposed remedy or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the Department's final selection of the remedy for this site.

SECTION 2: SITE LOCATION AND DESCRIPTION

The former LCP Chemical site is located 2 miles northwest of the City of Syracuse, in the Town of Geddes, Onondaga County, New York **(**see Figure 1**)**. The approximately 20-acre site is located in an industrial area on Gere Lock Road (formerly called Belle Isle Road), west of Bridge Street (Route 297), and south of the New York State Fairgrounds and an active railroad right-of-way. A scrap yard is located north of the site, a cogeneration facility is located to the west, and the former NAKOH Chemical facility is located to the northeast.

Site geology consists of 3 to 10 feet of fill (brick, concrete, gravel, coal cinders), followed by 1 to 6 feet of clay and approximately 35 feet of silty-sand and sandy silt. Glacial till (a mixture of clays, silts, sands, and boulders) is at a depth of 38 to 44 feet below the ground surface at a thickness of 3 to 20 feet. Below the till is bedrock.

Site hydrogeology consists of wetlands, a stream and two groundwater aquifers (upper and lower). The wetlands are approximately 9 acres in size and located west of the former facility. The stream, named the West Flume, is a man-made drainage channel that bisects the site and discharges to Geddes Brook which, in turn, discharges to Ninemile Creek 1.3 miles upstream and west of Onondaga Lake. The West Flume converges with Geddes Brook near the Route 695 overpass, 4500 feet west (downstream) of the LCP Chemical site. Site runoff discharges to the West Flume and to the wetland. The wetland also discharges to the West Flume. Site groundwater from the upper aquifer discharges to the West Flume, and site groundwater from the lower aquifer flows towards the West Flume, but does not discharge to the stream prior to the West Flume converging with Geddes Brook.

Operable Unit (OU) No. 2, which is the subject of this document, consists of a 1.7-acre area where a former hydrogen peroxide plant was located at the facility. This area is north of the West Flume, south of the New York State Fairgrounds, a scrap metal recycling facility and an active railroad right-of-way, east of an area of OU No. 1 called the brine mud area, and west of the former NAKOH Chemical facility. An operable unit represents a portion of the site remedy that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination. The remaining operable unit for this site is OU No. 1, described above. A Record of Decision was issued for OU No. 1 by the Department in 2000. All of the remedial work at OU No. 1 was completed as of 2008, with the exception of the final cap. However, a temporary cap is in place at the site. Remediation of OU No. 1 consisted of the following:

- the removal of tanks, containers and transformers;
- building demolition;
- sediment excavation and restoration of the West Flume and wetlands;
- soil washing, which reclaimed approximately 8 tons of elemental mercury;
- soil excavation of the Brine Mud Area and North Ditch;
- the excavation of pipes and sewers, which provided preferential pathways for contamination to enter into the West Flume; and
- the installation of a slurry wall, groundwater collection and cap system.

The two buildings formerly located on OU No. 2, a hydrogen peroxide plant process building and a hydrogen compressor building, along with associated tanks and containers, were demolished and/or removed in 2001. The underground sewers and utilities located on OU No. 2 were removed, and surface soil (*i.e.*, 1 to 3 feet) from OU No. 2 was excavated, as part of the OU No. 1 remedial action.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

From the mid 1800s to 1908, the land on which OU No. 2 is located was used to produce salt from naturally occurring brine springs in the area. The Atmospheric Nitrogen Company used the area between 1919 and

1940 to manufacture ammonia. Ammonia production ceased, and the facilities were demolished in the early 1950s. Debris from the demolition was used to fill the area. The debris also included ash and cinders from coal-fired power units.

In 1953, the Allied Chemical Corporation, a predecessor to Honeywell, constructed a chlor-alkali facility at OU No. 1 to manufacture sodium hydroxide and chlorine gas. Hydrogen gas, generated as a byproduct of the chlor-alkali facility, was used between 1955 and 1969 at OU No. 2 to manufacture hydrogen peroxide. Approximately 1,500 to 3,000 tons per year were manufactured using the 2-ethylanthraquinone (2-EAQ) process. This process included the use of xylene to manufacture hydrogen peroxide.

In 1979, LCP Chemicals-NY purchased the Allied facility (OU Nos. 1 and 2). Manufacturing operations continued at OU No. 1 until 1988. Industrial operations at OU No. 2 remained idle during this period of time.

It appears that the handling of chemicals (*e.g*., xylene) resulted in contaminated soil and groundwater at OU No. 2 through spills and/or leaks over the time of operation of the Hydrogen Peroxide facility.

3.2: Remedial History

In 1989, the Department listed the site as a Class 2 site in the Registry of Inactive Hazardous Waste Disposal Sites in New York. A Class 2 site is a site where hazardous waste presents a significant threat to the public health or the environment and action is required.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The Department and Honeywell International, Inc. (Honeywell) entered into a Consent Order on May 24, 2002. The Order obligates Honeywell to implement a remedial investigation/feasibility study under the remedial program. After the remedy is selected, the Department will approach the Honeywell to implement the selected remedy under an Order on Consent.

SECTION 5: SITE CONTAMINATION

A remedial investigation/feasibility study (RI/FS) has been conducted to evaluate the alternatives for addressing the significant threats to human health and the environment.

5.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The RI was conducted between September 2002 and March 2004. The field activities and findings of the investigation are described in the RI report.

Activities that were performed during the RI included: soil borings and groundwater monitoring well installations for laboratory analysis of soils and groundwater, as well as for determining the physical properties of the soil and the hydrogeologic conditions at the site; and collection and analysis of surface and

subsurface soils, groundwater, surface water and sediment to determine contaminant types and levels in each environmental media at the site.

The main contaminant of concern at the site is xylene, however other organic compounds, such as 2-EAQ, ethylbenzene and phenols were also discovered in soil and groundwater. In addition, residual mercury in soil, potentially from industrial activities at OU No. 1, exists at OU No. 2. Sediment in the West Flume impacted by OU No. 2 was remediated as part of the OU No. 1 remedy.

5.1.1: Standards, Criteria, and Guidance (SCGs)

To determine whether the soil, groundwater, surface water and sediment contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater, drinking water, and surface water SCGs are based on the Department's "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code.

- Soil SCGs are based on the Department's Cleanup Objectives "Technical and Administrative Guidance Memorandum [TAGM] 4046: Determination of Soil Cleanup Objectives and Cleanup Levels" and 6 NYCRR Subpart 375-6 – Remedial Program Soil Cleanup Objectives.

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized in Section 5.1.2. More complete information can be found in the RI report.

5.1.2: Nature and Extent of Contamination

This section describes the findings of the investigation for all environmental media that were investigated.

As described in the RI report, many soil, groundwater, surface water and sediment samples were collected to characterize the nature and extent of contamination. As summarized in Table 1, the main categories of contaminants that exceed their SCGs are volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and inorganics (metals). For comparison purposes, where applicable, SCGs are provided for each medium.

Chemical concentrations are reported in parts per billion (ppb) for water and parts per million (ppm) for soil, and sediment.

Table 1 summarizes the degree of contamination for the contaminants of concern in soil and groundwater, and compares the data with the SCGs for the site. The following are the media which were investigated and a summary of the findings of the investigation.

Surface Soil

Former surface soils at OU No. 2 were removed as part of the OU No. 1 remedy. The depth of soil removed as part of the OU No. 1 remedy at OU No. 2 was between 1 and 3 feet. The OU No. 2 area was graded for drainage and covered with 6 inches of clean gravel. Therefore, no further characterization was required for surface soils.

Off-site surface soils to the north and west, adjacent to OU No. 2, have been removed as part of the OU No.1 remedy. In the areas to the north and west, clean fill and topsoil was brought in, and the areas were seeded with a conservation mix. In addition, off-site surface soils east and adjacent to OU No. 2, on the NAKOH Chemical property, were shown to contain site related residual mercury at concentrations from 0.06 to 1.9 ppm (see Figure 2). Most of these concentrations exceed the NYSDEC Part 375 Soil Cleanup Objective of 0.18 ppm for unrestricted use, but are below both the objectives for industrial use (5.7 ppm) and commercial use (2.8 ppm). The property is currently zoned as industrial.

Surface soil contamination identified during the RI/FS was addressed during the implementation of the OU No. 1 remedy.

