Department of Environmental Conservation

Division of Environmental Remediation

Record of Decision

Arch Chemicals, Inc.
(formerly Olin Corporation)
Operable Unit No. 2
City of Rochester, Monroe County
Site Number 8-28-018A

March 2002

New York State Department of Environmental Conservation
GEORGE E. PATAKI, *Governor* Erin M. Crotty, *Commissioner*

DECLARATION STATEMENT - RECORD OF DECISION

Arch Chemicals, Inc. (formerly Olin Corporation)
Inactive Hazardous Waste Site
Operable Unit No. 2
City of Rochester, Monroe County, New York
Site No. 828018A

Statement of Purpose and Basis

The Record of Decision (ROD) presents the selected remedy for the Arch Chemicals, Inc. (Arch) Class 2 inactive hazardous waste disposal site which was chosen in accordance with the New York State Environmental Conservation Law. The remedial program selected is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300).

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (NYSDEC) for the Arch inactive hazardous waste disposal site and upon public input to the Proposed Remedial Action Plan (PRAP) presented by the NYSDEC. A listing of the documents included as a part of the Administrative Record is included in Appendix B of the ROD.

Assessment of the Site

Actual or threatened release of hazardous waste constituents from this site, if not addressed by implementing the response action selected in this ROD, presents a current or potential significant threat to public health and the environment.

Description of Selected Remedy

Based on the results of the Remedial Investigation/Feasibility Study (RI/FS) for the Arch site and the criteria identified for evaluation of alternatives, the NYSDEC has selected Groundwater Pumping/Hydraulic Control, Treatment, Discharge to Publicly-Owned Treatment Works, Institutional Controls, and Long-term Monitoring. The components of the remedy are as follows:

- Continued operation and maintenance of the existing groundwater extraction and treatment (granular activated carbon) system;

- Installation and operation of an overburden groundwater interceptor trench along the southeast/south perimeter of the plant property along with the installation and sampling of downgradient/offsite groundwater monitoring wells in overburden and bedrock near the interceptor trench;

- Installation and operation of a bedrock pumping well on the western site perimeter between PW-11 and PW-7;

- Installation and operation of an offsite bedrock pumping well adjacent to the southeast corner of the Gates Dolomite quarry (located about 4000 feet southwest of the site);

- Deed restrictions on future use as industrial/commercial and prohibition on use of groundwater beneath the site. The site owner will annually certify that the deed restrictions are in effect and that the annual notifications of property owners within the offsite area of groundwater contamination were completed;

- Natural attenuation of the existing offsite plume which will gradually reduce contaminant concentrations in groundwater;

- Implementation of a long-term monitoring program since untreated hazardous waste remain at the site.

New York State Department of Health Acceptance

The New York State Department of Health concurs with the remedy selected for this site as being protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

3/29/2002
Date

Michael J. O'Toole, Jr., Director
Division of Environmental Remediation

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RECORD OF DECISION

Arch Chemicals, Inc. (formerly Olin Corporation)
(Operable Unit No. 2 - Groundwater)
City of Rochester, Monroe County, New York
Site No. 8-28-018a
March 2002

SECTION 1: SUMMARY OF THE RECORD OF DECISION

The New York State Department of Environmental Conservation (NYSDEC) in consultation with the New York State Department of Health (NYSDOH) has selected this remedy for contaminated groundwater to address the significant threat to human health and/or the environment created by the presence of hazardous waste at the Arch Chemicals, Inc. (Arch), former Olin Corporation (Olin) site, a Class 2 inactive hazardous waste disposal site. As more fully described in Sections 3 and 4 of this document, former waste management operations, such as subsurface sewer leaks, chemical spills, and disposal of laboratory and off-specification wastes have resulted in the disposal of a number of hazardous wastes, including chloropyridines and a variety of chlorinated solvents (such as carbon tetrachloride, chloroform, methylene chloride, and tetrachloroethene) at this specialty chemical manufacturer, some of which have migrated from the site to surrounding areas, including the Dolomite Products quarry in the Town of Gates (Gates Dolomite quarry) and the Erie Canal. These disposal activities have resulted in the following significant threats to the public health and/or the environment associated with contaminated groundwater:

- a significant threat to human health associated with direct contact with contaminated groundwater onsite, at the Gates Dolomite quarry, and the quarry discharge to the Erie Canal as well as potential human exposure associated with potential future use of offsite groundwater; and

- a significant environmental threat associated with the impacts of contaminated groundwater in the fractured bedrock aquifer which discharges into the Gates Dolomite quarry, the quarry discharge channel, and the Erie Canal.

In order to eliminate or mitigate the significant threats to the public health and/or the environment that the hazardous wastes disposed at the Arch/Olin site have caused, the following remedy was selected for contaminated groundwater, onsite and offsite:

- Onsite Groundwater - Groundwater Pumping/Hydraulic Control, Treatment, Discharge to Publicly-Owned Treatment Works (POTW), Institutional Controls, and Long-term Monitoring.

- Offsite Groundwater - Groundwater Pumping at the Quarry Boundary, Treatment if Necessary to Meet Discharge Criteria, Natural Attenuation, Groundwater Notifications, and Long-term Monitoring.

Note that this portion of the overall site remedy, Contaminated Groundwater, is referred to as Operable Unit No. 2 (OU-2). The contaminated soil and bedrock onsite (i.e., source areas) will be addressed separately as Operable Unit No. 1 (OU-1) as discussed below in Section 3.3.

This remedy will address the significant threats posed by contaminated groundwater through hydraulic control at the site and quarry perimeters. Arch/Olin has extracted contaminated groundwater from an array of onsite pumping wells for a number of years. This system will continue to operate and will be enhanced with the addition of an interceptor trench along the southeast/south site perimeter (with offsite groundwater monitoring to evaluate effectiveness), an additional bedrock pumping well on the west site perimeter, and a bedrock pumping well at the southeast edge of the Gates Dolomite quarry. The migration of contaminated groundwater will be expected to be controlled by this groundwater extraction system. Extracted groundwater will be treated by granular activated carbon to prescribed discharge criteria and discharged to the Monroe County Pure Water Authority Treatment Works. In addition, restrictions will be imposed on groundwater use and long-term monitoring will be performed.

The selected remedy, discussed in detail below in Sections 7 and 8, is intended to attain the remediation goals selected for this site, in Section 6 of this Record of Decision (ROD), in conformity with applicable standards, criteria, and guidance (SCGs).

SECTION 2: SITE LOCATION AND DESCRIPTION

The Arch Chemicals plant is located on a fifteen-acre parcel at 100 McKee Road in a commercial/industrial area of the City of Rochester (see Figure 1; all figures follow page 20 in the back of the document). Arch (formerly Olin Corporation prior to 1999) has produced specialty chemicals at this location since 1954. The active manufacturing complex is comprised of a number of facilities including the main manufacturing plant, a chemical tank farm, a waste pretreatment building, and a large warehouse. Surrounding land uses are industrial and commercial; the nearest residential neighborhoods are about 2000 feet east (Mt. Read Blvd.) and west (Varian Lane) of the site. Significant physical features include the Erie Canal and the Gates Dolomite quarry, located about 1000 feet west and 4000 feet southwest, respectively, of the site.

Past releases of hazardous wastes have resulted in soil and groundwater contamination which pose a significant threat to the environment and/or public health. Accordingly, the site was assigned Site No. 828018A and listed as a Class 2 site on the NYS Registry of Inactive Hazardous Waste Disposal Sites.

As noted above, this remedy addresses contaminated groundwater both onsite and offsite and is referred to as Operable Unit No. 2 (OU-2). An Operable Unit represents a portion of the site remedy which 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 Operable Unit No. 1 (OU-1; contaminated soil and bedrock) is described in Section 3.3 below.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

Industrial use of the site began in 1948, when Genesee Research, a fully-owned subsidiary of the Puritan Company, established a manufacturing facility for automotive specialty products (e.g., brake fluids, polishes, anti-freeze, and specialty organic chemicals). In 1954, Mathieson Chemical Corporation acquired Puritan and merged with Olin Industries to become Olin Mathieson Chemical Corporation. Production of brake fluid and anti-freeze continued for a time but in the early 1960s, production of specialty organic chemicals, such as Zinc Omadine® and chloropyridine began. In 1969, Olin Mathieson changed its name to Olin

Corporation (Olin) and in 1999, Olin spun off its specialty chemicals business to form an independent company known as Arch Chemicals, Inc. (Arch). The Arch Rochester plant is the sole manufacturer of chloropyridines in the United States. The primary product line is Omadine® biocides, used in anti-dandruff shampoos and by the metalworking industry. Other products include more than 60 specialty organic chemicals used in personal care products, crop protection, rubber and plastic additives, and the textile industry.

Due to the long history and nature of the manufacturing operations, a large number of chemical raw materials, intermediates, products, and wastes have been handled at the site. Some of these chemicals have been released, spilled, and/or disposed during former manufacturing and waste management operations. The most significant sources of chemical contaminants to site soils and groundwater are considered to be:

- leakage from process waste sewers and floor drains (These leaks were fixed and sewer lines were largely moved aboveground by 1988. Periodic upgrades since then have also been completed.); and

- plant washdown of chemical spills and overflow to outside soils (practice stopped in mid-1970s).

These releases comprise the major source area at the site and it is referred to as the Well B-17 Area (see Figure 2).

Other operations which resulted in land disposal include:

- former laboratory and off-specification waste disposal area - laboratory and off-specification wastes were disposed in a pit north of the laboratory from the 1950s to 1970. During construction of a boiler house in 1983, obvious wastes and surrounding soil were excavated and properly disposed off-site;

- pretreatment plant area - the pretreatment plant and related piping/sewers are currently lined and regularly inspected but historic leaks/spills may have occurred (as indicated by available groundwater data). Also, according to plant records, burial of sodium amide occurred in this vicinity in the early1960s;

- tank farm area - the tank farm is currently lined and bermed to contain possible leaks or spills but historic leaks/spills may have occurred;

- former acid neutralization pond - located near well BR-5 and the current tank farm, a 30' by 100' by 4' deep pond was used from 1966 to 1971 to neutralize nitrating acid from the manufacture of benzotrifluoride. An ammonium hydroxide spent scrubber solution was also discharged to the pond;

- rail tanker unloading - unloading of bulk chemical rail tankers has periodically resulted in spillage near the Well B-17 area. One documented spill of toluene diamine (noted as TDA Area on Figure 2) occurred in 1969; impacted soils were reportedly spread south of the railroad tracks and covered with clean fill.

3.2: <u>Remedial History</u>

The site has been the subject of several environmental investigations, including groundwater investigations conducted in 1981-1982 and 1988-1990 and a two-phased remedial investigation (RI), conducted in

1993-1997. Results of these investigations indicated that site-related contaminants had been released into the environment and were impacting onsite soils and groundwater as well as offsite groundwater.

After an initial investigation in 1981 revealed the presence of significant groundwater contamination, several perimeter overburden monitoring wells were converted to pumping wells in 1983 in an effort to contain shallow groundwater. The groundwater extraction system was gradually expanded to include seven bedrock extraction wells after further investigation in the late 1980s revealed that bedrock was the primary route of contaminant migration. Extracted groundwater is conveyed by pipeline to the plant treatment system (granular activated carbon) prior to discharge to the Monroe County Pure Waters Publicly Owned Treatment Works. Due to minimal yields from the overburden wells and the dewatering of the overburden in some areas by bedrock pumping wells, Arch discontinued overburden pumping in the year 2000. The current groundwater extraction system of seven bedrock wells is depicted on Figure 3.

3.3: Operable Unit No. 1

Operable Unit No. 1 (Contaminated Soil/Bedrock) will be addressed in a future PRAP. Significant soil and groundwater contamination is evident in the Well B-17 Area where past releases from leaking sewers and plant spill washdown were concentrated. Other areas of concern include the former Lab and Off-spec Waste Disposal Area and the Pretreatment Plant Area near monitoring well PZ-106. Very high levels of dissolved-phase chemicals (at times approaching the solubility limit of some chemicals) and the sporadic detection of separate phases in bedrock monitoring wells indicates the presence of dense non-aqueous phase liquid (DNAPL; undissolved chemicals) in these areas. As discussed below in Section 4.1.2.1, DNAPL presents very persistent sources of contaminants to groundwater and significant technical challenges for effective remediation. For example, a significant proportion of the DNAPL mass may have diffused into the bedrock matrix where it cannot be readily extracted. While emerging technologies are evaluated to deal with this difficult problem (such as thermally-enhanced vacuum extraction), the current groundwater extraction and treatment system and the enhancements of this remedy (OU-2; groundwater interceptor trench and additional bedrock pumping wells) will gradually remove contaminant mass from source areas via dissolution into groundwater and subsequent capture by the extraction wells.

SECTION 4: SITE CONTAMINATION

To evaluate the contamination present at the site and to evaluate alternatives to address the significant threat to human health and the environment posed by the presence of hazardous waste, the PRP has conducted a Remedial Investigation/Feasibility Study (RI/FS).

4.1: 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 in two main phases followed by supplemental offsite work. The first phase was conducted between September 1993 and February 1994 and the second phase between August 1995 and December 1995 with additional offsite well installations in 1996. Reports entitled the Phase I RI Report (August 1995), the Phase II RI Report (May 1996), and the Phase II RI Report Addendum (June 1996), the Supplemental Human Health Risk Evaluation (November 1996), and final Phase II RI Report (October 1997) have been prepared which describe the field activities and findings of the RI in detail.