Subsurface Soil

Subsurface soils at OU No. 2 and along the west edge of the NAKOH Chemical property are affected primarily with xylene and ethylbenzene, with the highest concentrations from 3 to 20 ft below ground surface (see Figure 3). Maximum concentrations of xylene and ethylbenzene detected in site soil are 7,540 ppm and 880 ppm, respectively, at 2 to 6 ft below ground surface at PGP-8 just west of the former peroxide building. On average, xylene compounds make up 85 to 95% of the VOCs in site subsurface soils, and ethylbenzene makes up the remaining 5 to 15%. These two VOCs were detected above NYSDEC Part 375 soil cleanup objectives for unrestricted use (0.26 ppm and 1 ppm, respectively) as deep as 20 to 25 ft below ground surface.

2-EAQ was detected in soil samples at the site. The maximum concentration detected was 1,200 ppm in vadose zone sample SB-5, and at location PGP- 12, at 3 to 5 and 10 to 12 ft below ground surface beneath the former peroxide processing building. There is no SCO value for 2-EAQ in Part 375. However, the maximum soil concentration for an individual SVOC per TAGM 4046 is 50 ppm.

PAHs have been detected in subsurface soil at OU No. 2 at total concentrations up to 1,090 ppm. Some of the compounds included in this total include benzo(a)anthracene (at concentrations up to 82 ppm, for which the NYSDEC Part 375 soil cleanup objectives for industrial use is 11 ppm) and dibenz(a,h)anthracene (at concentrations up to 12 ppm for which the Part 375 soil cleanup objectives for industrial use is 1.1 ppm). These chemicals are associated with common fill material and construction debris from the former Atmospheric Nitrogen Company.

Concentrations of mercury in subsurface soils on-site ranged from 0.01 – 14 ppm in comparison to the unrestricted SCO of 0.18 ppm. Mercury was detected in 9 of 165 samples above the industrial SCO of 5.7 ppm. In addition, arsenic was detected 3 of 44 samples above Part 375 soil cleanup objectives for both unrestricted and industrial use (13 ppm and 16 ppm, respectively).

Subsurface soils at the NAKOH Chemical property are less contaminated than subsurface soils at OU No. 2. Xylene was found at concentrations ranging from non-detect to 19 ppm, and ethylbenzene was found at concentrations ranging from non-detect to 1.5 ppm. These were the only VOCs detected at the NAKOH Chemical property. Subsurface soil mercury concentrations at the NAKOH Chemical property ranged from non-detect to 7.7 ppm. Eight of the 28 samples exceeded the Part 375 soil cleanup objective for unrestricted site use (0.18 ppm).

Subsurface soil contamination identified during the RI/FS will be addressed in the remedy selection process.

Groundwater

Shallow groundwater from the site discharges to the West Flume. Xylene and ethylbenzene are the only VOCs observed in groundwater at OU No. 2 and the NAKOH Chemical property above New York State Class GA groundwater quality standards (5 ppb) (see Figure 4). Xylene makes up approximately 90% of the VOCs detected in affected site groundwater, and ethylbenzene makes up the remaining 10%. These proportions are consistent with percentages of xylene and ethylbenzene observed in site subsurface soil samples. Lower concentrations of VOCs were observed in shallow groundwater from the North Ditch area monitoring wells PMW-5S and PMW-6S than were observed in groundwater from Peroxide Plant monitoring wells NMW-2S and PMW-1S. Since the concentration gradient declines to the north and since data show that VOCs were not detected in monitoring wells NMW-1S, MMW-1, PMW-8S, PMW-9S, PMW-10S, and MW-32S, the extent of shallow groundwater affected by xylene and ethylbenzene to the north of OU No. 2 has been delineated. Shallow groundwater moving to the north does not discharge to the North Ditch in the vicinity of the site. Other chemicals in groundwater above state groundwater quality standards are phenol-related semi-volatile compounds and, to a lesser extent, metals. Phenol and phenol-containing compounds exceed Class GA groundwater quality standards to a limited extent at three shallow OU No. 2 monitoring wells and at NMW-2S on NAKOH Chemical property. Phenol-related compounds in groundwater are co-located with xylene. Mercury was detected in groundwater above state groundwater quality standards only at NMW-2S during one of two sampling rounds, indicating limited mobility and impact to groundwater quality. Other metals above state groundwater quality standards are limited primarily to naturally occurring iron and sodium. The only PAH detected in groundwater was naphthalene, which was found intermittently and at concentrations below its State groundwater guidance value.

Data from deep monitoring wells (screened 30 to 45 ft below ground surface) indicate that deep groundwater from OU No. 2 and from NAKOH Chemical is migrating toward the south and beneath the West Flume. Deep groundwater does not appear to be affected, with the exception of xylene at 13 ppb observed at MW-13D in the eastern half of OU No. 2. Iron and sodium were observed in deep groundwater throughout the site.

Groundwater contamination identified during the RI/FS will be addressed in the remedy selection process.

Surface Water

Surface water contamination identified during the RI/FS was addressed during the implementation of the OU No. 1 remedy. The primary source of surface water contaminants in the West Flume was remediated through the removal of the sediment in the West Flume (see “Sediments” below).

Sediments

Sediment contamination identified during the RI/FS was addressed during the implementation of the OU No. 1 remedy. Sediment in the West Flume, adjacent to and south of the site, was excavated and consolidated at the OU No. 1 Site. Clean fill and topsoil was placed to bring the stream back up to grade, and the stream was restored through plantings and seeding.

5.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS. There were no IRMs performed at this site during the RI/FS.

Although no IRMs were conducted, there were several remedial actions conducted at the OU No. 2 area and adjacent off-site areas as part of the OU No. 1 remedy. These actions included soil removal to depths of 1 to 3 feet at the OU No. 2 area and backfill with a 6-inch clean gravel cover; soil removal adjacent to OU No. 2 to the north and west (North Ditch and Brine Mud Area) with clean soil backfilling and seeding; sediment removal and restoration in the West Flume adjacent to and south of OU No. 2; on-site building demolition; and removal of underground sewers and pipes.

5.3: Summary of Human Exposure Pathways:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in Section 6.1 and Appendix D of the RI report. An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population.

The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (*e.g.*, ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.
Currently, there are no completed exposure pathways associated with the OU-2 site. Consumption of contaminated groundwater is not expected because the OU-2 site and surrounding area are serviced by a municipal drinking water supply. Human contact with any surface soil contamination at the site is also not expected because OU-2 surface soils were removed as part of the OU-1 remedial action and backfilled with clean gravel.

Potential exposure pathways that exist for the OU-2 site include dermal contact with contaminated groundwater and subsurface soil during future excavation activities and inhalation of contaminated air due to soil vapor intrusion into any future constructed buildings.

5.4: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as impacts to other natural resources such as aquifers and wetlands.

The Fish and Wildlife Impact Analysis, which is included in the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors.

The following environmental exposure pathways and ecological risks have been identified:

- Ecological screening conducted prior to the OU No. 2 area soil removals (as part of the OU No. 1 remedy) identified a potential for adverse effects on flora and fauna at both OU No. 2 and NAKOH Chemical, because maximum concentrations of certain chemicals in soil exceeded ecological screening benchmarks at both locations.

- Soil removed as part of the OU No. 1 remediation addressed the majority of the ecological issues identified in the screening assessment, and current site risks are lower due to the soil removal and backfill with clean gravel.

- While the lack of suitable plant or animal habitat, due to the site's industrial nature, currently limits ecological exposure to contaminants, a return to a more natural habitat in the future may create additional ecological risk.

Site contamination has impacted the groundwater resource in the shallow aquifer. Groundwater in the vicinity of the site is not a source of drinking water. While site groundwater discharges to the West Flume, a New York State Class C water body, there are no discernable impacts to water quality.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- exposures of persons at or around the site to VOCs, SVOCs and metals in soil;

- exposures of persons at or around the site to VOCs, SVOCs and metals in groundwater;

- environmental exposures of flora or fauna to VOCs, SVOCs and metals in soil; and

- the release of contaminants from soil into groundwater that may create exceedances of groundwater quality standards.

Further, the remediation goals for the site include attaining to the extent practicable:

- ambient groundwater quality standards and
- Part 375 soil SCGs.

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the LCP OU No. 2 Site were identified, screened and evaluated in the FS report which is available at the document repositories established for this site.

A summary of the remedial alternatives that were considered for this site is discussed below. The present worth represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

The following potential remedies were considered to address the contaminated soils and groundwater at the OU No. 2 area of the site.

Alternative 1: No Further Action

Present Worth: *$400,000*
Capital Cost: *$0*
Annual Costs:
(Years 1-30): *$30,000*

The No Further Action alternative recognizes remediation of the site conducted under previously completed soil and sewer excavations as part of the LCP OU No. 1 remedy. To evaluate the effectiveness of the remediation completed under the previously completed excavations, only continued monitoring is necessary.

This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment.

Alternative 2: In Situ Aerobic Bioremediation

Present Worth: *$2,700,000*
Capital Cost: *$1,400,000*
Annual Costs:
(Years 1-10): *$180,000*
(Years 11-30): *$12,000*

Alternative 2 includes the following technologies retained from the screening conducted in the FS: horizontal wells and *in-situ* treatment. Horizontal wells would be installed to prepare the subsurface to receive and transmit oxygen. Aerobic bioremediation would be promoted *in-situ* by applying oxygen in the affected subsurface (20 to 25 ft below ground surface) through approximately five horizontal wells, 300 ft in length at a depth of 30 ft. Air injected into the subsurface may need to be vented (*e.g.*, by installing vertical vent wells). Subsurface conditions would be monitored while the oxygen is added to confirm that aerobic bioremediation was effectively taking place. This alternative includes an environmental easement that would include institutional controls, such as groundwater use restrictions and a Site Management Plan (SMP), and engineering controls, such as a 1-foot soil cover, and periodic certifications. The SMP would be prepared to: (1) identify known locations of any remaining impacted soil at the site; (2) establish appropriate controls for future disturbances of site soil; (3) set forth the inspection and maintenance activities for perimeter fencing and cover materials; and (4) establish protocols and frequencies for media monitoring activities. The SMP would be a means to address potential future soil excavation. The alternative would take approximately 1 year to design, 2 years to implement and 10 years to meet remedial goals.

Alternative 3: Sparge Trench Parallel to the West Flume

Present Worth: *$3,900,000*
Capital Cost: *$1,300,000*
Annual Costs:
(Years 1-30): *$200,000*

Alternative 3 includes the following technologies retained from the screening conducted in the FS: collection trench, air sparging, possibly soil vapor extraction within the trench, possibly *in-situ* groundwater treatment with reactive material, and vapor-phase treatment if required. This alternative would result in the treatment of groundwater as it passes through a sand trench installed parallel to the West Flume.

Vertical sparge wells would be installed in the sand trench to bubble air into affected groundwater. Vertical extraction wells would also be installed within the trench if required to capture VOCs released as a result of sparging. Sumps at each end of the trench would also be provided to collect VOCs. VOCs from the trench would be vented and would be treated, if required. The need for active venting and/or treatment of vapors would be determined during the design.

A reactive material (oxidizing or adsorbing material) would be added within the entire trench or along the downstream face of the trench parallel to the West Flume to treat SVOCs (*e.g.*, phenol) as water migrates toward the Flume. The need for and relative merits of this reactive material would be determined during the design. Additionally, a geomembrane liner would be installed on the downgradient face of the sparge trench to minimize the potential for communication between groundwater and West Flume surface water. The need for and relative merits of this liner would also be determined during the design.

The site would be restored to original ground surface. This alternative includes an environmental easement that would include institutional controls, such as groundwater use restrictions and engineering controls, such as a 1-foot soil cover, and periodic certifications. This alternative would also include the same SMP provided under Alternative 2 because soil at the site would still contain chemical contaminants at concentrations exceeding unrestricted soil cleanup objectives. The alternative would take approximately 1 year to design, 1 year to implement and at least 30 years to meet remedial goals.

Alternative 4: *In-Situ* Chemical Oxidation w/ Supplemental Vadose Zone Soil Treatment

Present Worth: *$4,200,000*
Capital Cost: *$3,900,000*
Annual Costs:
(Years 1-3): *$100,000*
(Years 4-30): *$12,000*

Alternative 4 includes the following technologies retained from the screening conducted in the FS: *in-situ* chemical oxidation treatment and supplemental vadose zone soil treatment. Under this alternative, chemical reagents would be injected into the subsurface to oxidize organic constituents adsorbed to soil and dissolved in groundwater.

Pilot testing conducted at the site in 2006 and 2007 used stabilized hydrogen peroxide (Fenton's Reagent) and a complexed iron catalyst at a neutral pH to treat the saturated zone. Comparing the baseline and post-second event soil results, there was an overall 93% reduction in the saturated zone of xylene and ethylbenzenes, and a 76% reduction in 2-EAQ.

To address soil RAOs in the vadose zone, supplemental treatment of vadose zone soils may be necessary. Supplemental treatment could be *in-situ* or *ex-situ* soil treatment (*e.g.*, land farming or biopiles). Vadose zone treatment would be evaluated as part of the Remedial Design.

Following completion of the chemical oxidation and subsequent soil treatment activities, the site would be restored. Placement of a 1-foot thick layer of clean soil over the site would be included with this alternative. This layer would minimize the potential for human or biota contact with site soils that would not be sufficiently affected by treatment (*e.g.*, mercury and PAHs). A cover would also prevent migration, *via* storm water runoff, of any remaining site contaminants from entering the West Flume (see Figure 5).

This alternative includes an environmental easement that would include institutional controls, such as groundwater use restrictions and engineering controls, such as a 1-foot soil cover, and periodic certifications. This alternative would also include the same SMP provided under Alternative 2 because soil at the site would still contain chemical contaminants at concentrations exceeding unrestricted soil cleanup objectives.

The alternative would take approximately 1 year to design. It is anticipated that the time required to complete treatment at the LCP OU No. 2 site would be less than 3 years.

Alternatives 5A and 5B – Groundwater Containment with a Barrier Wall or Collection Trench

Alternative 5A:
Present Worth: *$4,600,000*
Capital Cost: *$1,300,000*
Annual Costs:
(Years 1-30): *$210,000*

Alternative 5B:
Present Worth: *$4,500,000*
Capital Cost: *$960,000*
Annual Costs:
(Years 1-30): *$280,000*

Alternatives 5A and 5B are soil and groundwater containment alternatives. Both of these alternatives include placement of a 1-foot clean soil cover; treatment of pumped groundwater in accordance with State discharge requirements; and an environmental easement that would include institutional controls to help prevent any direct contact with subsurface soils. Both alternatives would also include the same SMP provided under Alternative 2 because soil at the site would still contain chemical contaminants at concentrations exceeding unrestricted soil cleanup objectives. Both alternatives would take approximately 1 year to design, 1 to 3 years to implement and at least 30 years to meet remedial goals.

For Alternative 5A, Cap and barrier wall:

> A low-permeability barrier wall encircling OU No. 2 would be installed and keyed into the till beneath the site. The wall would be constructed of low-permeability bentonite or equivalent material that is compatible with the high natural sodium concentrations at the site. An impermeable cap would be keyed into the barrier wall. Minimal pumping, approximately 1 gal/min, from vertical wells inside the wall would create a groundwater hydraulic gradient at the wall inward toward the site.

For Alternative 5B, hydraulic containment:

> Shallow site groundwater would be pumped at approximately 2 gal/min from a groundwater collection trench parallel to the West Flume to prevent contaminated groundwater from migrating to the West Flume. The dimensions of the groundwater collection trench would be similar to those for the sparge trench under Alternative 3.

Alternatives 6A, 6B, and 6C – Soil Removal to Various Depths

Alternative 6A
Present Worth: *$3,300,000*
Capital Cost: *$2,300,000*
Annual Costs:
(Years 1-30): *$70,000*

Alternative 6B
Present Worth: *$5,900,000*
Capital Cost: *$5,100,000*
Annual Costs:
(Years 1-30): *$57,000*

Alternative 6C
Present Worth: *$11,000,000*
Capital Cost: *$11,000,000*
Annual Costs:
(Years 1-30): *$0*

Alternatives 6A, 6B, and 6C are removal-based alternatives. Under each alternative, soils would be excavated, and the excavated soil would be properly disposed of off-site. The excavated portion of the site would be restored to pre-excavation grade following removal. Construction water from excavation work below the water table would be managed either onsite or offsite and discharged in accordance with discharge limits established by the NYSDEC. Each of these alternatives includes an environmental easement that would include institutional controls to help prevent any direct contact with residual contaminated subsurface soils and groundwater, as appropriate. Only the depth of excavation differentiates these alternatives.

All alternatives would take approximately 1 year to design and 1 year to implement. It is estimated that remedial goals would be met for Alternative 6A in 8 years, 6B in 7 years and 6C in 6 years.