The RI included the following activities:

- *surface geophysical surveys to locate potential disposal areas;*
- *surface soil sampling and analysis;*
- *direct-push borings for sampling and analysis of soil gas, soil and groundwater;*
- *monitoring well and piezometer installations to monitor groundwater elevations and quality;*
- *borehole geophysical surveys and packer sampling to locate groundwater flow zones;*
- *hydraulic conductivity testing to determine groundwater flow velocities;*
- *pumping tests, well evaluations, and numerical modeling to evaluate/optimize the groundwater extraction system; and*
- *quarterly groundwater sampling and analysis.*

To determine which media (soil, groundwater, etc.) are contaminated at levels of concern, the RI analytical data was compared to environmental standards, criteria, and guidance values (SCGs). Groundwater, drinking water and surface water SCGs identified for the Arch/Olin site are based on NYSDEC Ambient Water Quality Standards and Guidance Values and Part 5 of New York State Sanitary Code. For soils, NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 provides soil cleanup guidelines for the protection of groundwater, background conditions, and health-based exposure scenarios. In addition, for soils, site specific background concentration levels can be considered for certain classes of contaminants. Guidance values for evaluating contamination in sediments are provided by the NYSDEC "Technical Guidance for Screening Contaminated Sediments".

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 below. More complete information can be found in the RI Reports.

Chemical concentrations are reported in parts per billion (ppb) and parts per million (ppm). For comparison purposes, where applicable, SCGs are provided for each medium.

4.1.1: <u>Site Geology and Hydrogeology</u>

A cross-sectional diagram of site geology is depicted in Figure 4. The soils beneath the Arch/Olin site are comprised largely of sand with some near-surface fill. Ranging in thickness from approximately 10 to 20 feet, these soils (known generically as overburden) are underlain by the bedrock formation known as the Lockport Dolomite. About 100 feet in thickness, this light-gray carbonate rock is extensively quarried for crushed stone. One such quarry is the Gates Dolomite quarry located on Buffalo Road about 4000 feet southwest of the site. Below the Lockport Dolomite, a transition to the Rochester Shale, a dark-gray, methane-rich shale of low permeability, is encountered. This transition forms the base of the groundwater flow system of concern at the site.

The Lockport Dolomite is highly-fractured in its uppermost 10 to 50 feet based on examinations of bedrock cores and the Gates Dolomite quarry. This upper fracture network, comprised primarily of horizontal bedding planes and vertical joint fractures, forms the primary groundwater flow zone at the site. Beneath this upper fractured zone, the bedrock generally becomes less fractured and less permeable. However, occasional but significant flow zones are present in deeper bedrock. Typically, these zones are of limited vertical extent (forming along major horizontal bedding surfaces and/or zones of significant mineral dissolution) but may extend significant distances horizontally. One such flow zone is evident in the Gates

Dolomite quarry. On the east quarry wall about 60 feet below grade, significant groundwater seepage occurs along the top of a competent, three-foot thick bed. Cascading in places, the seepage is concentrated about every 20 feet to 30 feet, a spacing roughly coincident with sets of vertical joint fractures. This zone appears to correlate with a zone of higher permeability beneath the plant site and site-related contaminants have been detected in the quarry seeps (as discussed below in Section 4.1.3).

Summary of Hydrogeology:

Depth to Groundwater:

- Onsite, groundwater is encountered in overburden at a depth of 10 feet or less;
- Offsite, as the Erie Canal is approached, the overburden becomes unsaturated and the water table dips into bedrock.

Groundwater Flow Directions:

- Onsite, groundwater flows primarily west and south with a southeastward flow component (see Figure 5);
- Offsite, west of the Erie Canal, dewatering operations at the Gates Dolomite quarry appear to control deeper groundwater flow over a considerable area (see Figure 6).

Hydraulic Conductivity (permeability) Estimates:

- Overburden = 10^{-4} to 10^{-3} centimeters per second (cm/sec);
- Shallow Bedrock = 10^{-4} to 10^{-2} cm/sec;
- Deeper competent bedrock = 10^{-6} to 10^{-3} cm/sec.

Groundwater Flow Velocity Estimates:

- Overburden = 5 - 300 feet/year;
- Bedrock = 5 - 5000 feet/year (competent to highly-fractured bedrock).

Groundwater Extraction System Evaluation

As noted above in Section 1.0, Arch/Olin has pumped groundwater from an array of wells for a number of years in an effort to contain contaminant migration at the site perimeter. In order to evaluate the effectiveness of the extraction system and optimize its performance, Arch/Olin performed pumping tests, well evaluations, and numerical modeling during the RI. Based on the results of this evaluation, Arch/Olin installed four additional shallow bedrock groundwater extraction wells (BR-9 in 1995 and PW10, PW11 and PW12 in 1999). PW10 and PW12 were located in source areas in order to help control migration and increase the contaminant mass removal rate of the extraction system. Figure 3 shows the current configuration of the shallow bedrock extraction system. Arch/Olin discontinued pumping from the overburden in 2000 due to minimal yields from the overburden wells, indications of strong downward flow from overburden to bedrock, and dewatering of the overburden in some areas (e.g., the southwest corner of the site) by bedrock pumping wells.

Ongoing evaluation of the groundwater extraction system also includes monitoring of pump rates and volume, estimates of mass removal, and semi-annual monitoring of groundwater quality and elevations from the monitoring well network. In recent years, the annual volume of pumped groundwater has exceeded 10 million gallons per year with estimates of contaminant mass removal ranging over 1000 pounds per year. Trends in contaminant concentrations and plots of groundwater elevation data indicate that the extraction system is effective along most of the downgradient site perimeter.

However, gaps in the containment system are apparent in two key areas: the southeast/south perimeter and the western perimeter between PW-11 and PW-7. Overburden wells along the southeast perimeter show high levels of contaminants (e.g., E-1 and S-3) and direct-push borings on the adjoining property to the south (during and subsequent to the RI) showed ppm levels of chloropyridines. Accordingly, an overburden groundwater interceptor trench is proposed for this area along with downgradient/offsite groundwater monitoring of overburden and bedrock in this area (see Figure 9). On the western perimeter, bedrock wells, PZ-103, BR-106, and MW-106 show persistently elevated contaminant concentrations and the main source area is located directly upgradient of these wells (see Figure 9). Accordingly, installation of a bedrock pumping well is proposed for this area.

4.1.2: <u>Nature of Contamination</u>

As described in the RI reports and subsequent quarterly sampling reports, numerous soil and groundwater samples were collected at the site to characterize the nature and extent of contamination. The main categories of contaminants which exceed their SCGs are volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) and inorganics (metals).

The main VOC contaminants of concern are carbon tetrachloride, chloroform, methylene chloride, tetrachloroethene, trichloroethene, 1,2-dichloroethene, vinyl chloride, 1,1,1-trichloroethane, 1,1-dichloroethane, chlorobenzene, benzene, toluene, and xylene.

The main SVOC contaminants of concern are chlorinated pyridines (e.g., 2,6-dichloropyridine, 2-chloropyridine, 3-chloropyridine, 4-chloropyridine), pyridine, p-fluoroaniline, and chlorobenzenes.

The main inorganic contaminants of concern are mercury and zinc which appear to be associated with releases of organic contamination.

4.1.2.1: Contaminant Fate and Transport

Significant soil and groundwater contamination is evident in areas of past releases at the Arch/Olin plant (e.g., leaking sewers, plant spill washdown, the former lab disposal area and the process waste pretreatment building). Very high levels of dissolved-phase organic chemicals (at times approaching the solubility limit of some chemicals) and the rare detection of separate phases in bedrock monitoring wells (BR-5 and BR-3 in the 1980s) indicates the presence of dense non-aqueous phase liquid (DNAPL) in some areas. The primary site contaminants, chloropyridines and chlorinated VOCs, are examples of DNAPL.

The distribution and fate of DNAPL in the subsurface depends on such factors as the volume and type (instantaneous or gradual) of the spills/releases, the properties of the DNAPL, and the properties of the geologic media. With densities greater and viscosities less than water, DNAPL can spread rapidly downward in the subsurface and penetrate well below the water table. Coupled with low solubilities (ranging from 0.01% to 2%), DNAPL may persist in the subsurface for many decades as a long-term source of groundwater contamination.

The potential for complex migration and distribution patterns present considerable difficulties in characterizing and remediating DNAPL sites. A further complication is the possibility of diffusion of both DNAPL and dissolved-phase contaminants into fractured media such as bedrock. Concentration gradients between contaminated fluids in fractures and the unfractured bedrock matrix can cause diffusion of contaminants (and with time, the possible "disappearance" of DNAPL) into the matrix. Eventually, concentration gradients would be expected to reverse and the extremely slow process of diffusion of contaminants back out of the matrix and into groundwater would occur. Accordingly, DNAPL and associated contaminant mass within geologic matrices present very long-term sources of dissolved contaminants to groundwater.

A conceptual model of contamination at the Arch/Olin site includes source areas with DNAPL present above and below the water table (see Figure 4). Within the overburden, DNAPL is most likely distributed as residual saturation (occupying some percentage of the soil pore space), whereas in bedrock, DNAPL is likely distributed in fractures and possibly, by dissolution and diffusion, in the bedrock matrix. Small isolated pools (saturated pore space) of DNAPL are also possible on the top of bedrock where very high concentrations of contaminants were detected during the RI. As precipitation and groundwater move through source areas, DNAPL slowly dissolves and contaminants migrate according to prevailing hydraulic gradients (primarily west and south).

Dissolved-phase transport in groundwater is the most significant contaminant migration pathway at the site and the focus of this proposed remedy (OU-2). In addition to active remedies, such as groundwater extraction and treatment, natural processes, such as biodegradation, volatilization, and sorption help to reduce or attenuate contaminant concentrations in groundwater. For example, biodegradation appears to be the most important fate process for chlorinated VOCs, such as tetrachloroethene and trichloroethene which gradually breakdown to dichloroethene, vinyl chloride, and eventually carbon dioxide and water. Carbon tetrachloride, chloroform, and methylene chloride, while at very elevated groundwater concentrations in places, show little offsite migration; biodegradation may account for this somewhat restricted distribution. On the other hand, chloropyridines show considerable mobility and persistence in the environment due apparently to relatively high concentrations in onsite source areas, their relatively high solubility (e.g., 2 to 3%), relatively low volatility, and relatively slow rates of degradation.

For other site contaminants, such as pesticides and polycyclic aromatic hydrocarbons (PAHs), sorption to soil was identified as the most important fate process controlling their distribution. For inorganics, such as metals, mobility in soil-groundwater systems is affected by soil-, water- and chemical-specific properties including compound solubility, pH, soil cation exchange capacity, and oxidation-reduction potential. Data collected during the RI indicate that the potential for significant offsite migration of these contaminants is comparatively low.

4.1.3: Extent of Contamination

Table 1 (all tables follow the figures in the back of the document) summarizes the range of concentrations for the contaminants of concern at the site 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.

Soil

Over seventy soil samples were collected during the RI; results indicate that the main contaminant source area is in the vicinity of Well B-17.

Surface Soil

Surface soil sampling at the site (17 samples at 0"-2") showed several polycyclic aromatic hydrocarbons (PAHs) and one or more chloropyridine isomers in all samples. Chloroform was the only VOC detected in the surface soil samples. The locations of the maximum concentration of chloroform and many of the semivolatile organic compounds (SVOCs) were in the Well B-17 Area. For example, the highest levels of PAHs were detected near the railroad siding in this area (e.g., fluoranthene = 74 ppm and pyrene = 62 ppm; SCGs = 50 ppm). Mercury and zinc were detected at levels above SCGs (i.e., SCGs = 0.1 ppm for mercury and 20 ppm for zinc) at a majority of the sample locations. Arsenic, cadmium, calcium, chromium, copper, iron, lead, and nickel were detected above SCGs at one or more locations. The maximum concentration of mercury, 214 ppm, was detected near the former Lab Sample Disposal Area; two additional samples in the area showed 7.2 ppm and 0.15 ppm, comparatively lower but well above the SCGs.

Subsurface Soil

Over fifty direct-push soil samples were collected across the site; the highest concentrations of VOCs, chloropyridines, and other SVOCs were detected in the Well B-17 Area (former leaks from sewers and spills from the main plant). One direct-push sample, adjacent to the main plant building near Well B-17, detected 4200 ppm of carbon tetrachloride (SCGs = 0.6 ppm), 1570 ppm of total chloropyridines (SCGs = 0.9 ppm for 2-chloropyridine and 0.8 ppm for 3-chloropyridine), 520 ppm of tetrachloroethene (SCGs = 1.4 ppm), and over 500 ppm of assorted other VOCs at 18 feet below grade at the top of rock. Given this result and a number of plant expansions over the years, it is clear that contamination extends under the footprint of the main plant. Figure 7 depicts the areal extent of soils above SCGs in the Well B-17 area.

Groundwater

Groundwater sampling has been ongoing at the facility since the early 1980s which has yielded an extensive analytical database. A wide variety of contaminants (SVOCs, VOCs, and inorganics) have been detected in overburden and bedrock groundwater beneath the site. Chloropyridines are the most frequently detected organic chemicals in both overburden and bedrock groundwater. The distribution of chloropyridines appears to represent the greatest extent of site contamination in the groundwater as shown in Figure 8.

In general, the highest contaminant concentrations in groundwater are found at the Well B-17 area. For example, sampling results for overburden well B-17 have ranged up to 28,000,000 ppb of total chloropyridines (SCGs for each chloropyridine isomer = 50 ppb) and up to 345,000 ppb of total VOCs (SCGs for most VOCs = 5 ppb). Sampling results from bedrock well BR-3 in this area have ranged up to 6,500,000 ppb of total chloropyridines and 600,000 ppb of total VOCs. Total contaminant concentrations are significantly lower in deep bedrock wells than in adjacent shallow bedrock wells.