Alternative 6A: Soil excavation would occur to a depth of approximately 8 feet below the ground surface. This depth is approximately 1-2 feet below the water table, below the bottom of the West Flume, and at the bottom of the clayey-silt unit. The total volume of soil to be removed would be approximately 13,000 cubic yards.

Alternative 6B: Soil excavation would occur to a depth of approximately 12 feet below the ground surface. The total volume of soil to be removed would be approximately 31,000 cubic yards, which is approximately half of the total volume of contaminated soils.

Alternative 6C: Soil excavation would occur to a depth of approximately 20 feet below the ground surface. The total volume of soil to be removed would be approximately 71,000 cubic yards, which is approximately the total volume of contaminated soils.

Alternatives 6A and 6B would also include the same SMP provided under Alternative 2 because soil at the site would still contain chemical contaminants at concentrations exceeding unrestricted soil cleanup objectives.

The following potential remedies were considered to address the off-site contaminated soils at the NAKOH Chemical property.

Alternative N1: No Action

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. It requires continued monitoring only, allowing the site to remain in an unremediated state. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment.

Alternative N2: Asphalt, Crushed Stone, or Vegetative Soil Cover and Institutional Controls

Alternative N2A
Present Worth: *$210,000*
Capital Cost: *$170,000*
Annual Costs:
(Years 1-30): *$3,000*

Alternative N2B
Present Worth: *$440,000*
Capital Cost: *$380,000*
Annual Costs:
(Years 1-30): *$5,000*

Alternatives N2A and N2B are cover-based alternatives. Each of these alternatives includes excavation (to the extent required to install the cover); onsite consolidation of excavated soils at LCP OU No. 1 within the containment cell; and institutional controls to help prevent direct contact with contaminated soils beneath the cap.

For both alternatives, the cover would be, 1 foot thick and would consist of asphalt (*e.g.*, 4 inches of asphalt over 8 inches of crushed stone), crushed stone, or soil (*e.g.*, 6 inches of topsoil over 6 inches of fill). The specific cover types for given areas would be determined during design and would consider such factors as proximity to the West Flume and run-off control. It should be noted that for cost estimation puposes, it was assumed that 50% of the cover would be asphalt, and 50% of the cover would be soil.

Although not required for protectiveness, some surface removals and grading may be required to install the cover system. As a conservative approach, a 1-foot removal is assumed for alternative evaluation purposes. The actual removals required to install the cover, which could be less, would be determined during design based on a topographic survey.

Both alternatives would also include an SMP. The SMP would be prepared to: (1) identify known locations of any remaining impacted soil at the site; (2) establish appropriate controls for future disturbances of site soil; (3) set forth the inspection and maintenance activities cover materials; and (4) establish protocols and frequencies for media monitoring activities. The SMP would be a means to address potential future soil excavation. Both alternatives would take approximately 1 year to design and 1 year to implement and meet remedial goals.

The specific soil cleanup objective differentiates these two alternatives which leads to different remedial area “footprints”.

> Alternative N2A: Under this alternative, soils at the NAKOH Chemical property that exceed the Part 375 commercial use soil cleanup objective for mercury of 2.8 ppm would be covered. It is estimated that approximately 14,700 square feet (sf) would be covered. The actual cover area may vary based on the results of design investigations.
>
> Alternative N2B: Under this alternative, soils at the NAKOH Chemical property that exceed the Part 375 residential use soil cleanup objective for mercury of 0.81 ppm would be covered. The area

with soils above this mercury PRG is approximately 52,300 sf. The actual cover area may vary based on the results of design investigations.

Alternative N3: Removal of Soils, Backfill, and Restoration of Surfaces

Alternative N3A
Present Worth: *$360,000*
Capital Cost: *$360,000*
Annual Costs:
(Years 1-30): *$0*

Alternative N3B
Present Worth: *$860,000*
Capital Cost: *$860,000*
Annual Costs:
(Years 1-30): *$0*

Alternatives N3A and N3B are soil removal alternatives. Under each alternative, excavated soils would be consolidated onsite within the LCP OU No.1 containment cell. The excavated portion of the site would be restored to pre-excavation grade following removal. Construction water from excavation work below the water table would be managed either onsite or offsite and discharged in accordance with discharge limits established by the NYSDEC. Each of these alternatives includes institutional controls to limit future site use to commercial/industrial.

Both alternatives would take approximately 1 year to design and 1 year to implement and meet remedial goals.

The specific soil clean up objective differentiates these two alternatives which leads to different remedial area "footprints".

Alternative N3A: Under this alternative, soils at the NAKOH Chemical property outside the building footprint that exceed the Part 375 commercial use soil cleanup objective for mercury of 2.8 ppm would be excavated. The area of soils that would be excavated is approximately 14,700 sf. (see Figure 5). It is estimated that the removal depth would average approximately 4 ft, based on soil sampling results from the RI. The total volume of soil to be removed is estimated to be approximately 2,000 cubic yards. Actual removal volumes may vary based on the results of design investigations.

Alternative N3B: Under this alternative, soils at the NAKOH Chemical property outside the building footprint that exceed the Part 375 residential use soil cleanup objective for mercury of 0.81 ppm would be excavated. The area of soils that would be excavated is approximately 52,300 sf. It is estimated that the removal depth would average approximately 3 ft, based on soil sampling results from the RI. The total volume of soil to be removed is estimated to be approximately 6,000 cubic yards. Actual removal volumes may vary based on the results of design investigations.

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York. A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

7. Cost-Effectivness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision. The costs for each alternative are presented in Table 2 (Please see cost table at the end of the PRAP).

This final criterion is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. Land Use. When cleanup to pre-disposal conditions is determined to be infeasible, the Department may consider the current, intended, and reasonable anticipated future land use of the site and its surroundings in the selection of the soil remedy.

The final criterion, Community Acceptance, is considered a modifying criterion and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

9. Community Acceptance. Concerns of the community regarding the RI/FS reports and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the Department will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

The Department is proposing Alternative 4, *in-situ* chemical oxidation with supplemental *in-situ* or *ex-situ* vadose zone soil treatment, as described in Section 7.1, as the remedy for this site. In addition, for the off-site NAKOH Chemical property, the Department is proposing Alternative N3A, the excavation of contaminated soil to the commercial soil cleanup objective for mercury. The elements of this remedy are described at the end of this section.

The proposed remedy is based on the results of the RI and the evaluation of alternatives presented in the FS. Alternative 4 (on-site) and Alternative N3A (off-site) are being proposed because, as described below, they satisfy the threshold criteria and provide the best balance of the primary balancing criteria described in Section 7.2. It would achieve the remediation goals for the site by treating on-site soils and groundwater and excavating off-site soils. Treatment of on-site soils would significantly reduce their toxicity in relation to potential direct contact and significantly reduce this source of groundwater contamination. Excavation of contaminated off-site soils at the NAKOH Chemical property would significantly reduce the potential for direct contact exposure. In addition, the environmental easement would further reduce the potential for exposures at the LCP OU2 site by restricting the site's future use to commercial/industrial, prohibiting access to groundwater, preventing unauthorized soil excavations in remediated areas, and requiring that a soil vapor intrusion evaluation be completed prior to any buildings being developed on the site.

On-site Alternative 1 (No Further Action) and off-site Alternative N1 (No Action) would not meet the remedial action objectives for soil or groundwater and would leave the site in its present condition. On-site Alternative 1 (No Further Action) and off-site Alternative N1 (No Action) would not provide any additional protection to human health or the environment and would not meet threshold criteria.

Because on-site Alternatives 2, 3, 4, 5A, 5B, 6A, 6B and 6C, and off-site Alternatives N2A, N2B, N3A and N3B satisfy the threshold criteria, the five balancing criteria are particularly important in selecting a final remedy for the site. On-site Alternative 1 and off-site Alternative N1 did not satisfy the threshold criteria and will not be further evaluated.

Short-Term Effectiveness:

Construction worker and community health and safety would need to be addressed under all of the alternatives by developing and implementing a health and safety plan and a community air monitoring plan.

Subsurface work would be most significant for Alternative 6 followed by Alternatives 3 and 5. Vadose zone soils would likely be excavated during implementation of Alternative 4. With Alternative 6, and to a lesser extent Alternatives 3, 4, and 5, volatile emissions, construction water, and excavated soil would need to be managed to control short-term risks associated with migration of contaminants. In addition, excavation on-site, but adjacent to the NAKOH Chemical building, may need to include measures such as shoring to preserve the structural integrity of the building.