In the Pretreatment Plant Area, bedrock well, PZ-106 has shown significant and persistent levels of VOCs (up to 1,000,000 ppb; largely carbon tetrachloride, chloroform, and carbon disulfide) and chloropyridines (up to 110,000 ppb). These results suggest the presence of a DNAPL source in the subsurface of this area. Other wells in this vicinity, such as overburden wells E-1 and S-3, have shown elevated (above historic means) concentrations (greater than 20,000 ppb total chloropyridines and VOCs) in recent sampling events.

At the Lab/Off-spec Waste Disposal Area, a direct-push groundwater sample detected 260,000 ppb of carbon tetrachloride and 80,000 ppb of chloroform (SCGs = 5 ppb). Given that other borings in the vicinity yielded much lower results and much of this former disposal area was reportedly excavated during construction of the plant boiler room, this problem may be somewhat localized.

In the area of PW-12, a somewhat different suite of contaminants (largely VOCs, such as toluene, xylene, benzene, chlorobenzene, chloroform, and methylene chloride), somewhat removed from the main manufacturing plant, is indicative of a separate source area. Well BR-101 was converted to a pumping well in 1999 to help address this problem.

Regarding inorganics, concentrations in groundwater are higher in the overburden than in the bedrock perhaps due to near surface contamination as well as high turbidity (suspended solids) in unfiltered overburden samples. Maximum inorganic concentrations were generally detected in wells showing high site-related organic contaminant concentrations. Some of the inorganics detected in the groundwater are believed to be naturally occurring elements, such as calcium and magnesium, but metals, such as mercury and zinc, appear site-related.

Offsite, west of the main source area, monitoring well cluster 106 has shown persistently elevated levels of chloropyridines (10,000 to 20,000 ppb; see Figure 9) and a perimeter pumping well is proposed to contain this contamination. VOCs, on the other hand, generally diminish to low levels in offsite wells (Figure 10). Further afield, chloropyridines show significant offsite migration in bedrock in a general southwest direction and terminating in the Gates Dolomite quarry. While overall contaminant migration offsite appears controlled by dewatering operations at the quarry, groundwater flow near the site has shown considerable variation in direction. For example, chloropyridines have been detected (160 ppb) in a bedrock monitoring well at the General Circuits site east of the Arch/Olin plant. The annual filling and emptying of the Erie Canal appears to affect groundwater flow in areas proximal to the Canal. For example, the relatively rapid filling of the Canal in the spring (April/May) causes rapid increases in bedrock groundwater levels adjacent to the Canal and likely a temporary reversal of flow eastward toward the site from the Canal.

Regarding contaminant trends over time (see Tables 3 and 4), a number of wells have shown significant decreases in contamination since completion of the RI in the mid-1990s (e.g., bedrock wells, BR-102, 103, 104). However, a number of other wells show steady or increasing concentrations (e.g., PZ-106, E-1, S-3 near the pretreatment building and offsite wells, MW-106, BR-106 and BR-105D).

Surface Water

Chloropyridines have been detected in samples from the Gates Dolomite quarry seeps, the quarry ponds, the quarry discharge channel along I-390, the quarry discharge point at the Erie Canal, and the Erie Canal. As discussed below, the highest concentrations are present at the groundwater discharge point in the quarry and lowest concentrations are present in the Canal.

As discussed in Section 4.1.1 above, significant groundwater discharge (small waterfalls, in places) is evident along a bedding-plane fracture in the east wall of the Gates Dolomite quarry. Sampling along this seep has shown total chloropyridine concentrations of up to 4900 ppb at the southeastern corner of the quarry. Samples from the two dewatering ponds in the SE corner of quarry, which collect groundwater, precipitation, and runoff from the whole quarry have ranged up to about 700 ppb (see Figure 11).

From the dewatering collection ponds, water is pumped up to a surface drainage channel which drains eastward to a roadside drainage channel along I-390, thence southward to a culvert, thence eastward under I-390 just north of Chili Avenue to a concrete outfall at the Erie Canal (see Figure 1). The quarry ponds are pumped at up to 2000 gallons per minute for several hours per day during times of high precipitation and average 700,000 gallons per day. The quarry acts as a very large collector well (roughly 2000 feet by 1000 feet by 100 feet deep) which influences groundwater over a considerable area. The quarry discharge, which has ranged up to about 200 ppb of chloropyridines at the Erie Canal outfall, is evidently the main source of the chloropyridine contamination in the Canal. Some contaminant input to the Canal is also likely from direct groundwater discharge from shallow bedrock near the plant but groundwater and surface water sampling suggests that this source is not significant.

Sampling of Erie Canal surface water has shown chloropyridines ranging from single-digit ppb in the summer to double-digit ppb (30-50 ppb) in the winter. Chloropyridines have been detected in the Canal as far north as Gillette Road (about 8 miles from the quarry discharge; sampling point SW-12) and south to Scottsville Road (about 2 miles from the quarry discharge; sampling point SW-6; see Figure 12). The low-water stage in the winter (the Canal is drained in late November) provides less dilution and appears to induce northward flow (higher head from the Genesee River locks). Flow appears to reverse when the Canal is filled in May for the navigation season.

Note: Chloropyridine concentrations have declined significantly at most surface water sampling locations since sampling commenced in 1995. For example, recent quarterly sampling results from the main quarry seep have leveled off at about 500 to 1000 parts per billion (ppb) total chloropyridines (down from a peak of about 5000 ppb). Likewise, Canal surface water sampling results have declined from up to 45 ppb to low single-digit ppb (typically 2-3 ppb of 2-chloropyridine) in winter with similar or lower levels in summer. These declines in chloropyridine concentrations may reflect more effective hydraulic control (increased pump rates and additional pumping wells) at the plant site.

4.2: <u>Summary of Human Exposure Pathways</u>:

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 health risks can be found in Section 4.0 of the Phase II RI report.

An exposure pathway is the manner by which an individual may come in contact with a contaminant. The five elements of an exposure pathway are 1) the source of contamination; 2) the environmental media and transport mechanisms; 3) the point of exposure; 4) the route of exposure; and 5) the receptor population. These elements of an exposure pathway may be based on past, present, or future events.

Pathways which are known to or may exist at the site include:

- direct contact with contaminated soils and groundwater;
- inhalation of contaminated dust from the site;
- inhalation of VOCs from contaminated groundwater and soils;
- direct contact with offsite surface water (quarry seeps, ponds, discharge channel, and the Erie Canal); and
- possible future ingestion/use of onsite or offsite groundwater.

Several factors currently exist which tend to reduce the potential for significant exposure to site contamination. Onsite, Arch maintains worker health and safety policies (e.g., personal protection and monitoring equipment) for intrusive activities which reduce the potential for direct contact and inhalation of site contaminants. Existing access controls (e.g., fencing and signs around the plant) reduce exposure potential for non-workers. Regarding possible dust generation and migration, the main source area is paved and largely surrounded by facilities reducing the potential for exposure.

Offsite, the Gates Dolomite quarry owners (Dolomite Products Company) were advised of the contamination in the quarry when discovered in 1995 and receive copies of the quarterly sampling results reducing the potential for worker exposure. The potential for direct contact by the general public with the quarry discharge waters in the quarry discharge channel is low since it parallels I-390 (fenced interstate) for much of its course. As noted above in Section 4.1.3, chloropyridine concentrations in surface waters have decreased significantly over the last few years. Once in the Canal, dilution and dispersion of the discharge further reduce the concentrations and hence minimize risks to recreational users. Higher concentrations have been noted in the winter, presumably due to less dilution from drainage of the Canal, when recreational use and potential exposure is minimal. The Supplemental Human Health Risk Evaluation in the Phase II RI report concluded that the contaminant concentrations detected in the Canal do not pose a human health concern.

As discussed below in Section 8, the selected remedy includes a number of additional controls which will further reduce the potential for exposure to site contaminants.

4.3: <u>Summary of Environmental Exposure Pathways</u>

This section summarizes the types of environmental exposures and ecological risks which may be presented by the site. The Ecological Risk Assessment (ERA) included in the Phase II RI presents a more detailed discussion of the potential impacts from the site to fish and wildlife resources.

No significant environmental resources (i.e., creeks, wetlands, habitats) were identified onsite. As noted above, contaminated quarry discharge waters are discharged to the Erie Canal. While fairly widespread, the relatively low concentrations of chloropyridines and relatively low partitioning coefficients (low bioconcentration potential) minimize environmental exposure and the risk of any adverse impacts. The ERA noted that the concentrations of the Canal surface water contaminants were lower than all toxicity benchmarks for aquatic receptors. Consequently, no adverse impacts to these receptors would be anticipated. Likewise, food chain-related exposures by semi-aquatic receptors were evaluated using bioconcentration factors to estimate fish tissue concentrations. Due to the low contaminant concentrations coupled with low potential uptake, bioconcentration hazards to semi-aquatic wildlife are considered insignificant.

SECTION 5: <u>ENFORCEMENT STATUS</u>

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 NYSDEC and Olin Corporation (now Arch Chemicals, Inc.) entered into a Consent Order on August 23, 1993. The Order obligates the responsible parties to implement a Remedial Investigation/Feasibility Study. Upon issuance of the Record of Decision, the NYSDEC will approach the PRPs to implement the selected remedy under an Order on Consent.

The following is the chronological enforcement history of this site.

Date: May 4, 1987
Index No. C8-0003-85-06
Subject of Order: Bedrock Groundwater Investigation

Date: August 23, 1993
Index No. B8-0343-90-08
Subject of Order: Remedial Investigation/ Feasibility Study

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 375-1.10. The overall remedial goal is to meet all standards, criteria, and guidance (SCGs) and be protective of human health and the environment. 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 goals selected for this Operable Unit are:

- *Eliminate, to the extent practicable, offsite migration of groundwater above NYSDEC Class GA Ambient Water Quality Criteria;*

- *Eliminate, to the extent practicable, human exposure to contaminated surface water at the Gates Dolomite quarry, the quarry discharge channel, and the Erie Canal;*

- *Restore, to the extent practicable, offsite groundwater to NYSDEC Class GA Ambient Water Quality Criteria;*

- *Eliminate, to the extent practicable, potential human exposure associated with possible future use of contaminated groundwater;*

- *Eliminate, to the extent practicable, exceedances of applicable environmental quality standards related to releases of contaminants to the waters of the state; and*

- *Eliminate, to the extent practicable, the exposure of fish and wildlife to levels of chloropyridines above standards/guidance values.*

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 laws and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the Arch/Olin site were identified, screened and evaluated in the report entitled Feasibility Study Report (January 2000). As noted above, this remedy (OU-2) addresses contaminated groundwater as well as surface waters impacted by contaminated groundwater at and near the site. A separate PRAP (OU-1) will address waste disposal areas and contaminated soils/bedrock onsite.

A summary of the detailed analysis follows. As presented below, the time to implement reflects only the time required to implement the remedy, and does not include the time required to design the remedy, procure contracts for design and construction or to negotiate with responsible parties for implementation of the remedy. Cost estimates assume a 5% interest rate and a 30-year operation and maintenance (O&M) period.

7.1: <u>Description of Remedial Alternatives</u>

<u>Alternative No. 1 – No Action</u>

Present Worth: . . . . *none*
Capital Cost: . . . . *none*
Annual O&M: . . . . *none*
Time to Implement: . . . . *none*

The No Action alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative would leave the site in an unremediated condition (existing groundwater extraction and treatment system and monitoring would cease) and it would not provide any additional protection to human health or the environment.

<u>Alternative No. 2 – Groundwater Extraction, Treatment, POTW Discharge, Institutional Controls, Monitoring, and Natural Attenuation</u>

Present Worth: . . . . *$ 5,760,000*
Capital Cost: . . . . *$ 28,000*
Annual O&M: . . . . *$ 373,000*
Time to Implement: . . . . *6 months*

This alternative would include:

- continued operation and maintenance of the existing groundwater extraction and treatment system;
- continued groundwater and surface water monitoring;
- continued adherence to the plant's health and safety policies for any intrusive activities at the site;
- annual notification of all property owners within the area of the offsite contaminant plume;
- deed restrictions on future property use and onsite groundwater use including annual certifications by the site owner that the deed restrictions are in effect and that annual notifications were completed for property owners within the offsite area of groundwater contamination; and
- natural attenuation of contaminated groundwater onsite and offsite (natural processes, such as, biodegradation, volatilization, and sorption which help to reduce/attenuate contamination).

Deed restrictions would limit the future use of the property to activities and uses that would not result in unacceptable exposure risks. The exact form and content of the deed restrictions would be developed by Arch in consultation and with the approval of NYSDEC and NYSDOH (would include restrictions on future use of the site to only industrial or commercial purposes as well as on use of onsite groundwater and annual certifications of the same). Additionally, the Town of Gates and all property owners within the offsite plume area would be notified annually of the presence of contaminated groundwater and its use would be discouraged (given the availability of public water and the poor natural groundwater quality, potable use of groundwater is unlikely).

Alternative No. 3 - Enhanced Groundwater Extraction (onsite and offsite at quarry boundary), Treatment, POTW Discharge, Institutional Controls, Monitoring, and Natural Attenuation

Present Worth: *$7,373,000*
Capital Cost: . . . . *$ 380,000*
Annual O&M: . . . . *$ 455,000*
Time to Implement: . . . . *6 months - 1 year*

This alternative would include all of the components of Alternative No. 2 plus installation and operation of:

- an overburden groundwater interceptor trench on the southeast/south perimeter of the plant property (see Figure 9);
- downgradient/offsite groundwater monitoring wells in overburden and bedrock near the interceptor trench;
- a bedrock pumping well on the western site perimeter between PW-11 and PW-7 (see Figure 9); and
- an offsite bedrock pumping well adjacent to the southeast corner of the Gates Dolomite quarry (see Figure 8).