Alternatives 3, 4, and 5 would protect the West Flume relatively rapidly once implemented. Alternative 6B and 6C would protect the West Flume based on the groundwater flow patterns determined during the remedial investigation and natural attenuation assessments completed as part of this feasibility study. Alternative 2 would also protect the West Flume, but not in as timely a fashion as the other alternatives.

Alternatives 4, 6A, 6B, and 6C would result in removal of contaminants of concern within 1 to 3 years, compared to at least 5 to 10 years for Alternative 2. Alternatives 4, 6A, 6B, and 6C would also be able to address the highest site concentrations of xylene and ethylbenzene more quickly than Alternative 2. However, Alternative 6C, and to a lesser extent Alternative 6B, would have a number of short-term challenges during design and soil removal, such as measures required to protect the integrity of the NAKOH Chemical Building.

For off-site (NAKOH Chemical property) remedial work, subsurface work would be most significant for Alternative N3B (excavation of soil to the unrestricted/residental cleanup objective for mercury), followed by Alternatives N3A and N2A and N2B (capping). Alternative N3B would require shoring to preserve the structural integrity of the building on the NAKOH Chemical property. All off-site alternatives could be implemented in one construction season.

Long-Term Effectiveness and Permanence:

Each of the alternatives evaluated can effectively meet site remedial action objectives for the West Flume over the long term. Alternatives 2 and 4, and Alternatives 6B and 6C, would provide effective control for the West Flume and for the site itself. Alternatives 2 and 4 would provide permanent treatment of organic contaminants of concern. Chemical oxidation treatment under Alternative 4 would be relatively rapid. Treatment efficiencies under Alternative 2 would be lower than under Alternative 4. Alternative 4 can also address a wider range of organic contaminants of concern than Alternative 2. Alternative 6A, 6B, and 6C would not provide permanence through treatment, except to a limited extent by treating construction water or pretreatment of soil (if required) prior to final disposal.

Alternative 6A (excavation to 8 ft) would address an estimated 28% of site xylene and 46% of site ethylbenzene found in site soils above the soil cleanup objectives. Alternative 6B (excavation to 12 ft) would address an estimated 42% of site xylene and 69% of site ethylbenzene above the soil cleanup objectives. Alternative 6C would address an estimated 85% of site xylene and 99% of site ethylbenzene found in site soils above the soil cleanup objectives.

Alternatives 3 and 5 would need to remain in operation for the foreseeable future and would only address contaminants of concern as they migrate *via* groundwater transport into the sparge trench or the barrier wall, respectively.

Alternative 4 would likely achieve up to an estimated 97% in soils of xylene, ethylbenzene and other oxidizable organic contaminants of concern. This is the most permanent and effective alternative over the long-term.

For off-site remedial work, Alternatives N3A and N3B are more effective and permanent than Alternatives N2A and N2B because they would remove mercury contaminated soil to soil cleanup objects which are below the NAKOH Chemical facility's current and foreseeable future zoning (industrial). Alternatives N2A and N2B would require maintenance of a cap. N3A and N3B are of comparable effectiveness and permanence in relation to the site use as an industrial use property.

Reduction of Toxicity, Mobility, or Volume through Treatment:

Alternatives 2 and 4 would provide the most extensive treatment of site soil and groundwater. Alternative 4 is expected to provide more treatment than Alternative 2, because treatment efficiencies measured at treated sites are generally higher for *in-situ* chemical oxidation than for *in-situ* bioremediation, and because oxidation can address more of the contaminants of concern than can bioremediation.

Alternatives 1, 3, and 5 would not result in as much reduction of toxicity, mobility, or volume as Alternatives 2 and 4. Alternatives 6A, 6B, and 6C would not provide any reduction of toxicity, mobility, or volume through treatment, except from treating construction water.

For off-site remedial work, the reduction of toxicity, mobility or volume through treatment would not occur under alternatives N2, N3A or N3B.

Implementability:

Each alternative is technically implementable. Alternatives 2 and 3 would require pilot testing to confirm treatment and removal efficiencies prior to full-scale design. Design investigations would also likely be required for Alternative 5 and Alternative 6. Bench and pilot testing has already been conducted for Alternative 4.

Cost:

All of the remedial costs are summarized in Table 2 (Remedial Alternative Costs), below. Besides the no action alternative, the total estimated costs (present worth) to implement the alternatives range from $2.7 million (Alternative 2) to $11 million (Alternative 6C).

Besides the no action alternative, the total estimated costs (present worth cost) to implement the off-site alternative range from $210,000 (Alternative N2A) to $860,000 (Alternative N3B).

The estimated present worth cost to implement the on-site remedy (Alternative 4) is $4.2 million. The cost to construct the remedy is estimated to be $3.9 million and the estimated average annual cost for 3 years is $0.1 million.

The estimated present worth cost to implement the off-site (NAKOH Chemical property) remedy (Alternative N3A) is $360,000. The cost to construct the remedy is also estimated to be $360,000 with $0 estimated average annual costs for O&M.

Land Use:

The current, intended, and reasonable anticipated future land use of the site and its surroundings is industrial or commercial.

The elements of the proposed remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program.

2. Chemical oxidant(s) and catalyst(s) would be injected into the subsurface to address site remedial action objectives. In addition to the injection of chemical oxidants below the water table, supplemental chemical oxidation treatment of vadose zone soils would be conducted (*e.g.*, direct application of chemical oxidants to the surface soil and/or land farming). Emission and/or odor controls would be implemented as required during remedy construction. Monitoring would be required to ensure that adverse effects to the aquifer or the West Flume would not occur during remediation. Monitoring would also be employed throughout the remedial action to assess the performance and demonstrate the effectiveness of the remedy. In addition, the *in-situ* chemical oxidation technology would be extended onto the NAKOH Chemical property to address the NMW-2 (northwest) area.

3. Construction of a soil cover over the site to prevent exposure to contaminated soils. The one-foot thick cover would consist of clean soil or crushed stone underlain by a demarcation layer to delineate the cover soil from the subsurface soil. Clean soil is soil that is tested and meets the Division of Environmental Remediation's criteria for backfill or local site background. A cover would also prevent migration, *via* storm water runoff, of any remaining site contaminants from entering the West Flume.

4. Imposition of an institutional control in the form of an environmental easement that would require (a) limiting the use and development of the property to commercial use, which would also permit industrial use; (b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH; and (d) Honeywell to complete and submit to the Department a periodic certification of institutional and engineering controls.

5. Development of a site management plan which would include the following institutional and engineering controls: (a) management of the final cover system to restrict excavation below the soil cover's demarcation layer. Excavated soil would be tested, properly handled to protect the health and safety of workers and the nearby community, and would be properly managed in a manner acceptable to the Department; (b) continued evaluation of the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified; (c) monitoring of groundwater; (d) identification of any use restrictions on the site; (e) fencing or other

means to control site access; and (f) provisions for the continued proper operation and maintenance of the components of the remedy.

6. For remediation on the off-site NAKOH Chemical property, soil would be excavated to the commercial soil cleanup objective for mercury (2.8 parts per million). Soil would be consolidated at the LCP OU No. 1 Site, within the cap and slurry wall system. Clean soil would replace the excavated soil. The NAKOH Chemical property is currently zoned industrial, and the reasonable anticipated future land use of the property and its surroundings is industrial or commercial.

7. Honeywell would provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owner in writing that this certification is no longer needed. This submittal would: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department.

8. The operation of the components of the remedy would continue until the remedial objectives have been achieved, or until the Department determines that continued operation is technically impracticable or not feasible.

9. Since the remedy results in untreated hazardous waste remaining at the site, a long-term monitoring program would be instituted. Inspection and, if necessary, repair of the cover would be conducted to ensure the cover prevents human contact with subsurface soils. This program would allow the effectiveness of the cover to be monitored and would be a component of the long-term management for the site.

TABLE 1
Nature and Extent of Contamination
Range of sampling dates: September 2002 – March 2007

SURFACE SOIL	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
Semivolatile Organic Compounds (SVOCs)	Benzo(a)anthracene	0.11 – 9.6	1	1 of 4
	Benzo(a)pyrene	0.11 – 9.1	1	1 of 4
	Benzo(b)fluoranthene	0.11 - 7	1	1 of 4
	Benzo(k)fluoranthene	0.11 – 7.1	1	1 of 4
	Chrysene	0.13 – 9.8	1	1 of 4
	Dibenzo(a,h)anthracene	1.9 – 1.9	0.33	1 of 4
	Hexachlorobenzene	0.41 – 0.41	0.33	1 of 4
	Indeno(1,2,3-cd)pyrene	0.082 – 5.1	0.5	1 of 4
Inorganic Compounds	Chromium[d]	22.9 – 42.4	1	2 of 2
	Mercury	0.06 – 1.9	0.18	7 of 8

SUBSURFACE SOIL	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	Ethylbenzene	0.004 - 880	1	88 of 189
	Toluene	0.002 – 0.77	0.7	1 of 188
	Xylene (mixed)	0.003 - 7540	0.26	126 of 188
Semivolatile Organic Compounds (SVOCs)	Benzo(a)anthracene	0.049 – 82	1	13 of 81
	Benzo(a)pyrene	0.046 – 71	1	13 of 81
	Benzo(b)fluoranthene	0.045 - 71	1	12 of 81
	Benzo(k)fluoranthene	0.054 - 41	1	10 of 81
	Chrysene	0.044 - 79	1	13 of 81
	Dibenzo(a,h)anthracene	0.051 - 12	0.33	7 of 81
	Fluoranthene	0.042 - 200	100	1 of 80
	Indeno(1,2,3-cd)pyrene	0.05 - 37	0.5	13 of 80
	Phenanthrene	0.045 – 190	100	1 of 80
	Pyrene	0.091 - 160	100	1 of 80

TABLE 1
Nature and Extent of Contamination
Range of sampling dates: September 2002 – March 2007

SUBSURFACE SOIL	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
Semivolatile Organic Compounds (SVOCs)	Dibenzofuran	0.046 - 14	7	5 of 70
Inorganic Compounds	Arsenic	0.97 – 40.3	13	3 of 44
	Chromium[d]	5.1 – 38.8	1	44 of 44
	Copper	8.6 – 781	50	5 of 44
	Lead	3.3 - 565	63	3 of 44
	Manganese	256 - 3040	1600	1 of 44
	Mercury	0.01 - 14	0.18	44 of 165

GROUNDWATER	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	1,2-Dichlorobenzene	0.22 – 7	3	5 of 65
	1,4-Dichlorobenzene	0.1 – 130	3	1 of 65
	2-Butanone	3 – 9290	50	2 of 65
	2-Hexanone	4 – 124	50	2 of 65
	Acetone	1.22 – 8080	50	7 of 63
	Chlorobenzene	0.33 – 9	5	1 of 65
	Ethylbenzene	2 – 8460	5	41 of 68
	Methylene Chloride	2 – 7.5	5	2 of 65
	Tetrachloroethene	6 – 6	5	1 of 65
	Toluene	0.44 – 720	5	20 of 68
	Xylene (mixed)	0.51 - 95400	5	44 of 68
Semivolatile Organic Compounds (SVOCs)	2,4,5-Trichlorophenol	1 – 3	1	2 of 49
	2,4-Dimethylphenol	10 - 1500	1	20 of 49
	4-Methylphenol	2 – 230	1	6 of 49
	4-Nitrophenol	34 - 34	1	1 of 47
	Phenol	2 – 590	1	8 of 48

TABLE 1
Nature and Extent of Contamination
Range of sampling dates: September 2002 – March 2007

GROUNDWATER	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
Inorganic Compounds	Antimony	1.8 – 26	3	22 of 57
	Arsenic	1.9 – 550	25	22 of 57
	Beryllium	0.22 – 6.5	3	1 of 57
	Cadmium	0.61 – 9.1	5	2 of 57
	Chromium	0.33 - 230	50	4 of 57
	Copper	2.6 - 2700	200	13 of 57
	Iron	18.8 - 93600	300	60 of 74
	Lead	1.2 - 590	25	14 of 46
	Magnesium	680 - 170000	35000	7 of 57
	Manganese	1.5 - 8300	300	22 of 57
	Mercury	0.02 – 5.3	0.7	15 of 60
	Selenium	1.5 – 84	10	12 of 57
	Sodium	14000 - 17920000	20000	63 of 64
	Thallium	0.83 – 10.2	0.5	13 of 57

[a] ppb = parts per billion, which is equivalent to micrograms per liter, ug/L, in water;
ppm = parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;
ug/m^3 = micrograms per cubic meter

[b] SCG = standards, criteria, and guidance values,

[c] LEL = Lowest Effects Level and SEL = Severe Effects Level. A sediment is considered to be contaminated if either of these criteria is exceeded. If both criteria are exceeded, the sediment is severely impacted. If only the LEL is exceeded, the impact is considered to be moderate.

[d] SCG Values are for hexavalent chrome concentrations, not total chrome concentrations. Speciation analysis would be required to verify the concentrations detected, and exceedance statistics. Results reported are total chrome concentration.

Table 2
Remedial Alternative Costs

Remedial Alternative (On-Site)		Capital Cost	Annual Costs	Total Present Worth
Alternative 1	No Further Action	$0	$30,000	$400,000
Alternative 2	In-Situ Aerobic Bioremediation	$1,400,000	$180,000	$2,700,000
Alternative 3	Sparge Trench	$1,300,000	$200,000	$3,900,000
Alternative 4	*In-Situ* Chemical Oxidation	$3,900,000	$100,000	$4,200,000
Alternative 5	Groundwater Containment			
5A	Encircling Barrier Wall and Cap	$1,300,000	$210,000	$4,600,000
5B	Groundwater Collection Trench	$960,000	$280,000	$4,500,000
Alternative 6	Excavation			
6A	Excavation to 8 feet and Backfill	$2,300,000	$70,000	$3,300,000
6B	Excavation to 12 feet and Backfill	$5,100,000	$57,000	$5,900,000
6C	Excavation to 20 feet and Backfill	$11,000,000	$0	$11,000,000
Remedial Alternative (Off-Site)				
Alternative N1	No Action	$0	$0	$0
Alternative N2	Cover			
N2A	Cover to Commercial/Industrial Soil Cleanup Objectives	$170,000	$3,000	$210,000
N2B	Cover to Unrestricted/Residential Soil Cleanup Objectives	$380,000	$5,000	$440,000
Alternative N3	Excavation			
N3A	Excavation to Commercial/Industrial Soil Cleanup Objectives and Backfill	$360,000	$0	$360,000
N3B	Excavation to Unrestricted/Residential Soil Cleanup Objectives and Backfill	$860,000	$0	$860,000

N

LATITUDE: N40° 42' 51"
LONGITUDE: W74° 06' 07"

FIGURE 1

LCP BRIDGE STREET OU-2

SITE LOCATION MAP

P:\Honeywell – Syr\444170\cad\dec submittal\44170SLM-dec.ppt

REF SS–1	
A'	ND*
REFERENCE SURFACE SOIL SAMPLE COLLECTED BETWEEN HORAN ROAD AND GEDDES BROOK NEAR MILTON AVENUE	

SAMPLE DEPTH RANGE KEY (FEET BELOW GROUND SURFACE)

A	*0–0.5'*
A'	*0.5'–1'*

LEGEND

- TANKS
- FENCE
- FORMER STRUCTURES
- DIRT ROADS
- PAVED ROADS
- APPROXIMATE PROPERTY LINE
- MONITORING WELL LOCATIONS
- SURFACE WATER SAMPLE LOCATIONS
- WEST FLUME SEDIMENT SAMPLE LOCATIONS
- SHALLOW SOIL SAMPLE LOCATIONS
- GEOPROBE BORING LOCATIONS
- SOIL BORING LOCATIONS
- NMW–1 — MONITORING WELL AT NAKOH CHEMICAL
- SL0105 — LCP OU1 RI SAMPLE (OCTOBER 1995)
- MERCURY SOIL CONCENTRATION ABOVE NYSDEC PART 375 UNRESTRICTED OBJECTIVE (.18 mg/kg).
- NA — NOT ANALYZED
- ND — NOT DETECTED