These additional groundwater recovery measures would fill known gaps in the existing extraction system and add interception and treatment of the offsite contaminant plume before entering the quarry. By controlling and treating the plume before discharge to the quarry, potential exposures to contaminated groundwater within the quarry and its subsequent discharge to the Erie Canal via a surface water discharge channel would be mitigated. Quarry discharges to surface waters would meet the applicable discharge limits.

Alternative No. 4 – Dual-phase Extraction (Source Areas), Enhanced Groundwater Extraction (onsite and offsite at quarry boundary), Treatment, POTW Discharge, Institutional Controls, Monitoring, and Natural Attenuation

Present Worth: *$7,634,000*
Capital Cost: . . . . *$ 410,000*
Annual O&M: . . . . *$ 470,000*
Time to Implement: . . . . *6 months - 1 year*

This alternative includes all components of Alternative No. 3 but adds dual-phase extraction at the source-area pumping wells (PW10 and PW12) to provide for increased contaminant mass removal. The addition of vapor phase extraction to groundwater extraction can increase mass removal and decrease remediation time frames given proper site conditions and volatile contaminants. Limited pilot testing of this technology at PW-12 showed little benefit (additional mass removal was minimal) perhaps due to the prevalence of chloropyridines (contaminants of relatively low volatility) in the area tested.

7.2 Evaluation of Remedial Alternatives

The criteria used to compare the potential remedial alternatives are defined in the regulation that directs the remediation of inactive hazardous waste sites in New York State (6 NYCRR Part 375). For each of the criteria, a brief description is provided, followed by an evaluation of the alternatives against that criterion. A detailed discussion of the evaluation criteria and comparative analysis is included in the Feasibility Study.

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

1. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether or not a remedy will meet applicable environmental laws, regulations, standards, and guidance. Since groundwater is the focus of this Remedy (OU-2), the most significant SCGs are groundwater standards as defined in 6NYCRR Part 703 (Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations) and NYSDEC TOGS 1.1.1. (Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations).

Alternative No. 1 would not comply with SCGs and does not meet this threshold requirement. Alternative No. 2 would not be expected to achieve SCGs for offsite groundwater due to incomplete hydraulic control at the site perimeter. The enhanced groundwater extraction systems of Alternatives No. 3 and No. 4 would allow for achievement of SCGs offsite through hydraulic control of contaminants at the site perimeter coupled with migration and capture of the existing offsite contaminant plume at the quarry perimeter and through natural attenuation processes. Onsite, groundwater would continue to exceed SCGs until contaminants in soil and bedrock (such as residual DNAPL at source areas) are gradually removed through groundwater partitioning and subsequent extraction. The timeframe would be indefinite without active remediation of contaminated soils and bedrock (this issue will be the subject of a future PRAP - OU-1).

2. 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.

Alternative No. 1 does not provide adequate protection to human health and the environment since no remedial action would be conducted and therefore does not meet this threshold criterion. Likewise, Alternatives No. 2 does not prevent potential exposures to contaminated groundwater at the quarry or its discharge. The additional groundwater control measures of Alternatives No. 3 and No. 4 would be protective of human health and the environment.

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.

Alternatives No. 1 and No. 2 do not include any additional remedial actions, therefore, short-term impacts to workers, the community, and the environment are not an issue. Alternatives No. 3 and No. 4 involve limited construction/drilling activities with short-term exposure risks to construction workers which would be mitigated through proper worker safety procedures. Alternatives No. 1 and No. 2 would not achieve remedial objectives within a reasonable timeframe whereas Alternatives No. 3 and No. 4 would be expected to achieve remedial objectives over a period of several years.

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 controls intended to limit the risk, and 3) the reliability of these controls.

Alternative No. 1 would not provide containment or treatment of contaminated groundwater while Alternative No. 2 would not fully contain contamination; neither alternative would be effective long-term. Alternatives No. 3 and No. 4 would be effective in the long-term given appropriate O&M. Groundwater treatment with granular activated carbon would allow capture and recycling of chemicals during offsite carbon regeneration. Additionally, Alternative No. 4 would include dual-phase extraction at source-area wells with the goal of accelerating mass removal of site-related contaminants. Pilot test data indicate, however, that the technology would result in a negligible increase in mass removal rates. Wastes would remain in the subsurface after the selected remedy has been implemented but these disposal areas comprise OU-1 and will be addressed under a future PRAP. In the interim, adequate and reliable controls exist (the plant's health and safety policies for intrusive activities) and would be implemented (deed restrictions) to mitigate potential exposure to contaminated soils or groundwater.

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.

Alternative No. 1 would not provide any reduction in toxicity, mobility, or volume of contaminated groundwater. Alternative No. 2 would result in some reduction of contaminant volume and mobility but would allow some offsite contaminant migration. Alternatives No. 3 and No. 4 would reduce the mobility of contaminated groundwater by establishing hydraulic control of groundwater at the plant boundary, reduce the volume of contaminants through irreversible treatment via carbon absorption, and reduce the toxicity by contaminant destruction during carbon regeneration.

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

Implementability would not be a significant issue with any of the alternatives. Institutional controls would not present any undue difficulties. All of the technologies (e.g., well drilling/pumping, trench construction, dual-phase extraction) are well-established and could be readily implemented. Some coordination with other property owners (i.e., Gates Dolomite quarry) for site access and facility shed space would be required for Alternatives No. 3 and No. 4.

7. Cost. Capital and operation and maintenance costs are estimated for each alternative and compared on a present worth basis. Although cost is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the remaining criteria, cost effectiveness can be used as the basis for the final decision. The costs for each alternative are presented in Table 2.

Alternatives No. 3 and No. 4 would meet all of the preceding criteria and are similar in cost ($7.37 million vs. $7.63 million). As noted above, a dual-phase extraction pilot test did not appear to increase the mass removal rate to any significant degree. Therefore, the extra $250,000 for this technology in Alternative No. 4 would not appear to be justified.

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. Community Acceptance - Concerns of the community regarding the RI/FS reports and the Proposed Remedial Action Plan have been evaluated. The "Responsiveness Summary" included as Appendix A presents the public comments received and the Department's response to the concerns raised. No significant public comments were received.

SECTION 8: SUMMARY OF THE SELECTED REMEDY

Based on the results of the RI/FS, and the evaluation presented in Section 7, the NYSDEC is selecting Alternative No. 3 (Enhanced Groundwater Extraction and Treatment, Institutional Controls, Monitoring, and Natural Attenuation) as the remedy for this site. This remedy will address the significant threats posed by contaminated groundwater through hydraulic control at the site and quarry perimeters. The existing groundwater extraction and treatment system will be enhanced with the addition of an interceptor trench on the southeast/south site perimeter, an additional bedrock pumping well on the west site perimeter, and a bedrock pumping well at the southeast edge of the Gates Dolomite quarry. These additional groundwater recovery measures will fill known gaps in the existing extraction system onsite and add interception and treatment of the offsite contaminant plume before entering the quarry. By controlling and treating the plume before discharge to the quarry, potential exposures to contaminated groundwater within the quarry and its subsequent discharge to the Erie Canal via a surface water discharge channel will be mitigated (quarry discharges to surface waters would be subject to the applicable discharge limits). Natural attenuation processes, such as degradation and sorption will also act to reduce contaminant concentrations in groundwater.

In addition, existing and proposed institutional controls will minimize the risks of exposure to contaminated groundwater and soil onsite. Long-term protection will be provided by deed restrictions on future use as industrial/commercial and prohibition on use of groundwater beneath the site. Offsite, potential use of groundwater will be mitigated by annual notification of property owners within the offsite area of groundwater contamination, the existing prohibition on use of groundwater in the City of Rochester, and the existing requirement for public water in new housing subdivisions in the Town of Gates, and the general availability of public water.

This selection is based on the evaluation of the four alternatives developed for this site. Only Alternatives No. 3 and No. 4 meet all of the evaluation criteria. The difference between these two alternatives is the addition of dual-phase extraction to Alternative No. 4 at an additional cost of $250,000. Pilot testing of a dual-phase extraction system at source area pumping well PW-10 did not increase the contaminant mass removal rate to any significant degree. Therefore, this extra expense does not appear justified and accordingly, Alternative No. 3 is the selected remedy.

The estimated present worth cost to implement the remedy is $7.37 million. The cost to construct the remedy is estimated to be $380,000 and the estimated average annual operation and maintenance cost for 30 years is $455,000.

The elements of the remedy are as follows:

- A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation and maintenance, and monitoring of the remedial program;

- Continued operation and maintenance of the existing groundwater extraction and treatment (granular activated carbon) system;
- Installation and operation of an overburden groundwater interceptor trench along the southeast/south perimeter of the plant property;
- Installation and sampling of downgradient/offsite groundwater monitoring wells in overburden and bedrock near the interceptor trench;
- Installation and operation of a bedrock pumping well on the western site perimeter between PW-11 and PW-7;
- Installation and operation of an offsite bedrock pumping well adjacent to the southeast corner of the Gates Dolomite quarry (located about 4000 feet southwest of the site);
- Determination and application of SPDES discharge limits for quarry discharge water;
- Continued adherence to the plant's health and safety policies for any intrusive activities at the site;
- Annual notification of property owners within the offsite area of groundwater contamination;
- Deed restrictions on future use as industrial/commercial and prohibition on use of groundwater beneath the site. The site owner will annually certify that the deed restrictions are in effect and that the annual notifications of property owners within the offsite area of groundwater contamination were completed;
- Natural attenuation of the existing offsite plume which will gradually reduce contaminant concentrations in groundwater;
- Implementation of a long-term monitoring program since untreated hazardous waste remain at the site. An extensive array of onsite and offsite monitoring wells are currently monitored for contaminant concentrations and groundwater elevations and this program will be expanded to include wells proposed herein. Assessment of trends in contaminant concentrations and groundwater levels over time will help to confirm interception of contaminants at the site perimeter. Thus, this program will allow the effectiveness of the groundwater extraction/hydraulic control system to be monitored (and optimized and/or enhanced, if necessary) and will be a component of the operation and maintenance for the site; and
- The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible.

SECTION 9: HIGHLIGHTS OF COMMUNITY PARTICIPATION

As part of the remedial investigation process, a number of Citizen Participation activities were undertaken in an effort to inform and educate the public about conditions at the site and the potential remedial alternatives. The following public participation activities were conducted for the site:

- A repository for documents pertaining to the site was established.
- A site mailing list was established which included nearby property owners, local political officials, local media and other interested parties.
- In April 1993, a fact sheet was issued which described site history, the start of the Remedial Investigation (RI), and the availability of the Citizen Participation Plan.
- In March 1995, a fact sheet was issued and a public meeting was held with presentations on Phase I RI results by NYSDEC and Olin.
- In December 1996, a fact sheet was issued which described the ongoing offsite groundwater investigation and the discovery of chloropyridine contamination in the Dolomite Products quarry in Gates and the Erie Canal.
- 1993-2002 - The community outreach program of Arch and, prior to 1999, Olin has issued periodic newsletters and established a Citizen Advisory Panel (one member is an employee of the Monroe County Health Department) which meets regularly.
- In February 2002, a fact sheet and public meeting announcement was issued for the PRAP for groundwater contamination (Operable Unit - 2).
- On March 18, 2002, a public meeting was held to present the PRAP to interested parties.
- In March 2002, a Responsiveness Summary was prepared to address the comments received during the PRAP public comment period and incorporated into this document as Appendix A.

Table 1

Nature and Extent of Contamination

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCGs/Background	SCG/ Bkgd. (ppb)
Groundwater	Volatile Organic Compounds (VOCs)	Carbon Tetrachloride	ND to 620,000	42 of 60	5
		Chloroform	ND to 320,000	40 of 60	7
		Methylene Chloride	ND to 78,000	32 of 60	5
		Tetrachloroethene	ND to 2,000	24 of 60	5
		Trichloroethene	ND to 1,000	15 of 60	5
	Semivolatile Organic Compounds (SVOCs)	2-Chloropyridine	ND to 400,000	52 of 60	50
		3-Chloropyridine	ND to 19,000	39 of 60	50
		4-Chloropyridine	ND to 1,300	12 of 60	50
		2,6-Chloropyridine	ND to 44,000	48 of 60	50
Surface Water	Semivolatile Organic Compounds (SVOCs)	2-Chloropyridine	0.0001 to 4.7	20 of 48	
		3-Chloropyridine	0.001 to 0.12	12 of 48	
		2,6-Chloropyridine	0.0003 to 1.0	18 of 48	
MEDIUM	**CATEGORY**	**CONTAMINANT OF CONCERN**	**CONCENTRATION RANGE (ppm)**	**FREQUENCY of EXCEEDING SCGs/Background**	**SCG/ Bkgd. (ppm)**
Soils	VOCs	Carbon Tetrachloride	ND to 4200	12 of 55	0.6
		Chloroform	ND to 380	8 of 55	0.3
		Methylene Chloride	ND to 2.8	4 of 55	0.1
		Tetrachloroethene	ND to 520	6 of 55	1.4
		Trichloroethene	ND to 73	3 of 55	0.7

Table 1 (Continued)

Nature and Extent of Contamination

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppm)	FREQUENCY of EXCEEDING SCGs/Background	SCG/ Bkgd. (ppm)
Soil	SVOCs	2-Chloropyridine	ND to 300	21 of 55	0.9
		3-Chloropyridine	ND to 34	18 of 55	0.8
		4-Chloropyridine	ND to 1100	17 of 55	
		2,6-Chloropyridine	ND to 170	24 of 55	
		Trichloroethene	ND to 73	3 of 55	0.7
Soils	Metals	Mercury	0.04 to 214	12 of 18	0.1
		Chromium	5 to 180	6 of 18	10
		Zinc	24 to 640	18 of 18	20
		Lead	5 to 530	2 of 18	400
		Arsenic	1.7 to 12	3 of 18	7.5

ND = Not Detected

ppb = parts per billion

ppm = parts per million

SCGs = Standards, Criteria, and Guidance (empty box indicates no SCG established)

(Note: This table summarizes the major contaminants of concern; a number of site contaminants are not listed above.**)**

Table 2

Remedial Alternative Costs

Remedial Alternative	Capital Cost	Annual O&M	Total Present Worth
No. 1 - No Action	$0	$0	$0
No. 2 - Existing Groundwater Extraction System, Institutional Controls, Monitoring	$ 28,000	$ 373,000	$ 5,760,000
No. 3 - Enhanced Groundwater Extraction System, Institutional Controls, and Monitoring	$ 380,000	$ 455,000	$7,373,000
No. 4 - Dual-Phase Extraction, Enhanced Groundwater Extraction System, Institutional Controls, and Monitoring	$ 410,000	$ 470,000	$7,634,000

(Note: Present Worth Calculations assume a 5% discount rate)

APPENDIX B

Administrative Record

Arch Chemicals, Inc. (formerly Olin Corporation)
City of Rochester, Monroe County, New York
Site No. 828018A

REPORTS:

1. Hydrogeological Investigation at Olin - Rochester Plant (September 1982)

2. Update Report (November 1985)

3. Groundwater Investigation - Olin Chemicals Group - Rochester Plant Site (September 1990)

4. Phase I Remedial Investigation (RI) Report (August 1995)

5. Phase II RI Report (May 1996)

6. Phase II RI Report Addendum (June 1996)

7. Supplemental Human Health Risk Evaluation (November 1996)

8. Final Phase II RI Report (October 1997)

9. Quarterly RI/FS Progress Reports (1993 - 2002)

10. Feasibility Study Report (January 2000)

11. Proposed Remedial Action Plan for OU - 2 (February 2002)

LEGAL AGREEMENTS:

Subject of Order:	Bedrock Groundwater Investigation (Index No. C8-0003-85-06)
Date:	May 4, 1987
Subject of Order:	Remedial Investigation/ Feasibility Study (Index No. B8-0343-90-08)
Date:	August 23, 1993

APPENDIX A

RESPONSIVENESS SUMMARY

Arch Chemicals, Inc. (formerly Olin Corporation)
Proposed Remedial Action Plan (OU -2)
City of Rochester, Monroe County, New York
Site No. 828018A

The Proposed Remedial Action Plan (PRAP) for the Arch Chemicals site, was prepared by the New York State Department of Environmental Conservation (NYSDEC) and issued to the local document repository on February 26, 2002. This Plan outlined the preferred remedial alternative proposed for the remediation of contaminated groundwater (OU - 2) at and near the Arch Chemicals site. The selected remedy is:

- Onsite Groundwater - Groundwater Pumping/Hydraulic Control, Treatment, Discharge to Publicly-Owned Treatment Works (POTW), Institutional Controls, and Long-term Monitoring.

- Offsite Groundwater - Groundwater Pumping at the Quarry Boundary, Treatment if Necessary to Meet Discharge Criteria, Natural Attenuation, Groundwater Notifications, and Long-term Monitoring.

The release of the PRAP was announced via a notice to the mailing list, informing the public of the PRAP's availability.

A public meeting was held on March 18, 2002 which included a presentation of the Remedial Investigation (RI) and the Feasibility Study (FS) as well as a discussion of the proposed remedy. The meeting provided an opportunity for citizens to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. The public comment period for the PRAP ended on March 27, 2002.

This Responsiveness Summary responds to all questions and comments raised at the March 18, 2002 public meeting as well as all written comments received during the public comment period.

The following are the comments received at the public meeting, with the NYSDEC's responses:

COMMENT #1: Arch should be commended for their efforts to investigate and remediate this problem.

RESPONSE #1: Comment noted; the NYSDEC acknowledges and appreciates the company's cooperation and efforts to date.

COMMENT #2: What is NAPL?

RESPONSE #2: NAPL stands for Non-Aqueous Phase Liquids which are organic liquids with low solubilities in water. As such, these liquids form separate phases (don't mix) in water. NAPL lighter than water (LNAPL, such as oil and gasoline), float and NAPL denser than water (DNAPL, such as chlorinated solvents, like trichloroethene and carbon tetrachloride), sink in water. When released to the subsurface, NAPL can migrate rapidly through pore spaces in soil and rock and form very long-term sources of groundwater contamination. Based on significant and persistent groundwater contamination, the occasional observation of NAPL in wells, and the considerable contaminant mass removed by pumping annually (>1000 pounds), considerable NAPL must exist in source areas beneath the Arch site. These source areas will be addressed in a future PRAP as Operable Unit No. 1. Complex distributions of NAPL in the subsurface can greatly complicate cleanup efforts.

The following is the sole written comment received with the NYSDEC response:

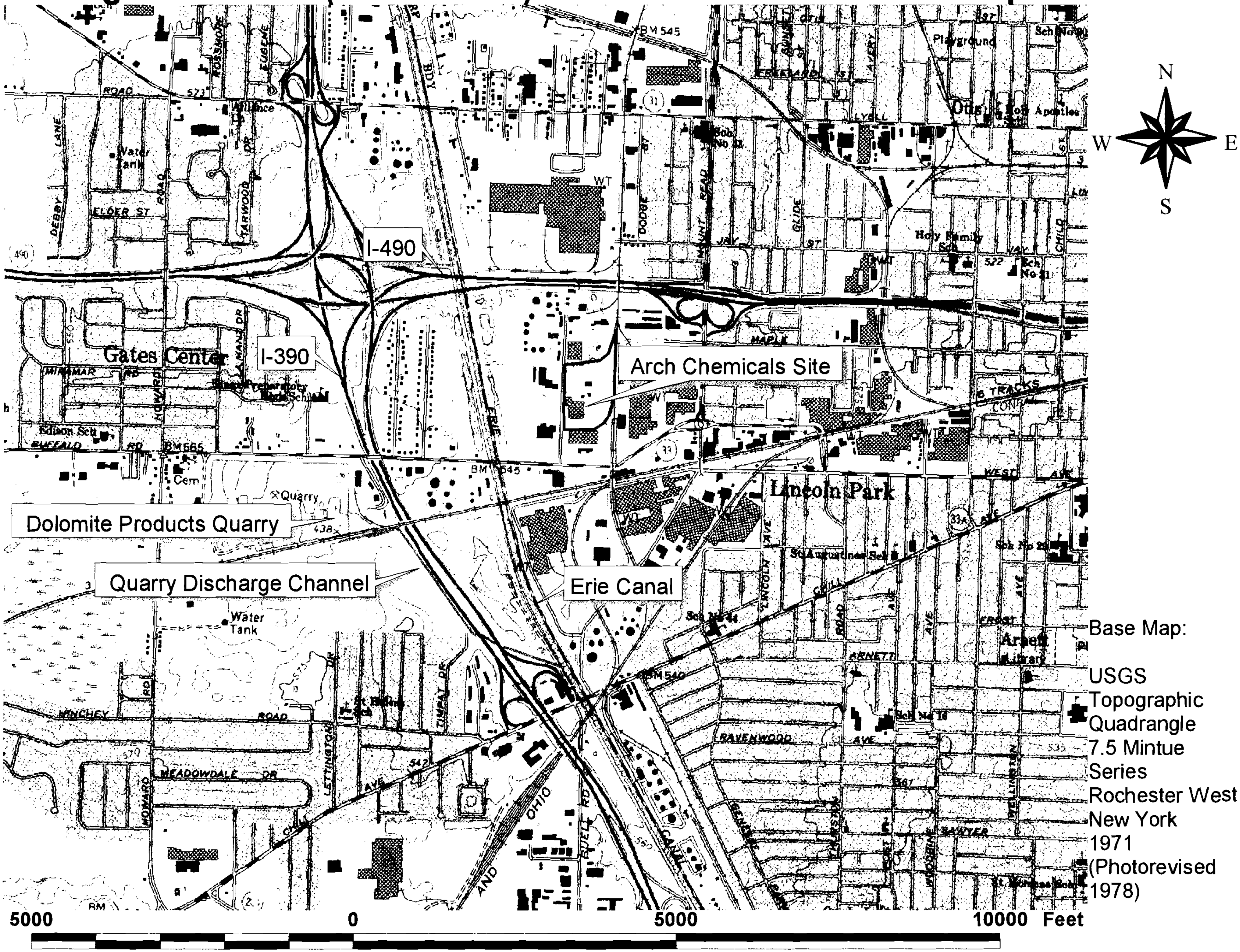
COMMENT #3: We are next door neighbors to Arch Chemicals at 58 McKee Road. I am writing to comment on the proposed remedy for Operable Unit No. 2 (groundwater contamination). We have no objection to the proposed Remedial Plan, provided it ensures the health and safety of our employees, and will continue to reduce contaminant levels on our property.

However, we are concerned that the remedy for Operable Unit No. 1 - Soil and Bedrock Contamination - has been postponed. As you know, the real goal of the State's Superfund program is to achieve "pre-disposal conditions." 6 N.Y.C.R.R. §375-1.10(b). We urge the Department to proceed expeditiously with requiring source treatment or removal in order to achieve a permanent cleanup, and stop the generation of further groundwater contaminants.

RESPONSE #3: The Department agrees that source remediation is necessary in order to achieve a permanent cleanup. The problem at Arch and at hundreds of similar sites state- and nation-wide has been locating and treating/removing source contamination (DNAPL) deep in the subsurface. The situation at Arch is further complicated by the location of the main source area beneath the main plant and associated pipe networks and structures (see figure 2) and the properties of the main contaminants, chloropyridines (low volatility and resistance to chemical oxidation and biological degradation). Treatability studies conducted during the FS showed low effectiveness for the potential remedial techniques: vacuum extraction and insitu chemical oxidation.

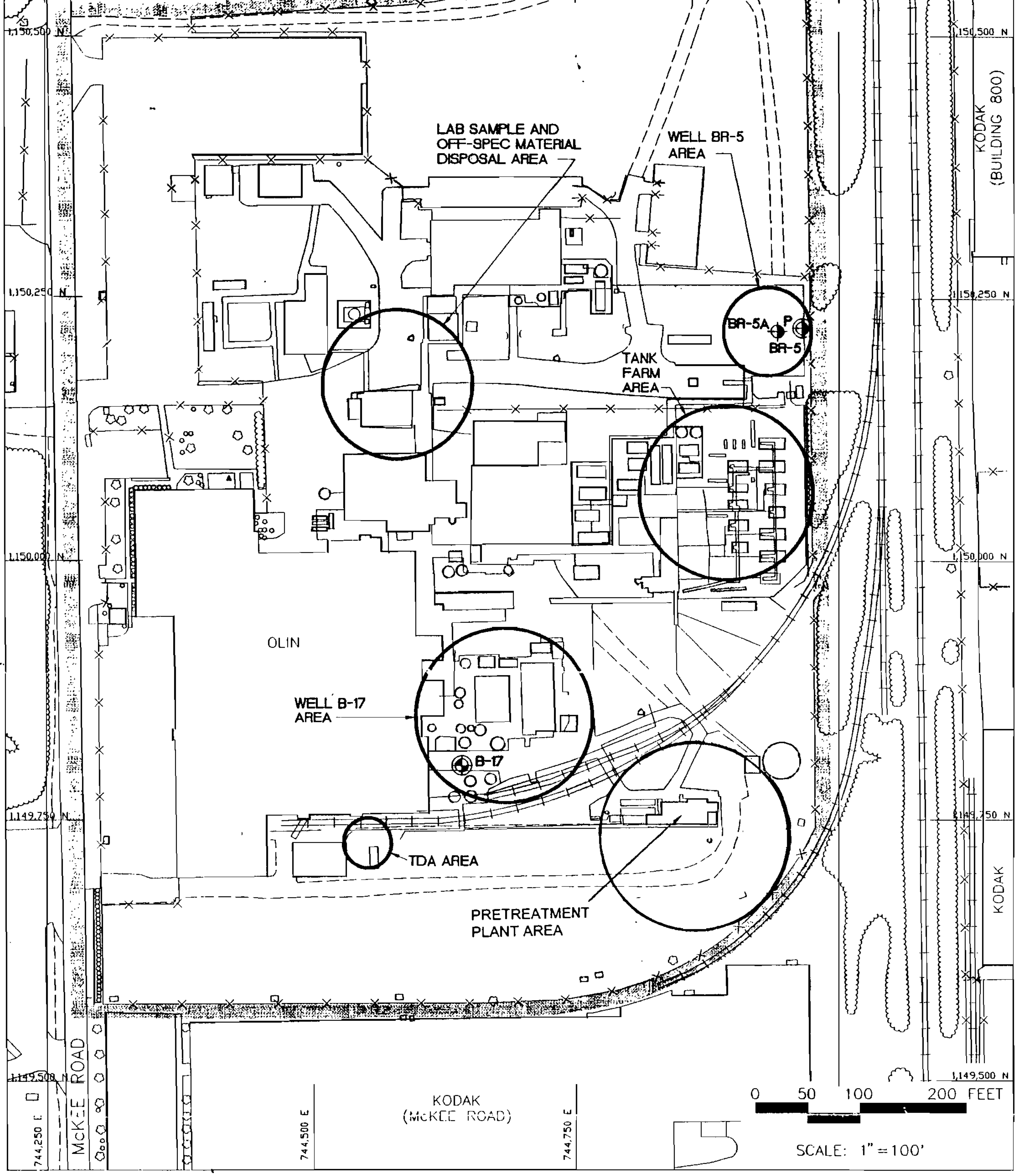
As noted above in Response #2 and in the Contaminant Fate and Transport section on page 7, DNAPL presents very persistent sources of contaminants to groundwater and significant technical challenges for effective remediation. For example, a significant proportion of the DNAPL mass may have diffused into the bedrock matrix where it cannot be readily extracted. While emerging technologies are evaluated to deal with this difficult problem (such as thermally-enhanced vacuum extraction), the current groundwater extraction and treatment system and the enhancements of this remedy (OU-2; groundwater interceptor trench and additional bedrock pumping wells) will gradually remove contaminant mass from source areas via dissolution into groundwater and subsequent capture by the extraction wells. Despite the additional time required to further assess potential remedies for source areas (OU-1), the selected remedy is protective of public health and the environment.