LCP OU2

LCP OU1

NAKOH

FORMER PEROXIDE BUILDING

APPROX. PROPERTY BOUNDARY

WEST FLUME

A	*0.66*
A'	*7.2*

A	*0.68*
A'	*1.9*

A	*1.2*
A'	*2.2*

A	*1.3*
AA	*0.06*

A	*1.9*
A'	*0.25*

A	*0.99*
A'	*4.2*

A	*0.82*
AA	*1.7*

REF SS–2	
A'	*1*
REFERENCE SURFACE SOIL SAMPLE COLLECTED EAST OF WEST FLUME NEAR BRIDGE STREET	

80 40 0 80 160

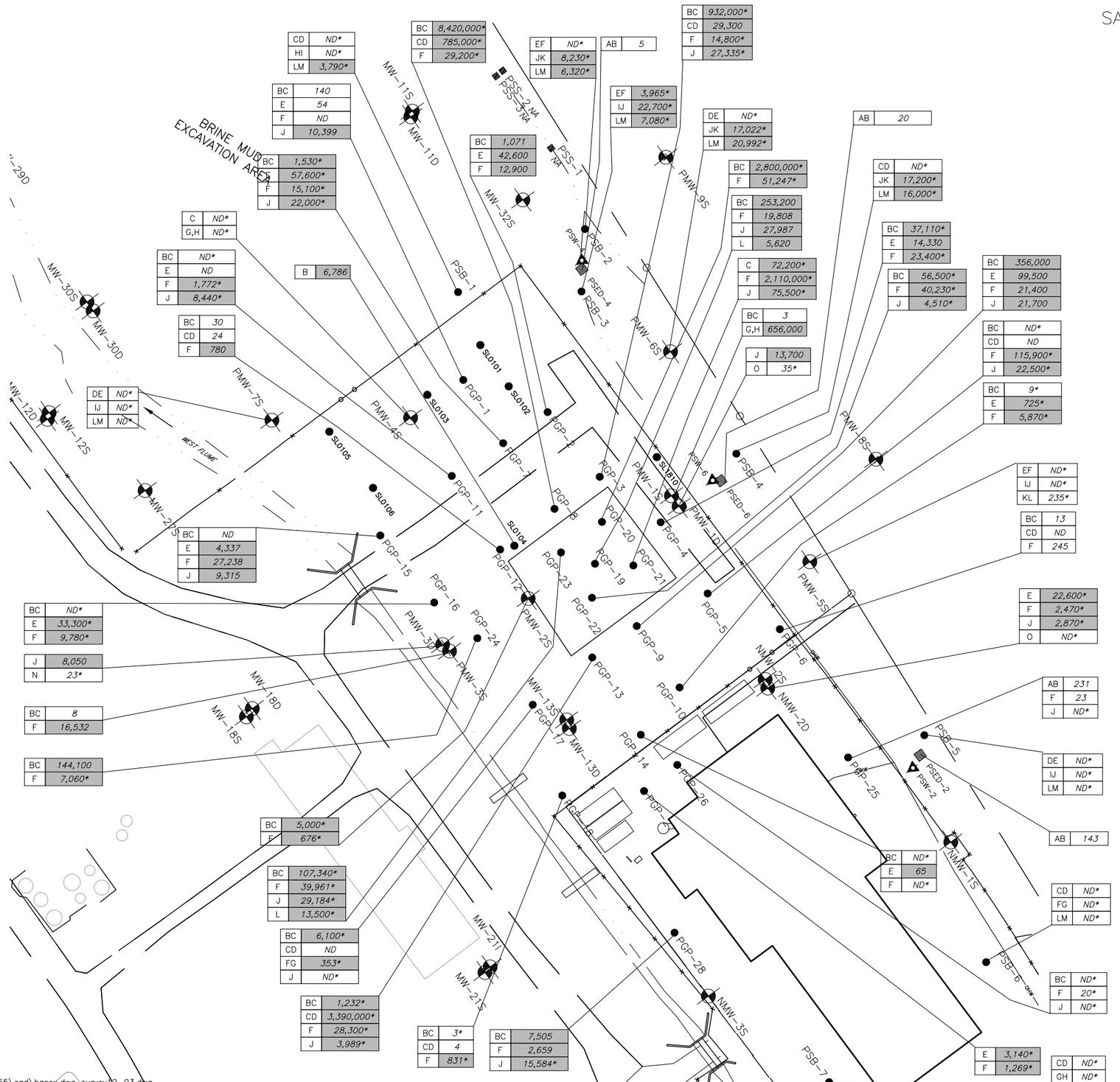
SCALE: 1"=80'

MAP SOURCE: C.T. MALE ASSOCIATES, P.C.

FIGURE 2

LCP BRIDGE STREET OU–2 TOTAL MERCURY IN SURFACE SOILS AT NAKOH (mg/kg)

FILE NAME: P:\HONEYWELL –SYR\444170–LCP OU2\10 TECHNICAL CATEGORIES\CAD\DEC SUBMITTAL\SK444170C001.DWG
PLOT DATE: 1/5/2010 1:38 PM PLOTTED BY: RUSSO, JILL



SAMPLE DEPTH RANGE KEY (FEET BELOW GROUND SURFACE)

B	2'–4'
C	4'–6'
D	6'–8'
E	8'–10'
F	10'–12'
G	12'–14'
H	14'–16'
I	16'–18'
J	18'–20'
K	20'–22'
L	22'–24'
M	24'–26'
N	26'–28'
O	28'–30'
P	30'–32'
Q	32'–34'
R	34'–36'
S	36'–38'
T	38'–40'
U	40'–42'
V	42'–44'
AB	1'–3'
BC	3'–5'
CD	5'–7'
DE	7'–9'
EF	9'–11'
FG	11'–13'
GH	13'–15'
HI	15'–17'
IJ	17'–19'
JK	19'–21'
KL	21'–23'
LM	23'–25'

LEGEND

- TANKS
- FENCE
- FORMER STRUCTURES
- DIRT ROADS
- PAVED ROADS
- APPROXIMATE PROPERTY LINE
- MONITORING WELL LOCATIONS
- SURFACE WATER SAMPLE LOCATIONS
- WEST FLUME SEDIMENT SAMPLE LOCATIONS
- SHALLOW SOIL SAMPLE LOCATIONS
- GEOPROBE BORING LOCATIONS
- SOIL BORING LOCATIONS
- NMW–1 — MONITORING WELL AT NAKOH CHEMICAL
- SL0105 — LCP OU1 RI SAMPLE (OCTOBER 1995)
- ONE OR MORE VOC'S OR TOTAL VOC CONCENTRATION ABOVE STATEWIDE NYSDEC PART 375 OBJECTIVES

NA	NOT ANALYZED
ND	NOT DETECTED
28	TOTAL VOC CONCENTRATION (ug/kg)
235*	TOTAL BTEX CONCENTRATION (ug/kg)

80 40 0 80 160

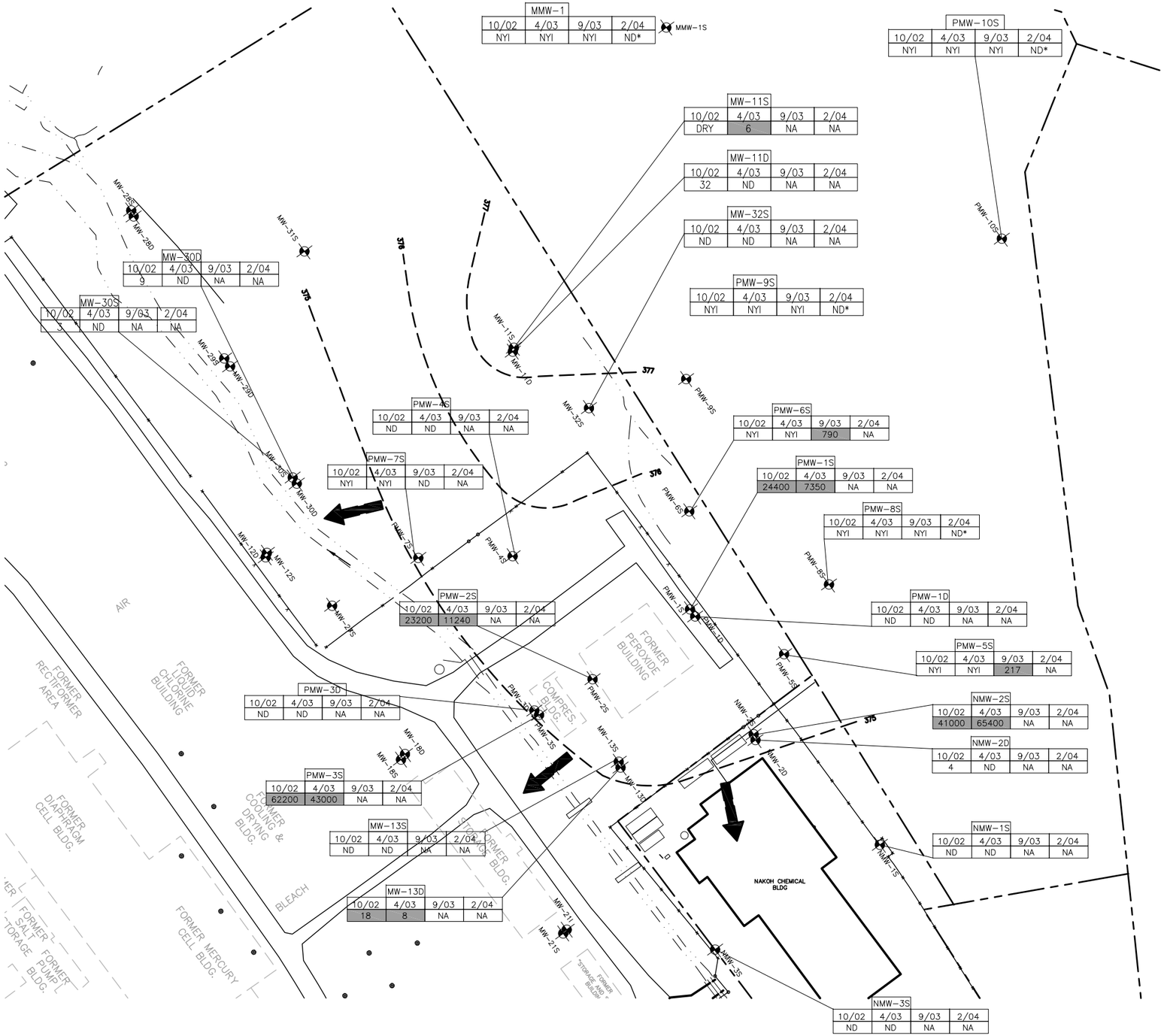
SCALE: 1"=80'