Figure 1 - Arch (former Olin) Chemicals Site Location Map



Base Map:

USGS Topographic Quadrangle 7.5 Mintue Series Rochester West New York 1971 (Photorevised 1978)



LEGEND

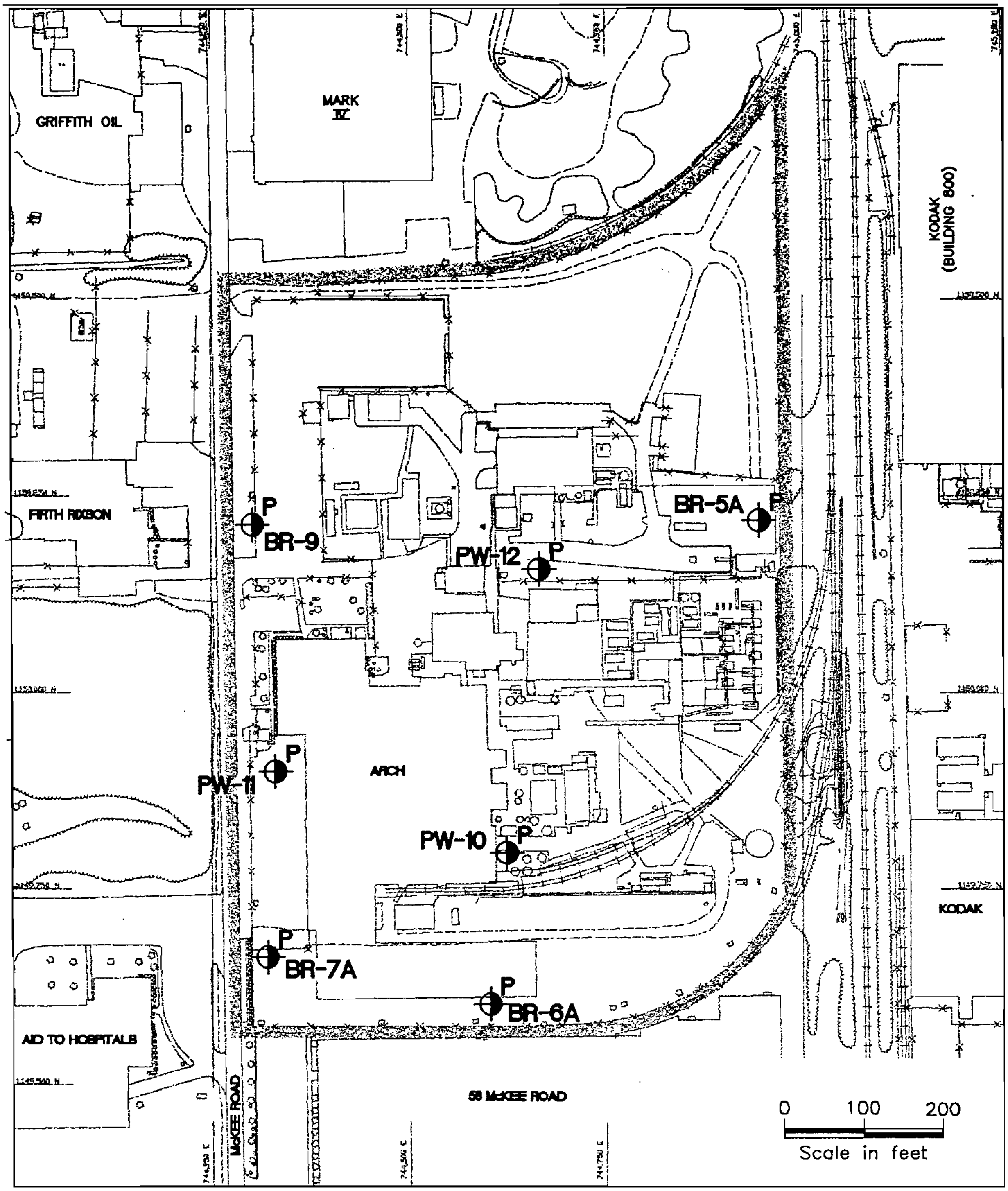
- OUTLINE OF OLIN PROPERTY BOUNDARY
- OVERBURDEN MONITORING WELL
- BEDROCK MONITORING WELL
- BEDROCK PUMPING WELL

FIGURE 2

LOCATION OF IDENTIFIED AND POTENTIAL CONTAMINANT SOURCE AREAS

OLIN CHEMICALS
PHASE I RI REPORT
ROCHESTER, N.Y.

J:\47980\47980009.DWG 12/23/99



LEGEND

BEDROCK PUMPING WELL

OUTLINE OF ARCH PROPERTY BOUNDARY

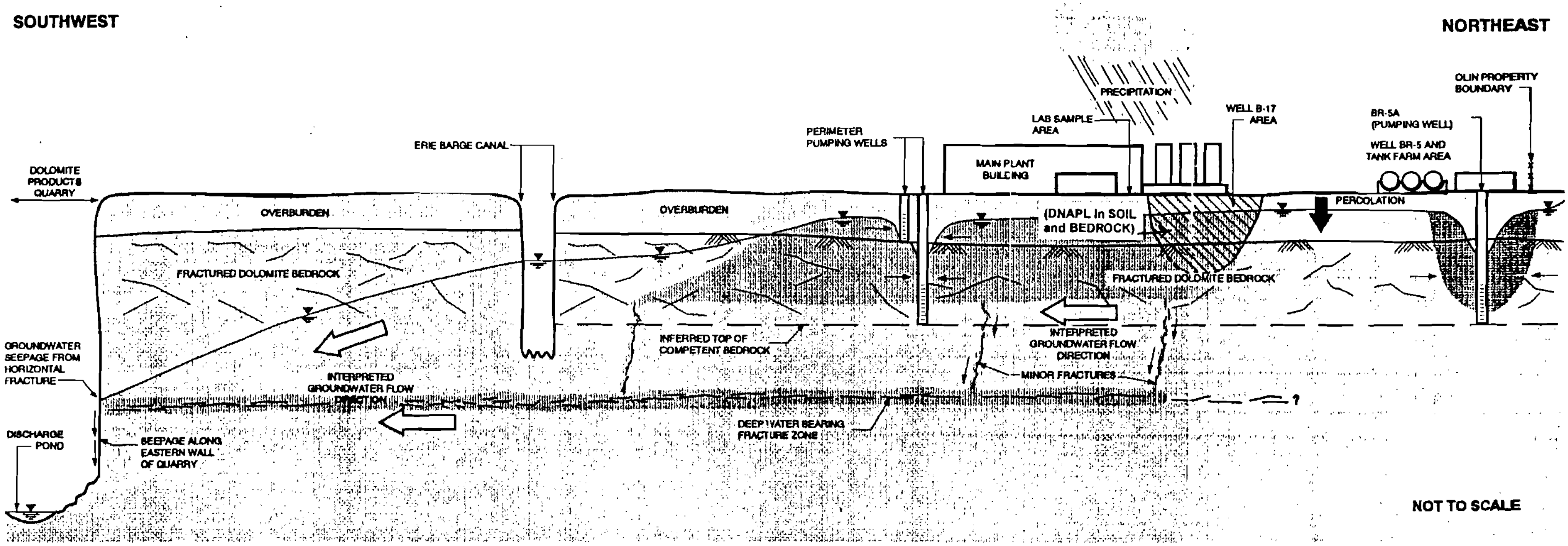
Harding Lawson Associates

HLA

Engineering and Environmental Services

ARCH Chemicals, Inc.

FIGURE 3
CURRENT BEDROCK GROUNDWATER EXTRACTION WELL NETWORK
FEASIBILITY STUDY
ROCHESTER, NEW YORK



POTENTIAL TRANSPORT MECHANISMS

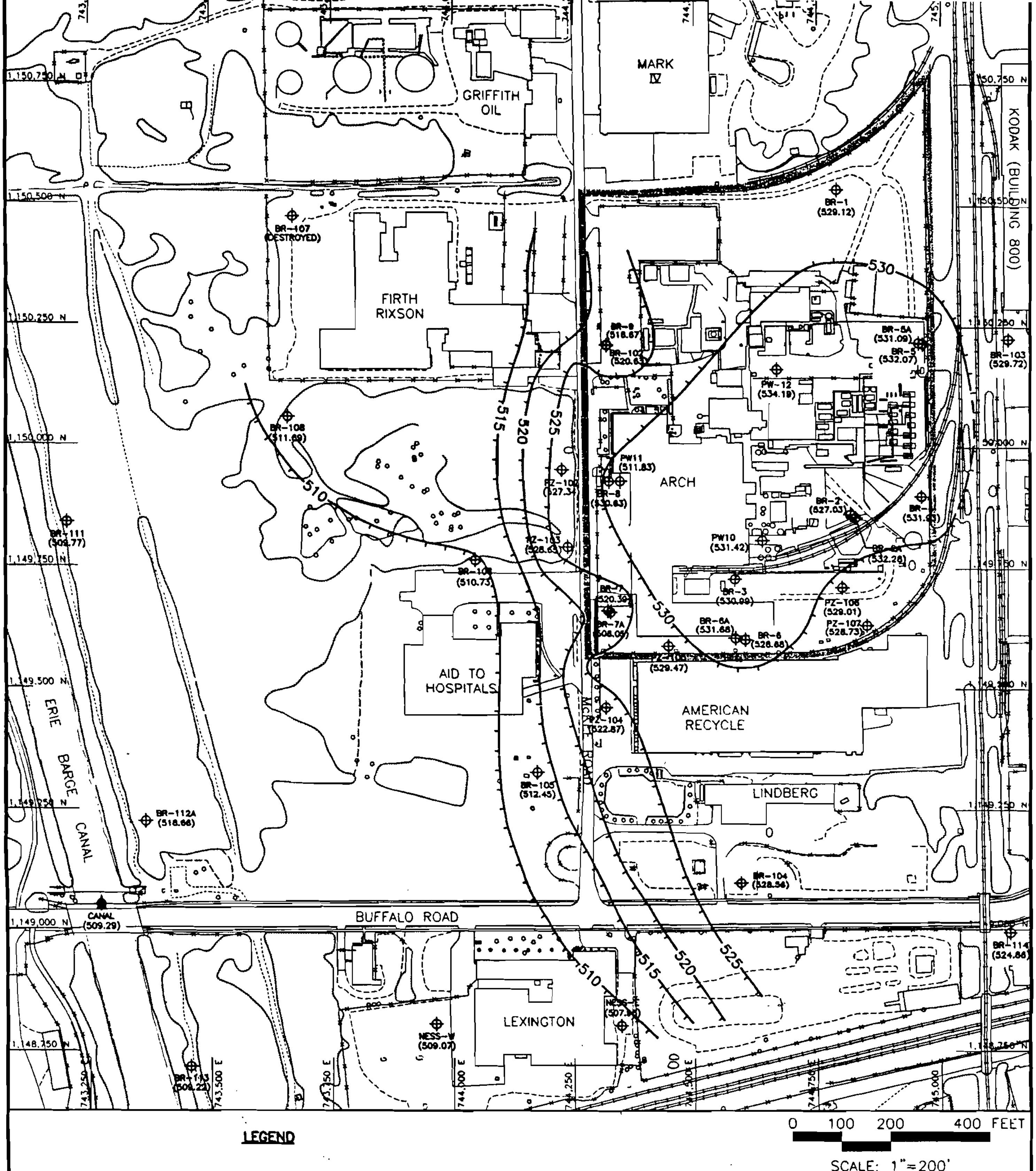
- LEACHING AND TRANSPORT OF RESIDUAL SOIL CONTAMINANTS AND NAPL TO WATER TABLE.
- GROUNDWATER TRANSPORT OF SUSPENDED AND DISSOLVED CONTAMINANTS IN BEDROCK.
- GROUNDWATER TRANSPORT OF DISSOLVED AND SUSPENDED CONTAMINANTS IN OVERBURDEN.
- GROUNDWATER TRANSPORT OF DISSOLVED CONTAMINANTS FROM BEDROCK GROUNDWATER TO SURFACE WATER.

FIGURE 4

SITE CONCEPTUAL MODEL

OLIN CHEMICALS
PHASE II RI REPORT
ROCHESTER, NEW YORK

W9603025D



LEGEND

OUTLINE OF ARCH PROPERTY BOUNDARY

—525— BEDROCK PIEZOMETRIC ELEVATION CONTOUR (MSL)

INTERPRETED GROUNDWATER FLOW DIRECTION (SHALLOW BEDROCK SYSTEM)

BR-113 (511.44) PIEZOMETRIC ELEVATION AT WELL OR PIEZOMETER (MSL)

▲ PIEZOMETRIC ELEVATION AT SURFACE WATER MEASUREMENT POINT

NOTE:

1. WATER LEVELS MEASURED ON NOVEMBER 6, 2000

FIGURE 5

NOVEMBER 2000 BEDROCK GROUNDWATER INTERPRETED PIEZOMETRIC CONTOURS

ARCH CHEMICALS
ROCHESTER, N.Y.

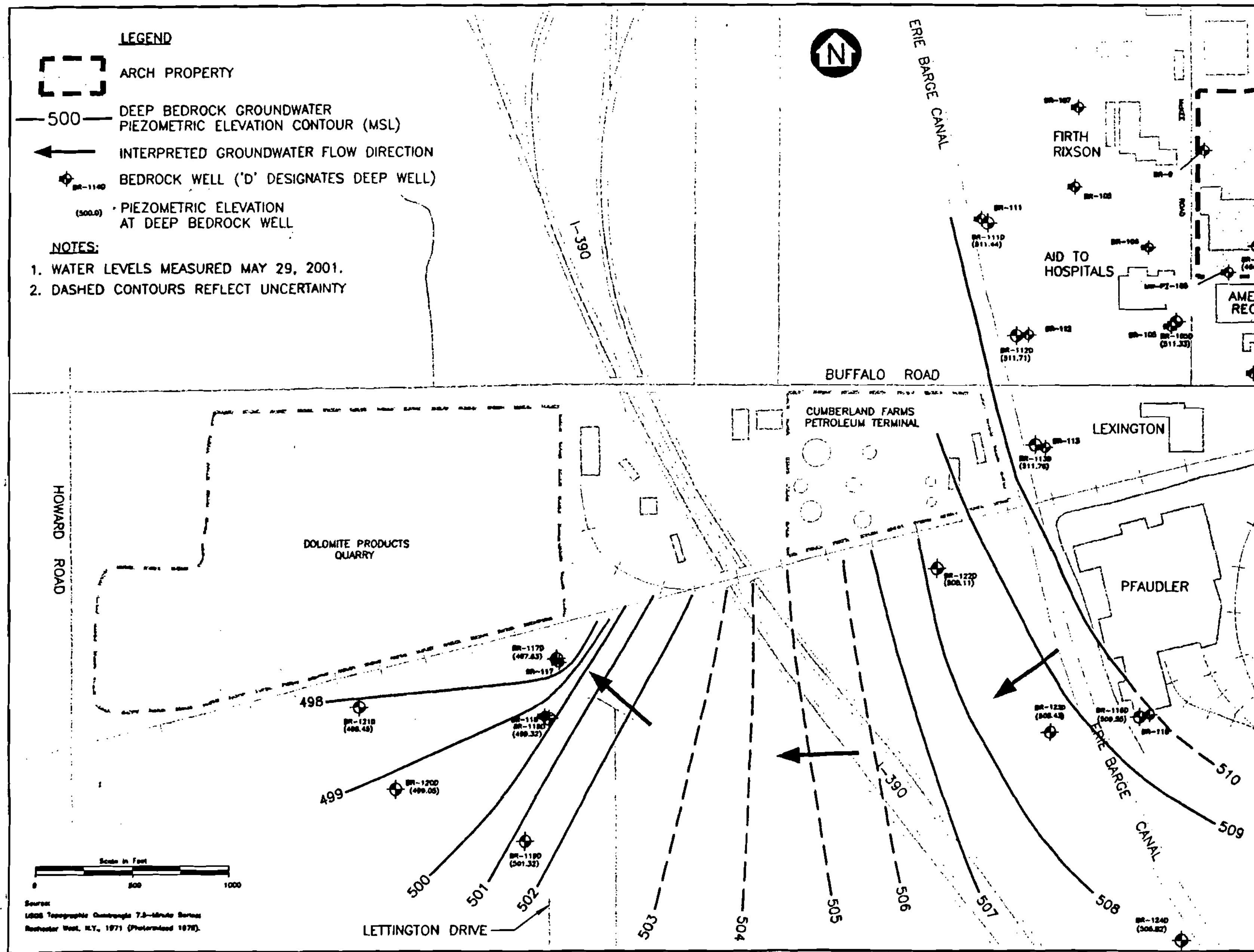
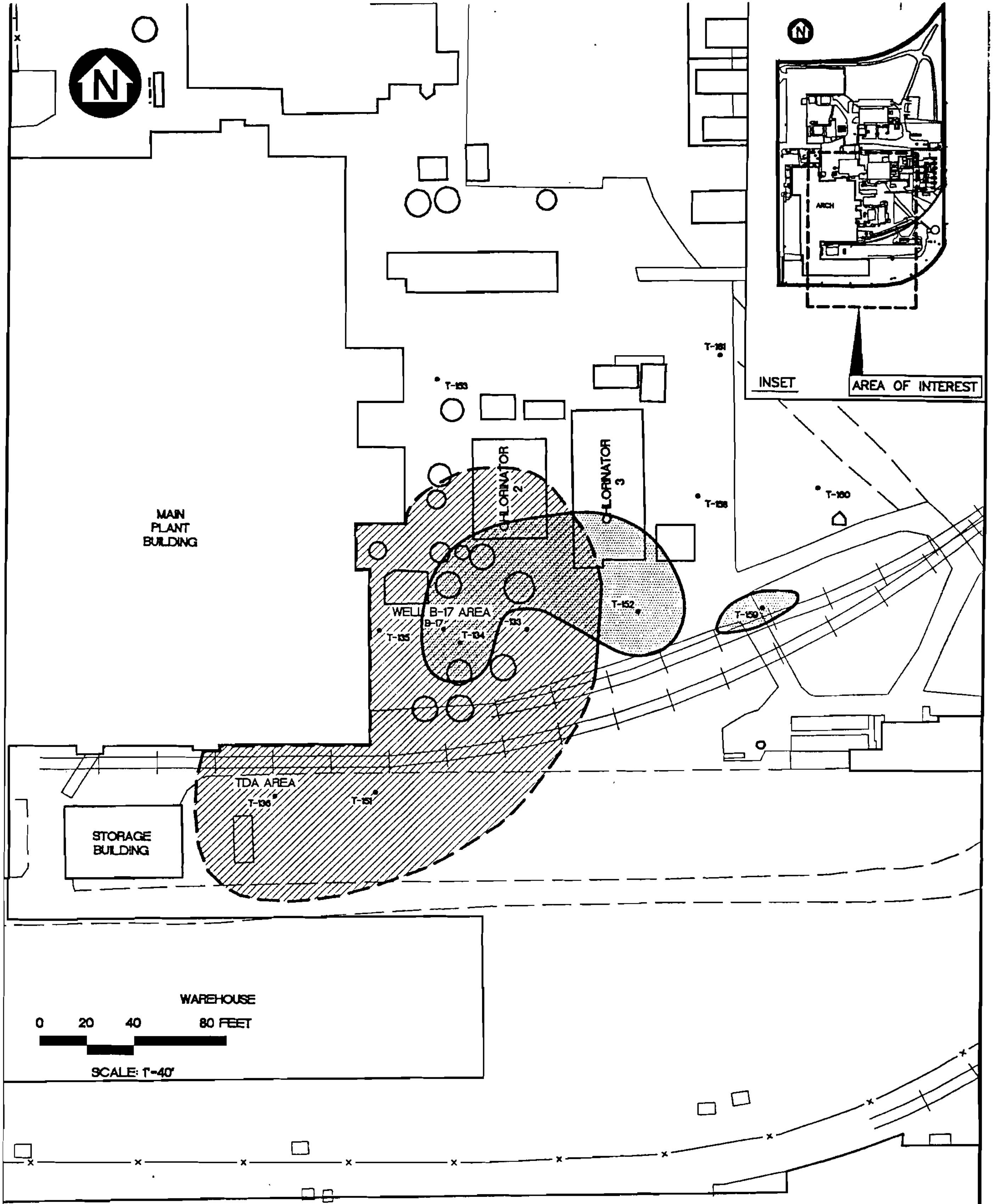


FIGURE 6
MAY 2001
DEEP BEDROCK GROUNDWATER
INTERPRETED PIEZOMETRIC CONTOURS
ARCH CHEMICALS
ROCHESTER, N.Y.



LEGEND:

T-152 • TERRAPROBE BORING LOCATION

UNSATURATED SOIL (0'-6' BGS) EXCEEDING NYSDEC SCOs (DASHED LINE INDICATES DELINEATION IS APPROXIMATED)

SATURATED SOIL (GREATER THAN 6' BGS) EXCEEDING NYSDEC SCOs (DASHED LINE INDICATES DELINEATION IS APPROXIMATED)

NO SAMPLING WAS CONDUCTED UNDER THE MAIN PLANT BUILDING

HLA Harding Lawson Associates
Engineering and Environmental Services

ARCH Chemicals, Inc.

FIGURE 7
EXCEEDANCES OF SOIL CLEANUP OBJECTIVES WELL B-17 AND TDA AREA
FEASIBILITY STUDY
ROCHESTER, NEW YORK

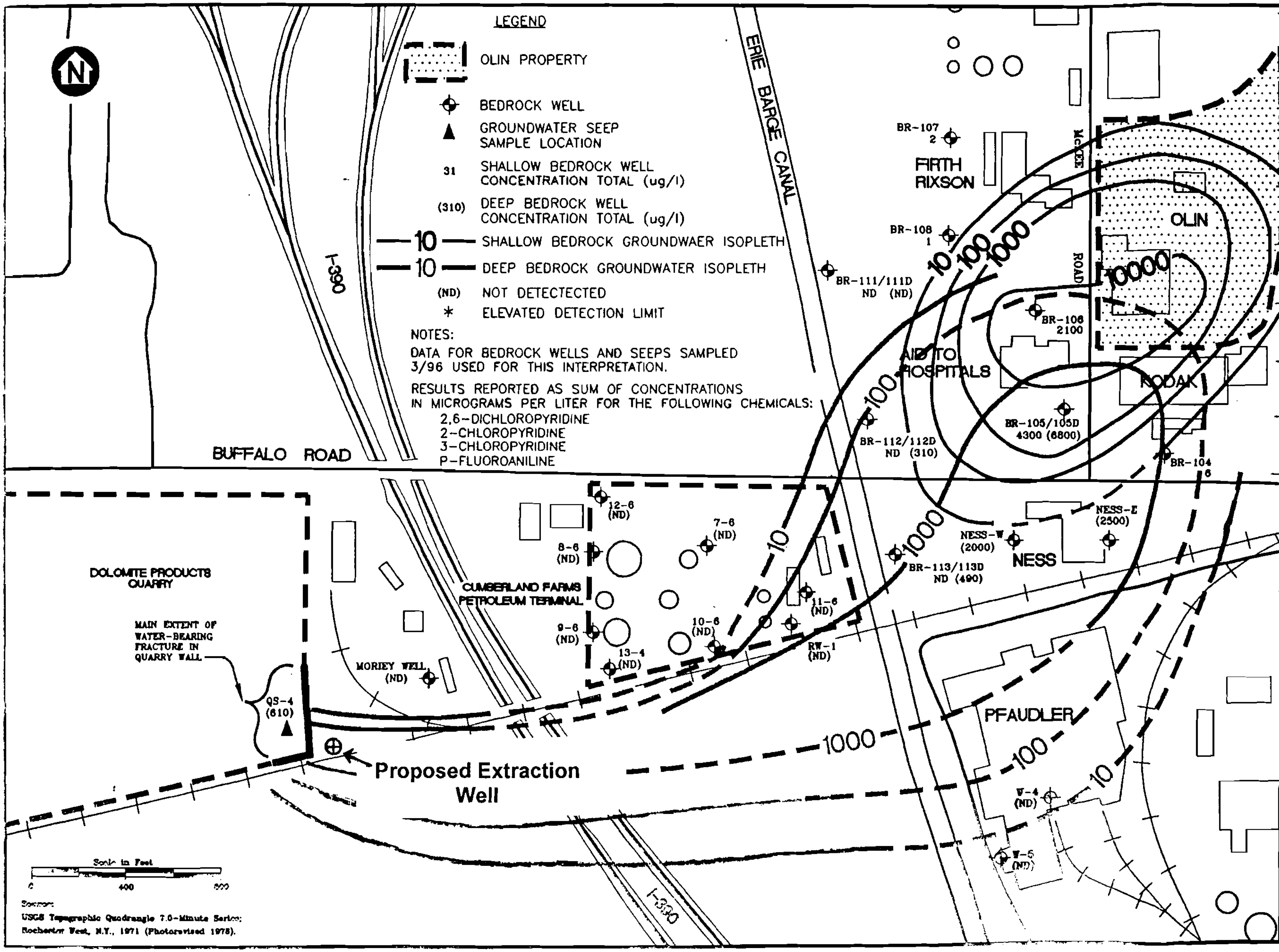
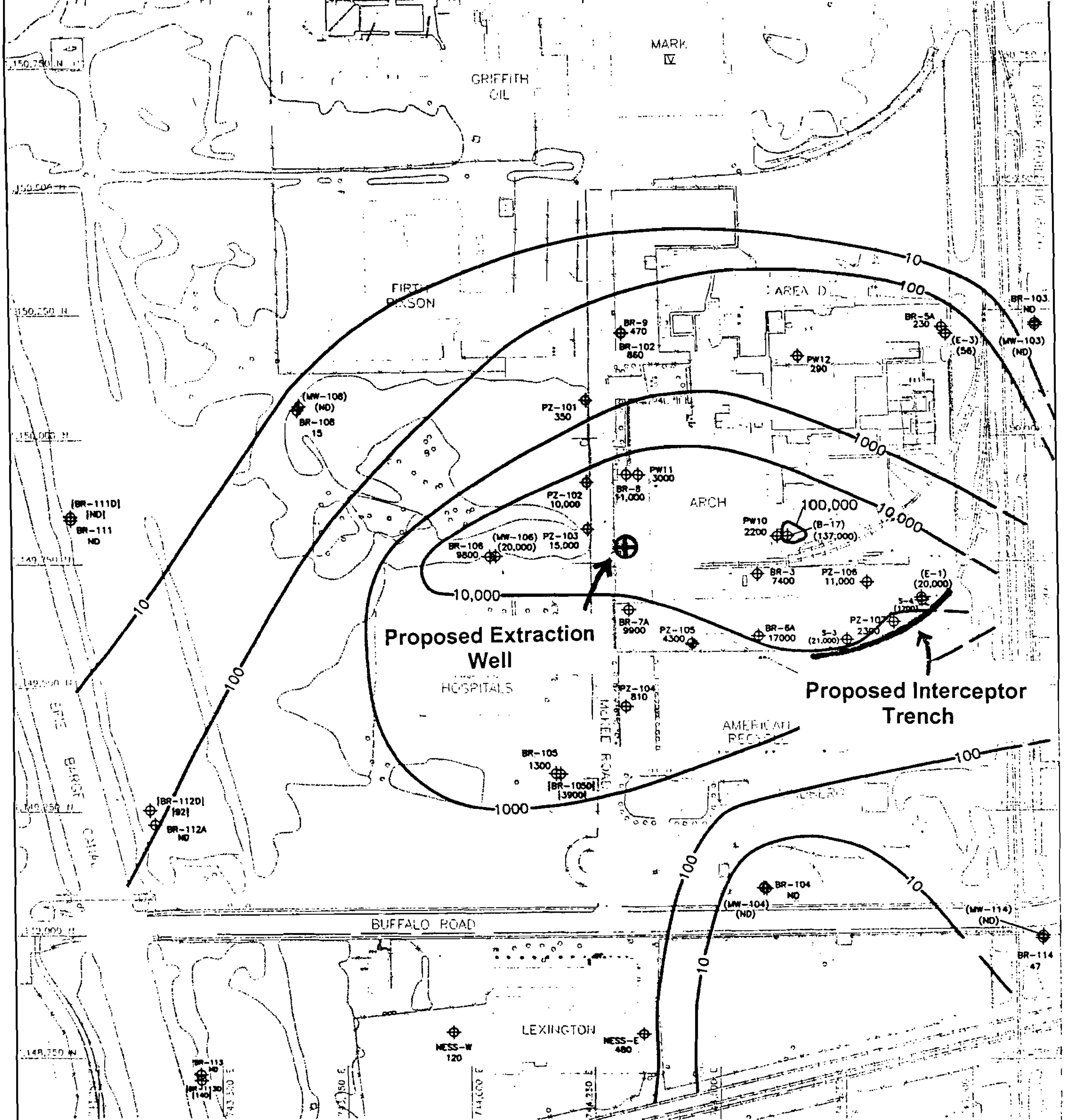