MAP SOURCE: C.T. MALE ASSOCIATES, P.C.

Xref: p:\741855\cad\basex.dwg survey12-03.dwg
P:\741855\cad\tag maps\41855t01A.dwg

FIGURE 3

LCP BRIDGE STREET OU-2
TOTAL VOCS
IN SUBSURFACE SOILS (ug/kg)



LEGEND

- FENCE
- DIRT ROADS
- PAVED ROADS
- APPROXIMATE PROPERTY LINE
- TANKS
- PMW-11S — MONITORING WELLS
- NMW-3 — MONITORING WELL AT NAKOH CHEMICAL
- XYLENES OR ETHYLBENZENES EXCEED NYSDEC CLASS GA GROUNDWATER STANDARDS OR GUIDANCE VALUES

MW-11D		
10/02	4/03	9/03
32	ND	NA

GROUNDWATER SAMPLE RESULTS IN ug/L

- APPROXIMATE GROUNDWATER FLOW DIRECTION
- NYI — NOT YET INSTALLED
- NA — NOT ANALYZED
- ND — NOT DETECTED
- * — ANALYZED FOR BTEX

MAP SOURCE: C.T. MALE ASSOCIATES, P.C.

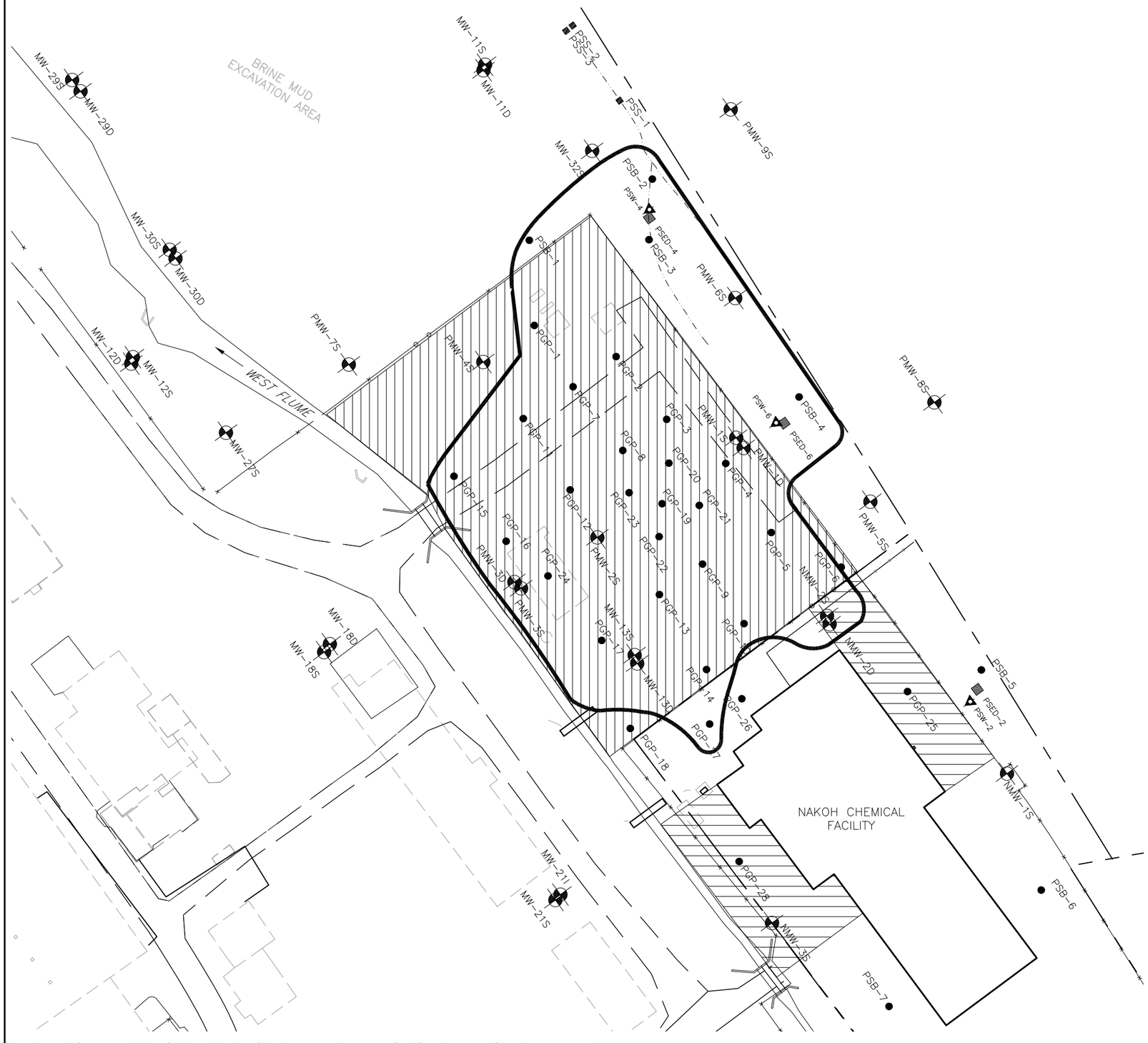
80 40 0 80 160

SCALE: 1"=80'

FIGURE 4

LCP BRIDGE STREET OU-2
TOTAL VOCs IN GROUNDWATER
(ug/L)

FILE NAME: P:\HONEYWELL -SYR\444170-LCP OU2\10 TECHNICAL CATEGORIES\CAD\DEC SUBMITTAL\SK444170C004.DWG
PLOT DATE: 11/16/2009 2:45 PM PLOTTED BY: RUSSO, JILL



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PLOT DATE: 1/5/2010 1:25 PM PLOTTED BY: RUSSO, JILL

LEGEND

- FENCE
- DIRT ROADS
- PAVED ROADS
- APPROXIMATE PROPERTY LINE
- APPROXIMATE LIMITS OF IN-SITU CHEMICAL OXIDATION (ALTERNATIVE 4)
- APPROXIMATE LIMITS OF SOIL EXCAVATION (ALTERNATIVE N3A).
- APPROXIMATE LIMITS OF SOIL COVER ON LCP OU-2 PROPERTY
- MONITORING WELL LOCATIONS
- SOIL BORING LOCATIONS

NOTES:

LIMITS OF REMEDIATION ARE BASED ON DATA FROM THE REMEDIAL INVESTIGATION AND ARE SUBJECT TO REVISION DURING DESIGN AND IMPLEMENTATION.

MAP SOURCE: C.T. MALE ASSOCIATES, P.C. DATED 12/03.

80 40 0 80 160

SCALE: 1"=80'

FIGURE 5

Honeywell

TOWN OF GEDDES, NEW YORK

LCP BRIDGE STREET OU-2
ALTERNATIVES 4 AND N3A

PARSONS
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