FIGURE 8

TOTAL PYRIDINES INTERPRETED CONCENTRATION ISOPLETHS FOR DEEP AND SHALLOW BEDROCK GROUNDWATER

OLIN CHEMICALS
PHASE II RI REPORT ADDENDUM
ROCHESTER, N.Y.



LEGEND

OUTLINE OF ARCH PROPERTY BOUNDARY

[BR-112D] [1.3] CONCENTRATION AT SAMPLE LOCATION (ug/L)

[1000] DEEP BEDROCK WELL

(1000) OVERBURDEN WELL

1000 BEDROCK WELL

NOTES:

1. SAMPLES COLLECTED FROM MAY 30 THRU JUNE 8, 2001.
2. SELECTED CHLOROPYRIDINES CONSIST OF 2,6-DICHLOROPYRIDINE, 3-CHLOROPYRIDINE, AND 3-CHLOROPYRIDINE, 4-CHLOROPYRIDINE, AND P-FLUOROANILINE.
3. CONCENTRATION CONTOURS REPRESENTED FOR BEDROCK WELLS AND SELECTED OVERBURDEN AND DEEP BEDROCK WELLS.

N

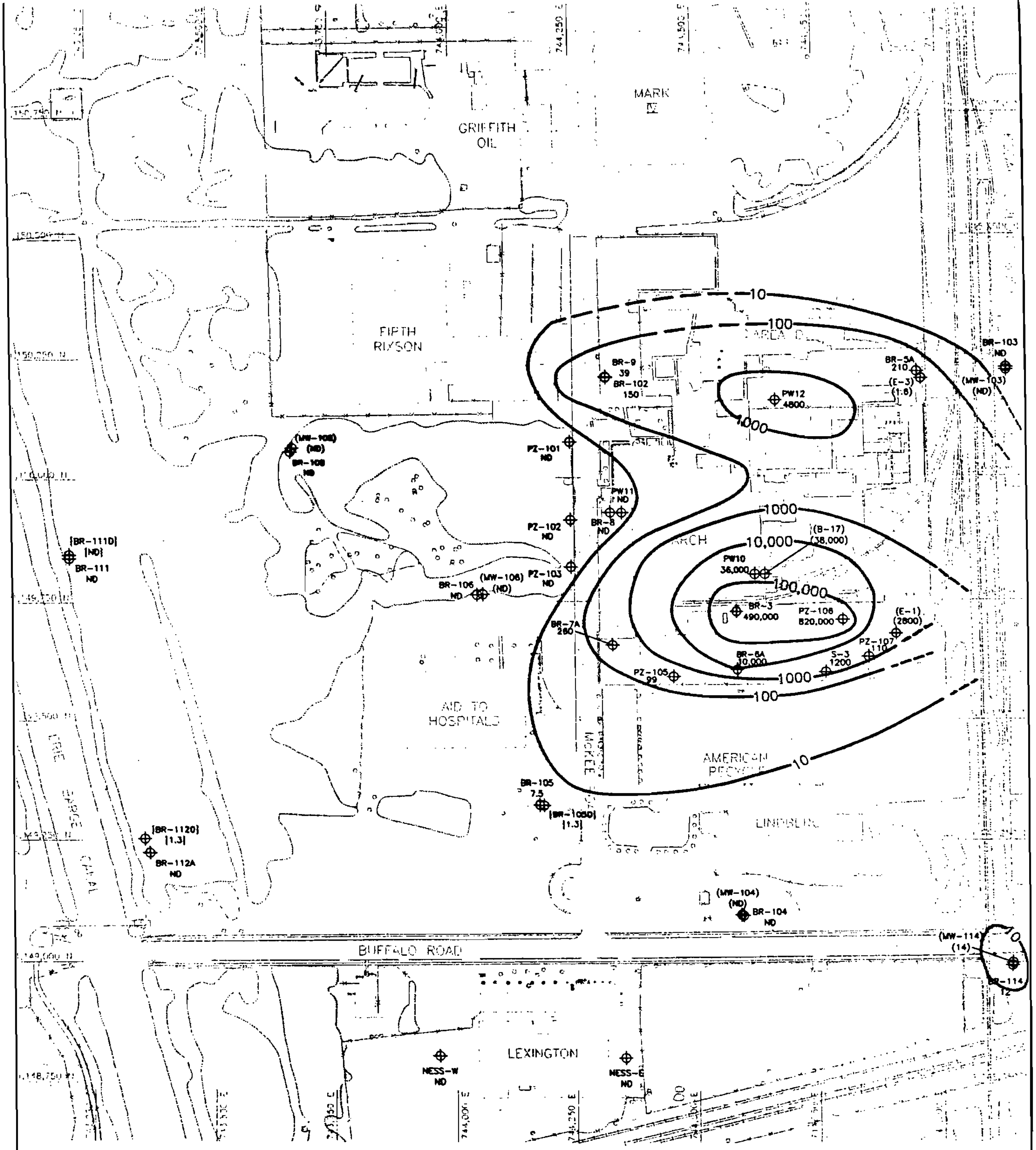
0 100 200 400 FEET

SCALE: 1"=200'

FIGURE 9

MAY 2001
SELECTED CHLOROPYRIDINE CONCENTRATION CONTOURS IN BEDROCK GROUNDWATER

ARCH CHEMICALS
ROCHESTER, N.Y.



LEGEND

OUTLINE OF ARCH PROPERTY BOUNDARY

{BR-112D} {1.3} CONCENTRATION AT SAMPLE LOCATION (ug/L)

{1000} DEEP BEDROCK WELL

(1000) OVERBURDEN WELL

1000 BEDROCK WELL

NOTES:

1. SAMPLES COLLECTED FROM MAY 30 THRU JUNE 8, 2001.
2. SELECTED VOLATILE ORGANIC COMPOUNDS CONSIST OF CARBON TETRACHLORIDE, CHLOROFORM, METHYLENE CHLORIDE, TETRACHLOROETHENE AND TRICHLOROEHTENE.
3. CONCENTRATION CONTOURS REPRESENTED FOR BEDROCK WELLS AND SELECTED OVERBURDEN AND DEEP BEDROCK WELLS.

0 100 200 400 FEET

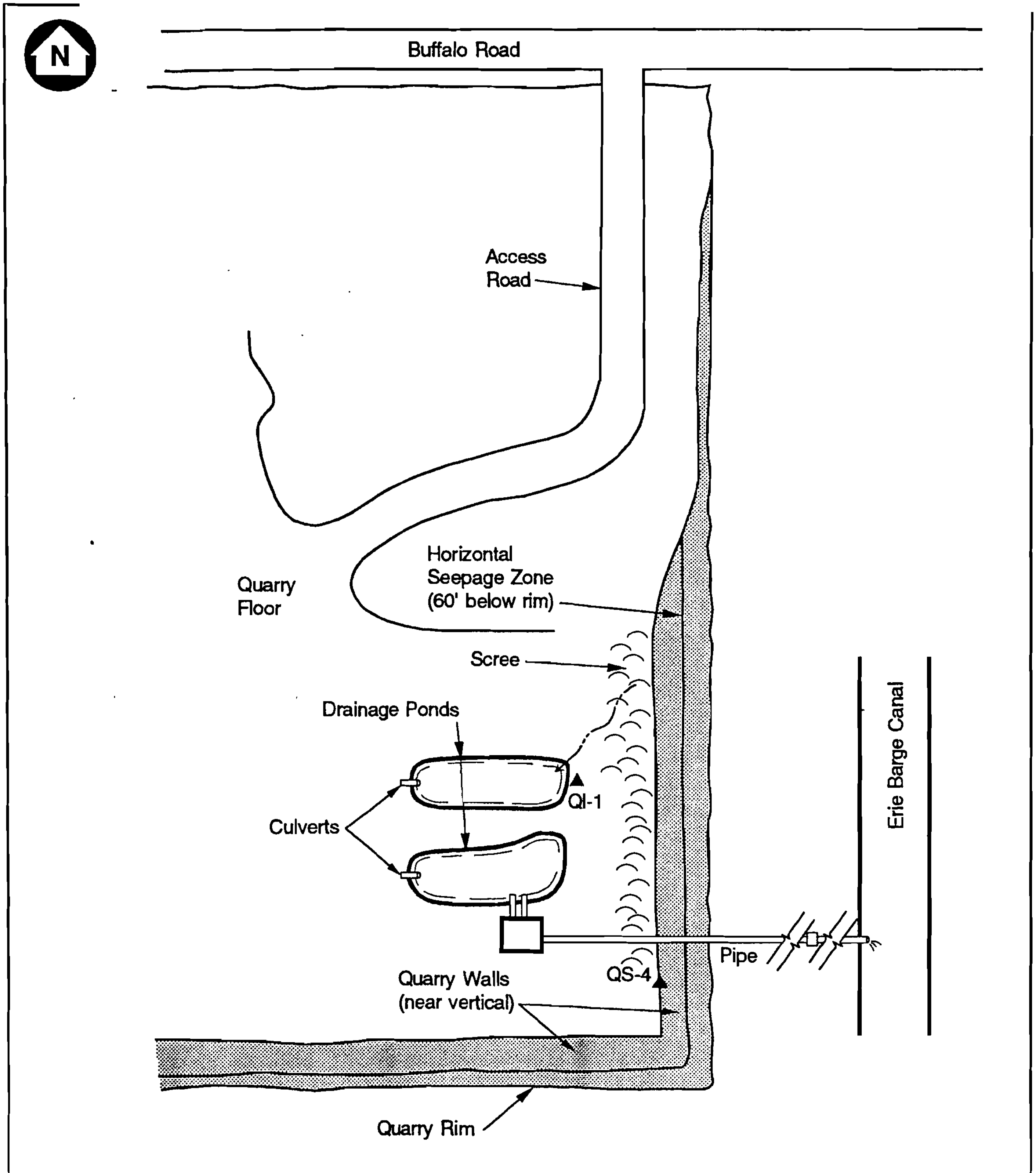
SCALE: 1"=200'

N

FIGURE 10

MAY 2001
SELECTED VOLATILE ORGANIC COMPOUND CONCENTRATION CONTOURS FOR GROUNDWATER

ARCH CHEMICALS
ROCHESTER, N.Y.



Legend

QS-4 ▲ Seep Sample Location

QI-1 ▲ Pond Inflow Sample Location

Not to Scale

FIGURE 11

SAMPLE LOCATIONS DOLOMITE PRODUCTS QUARRY

ARCH CHEMICALS
ROCHESTER, NEW YORK

W9801019

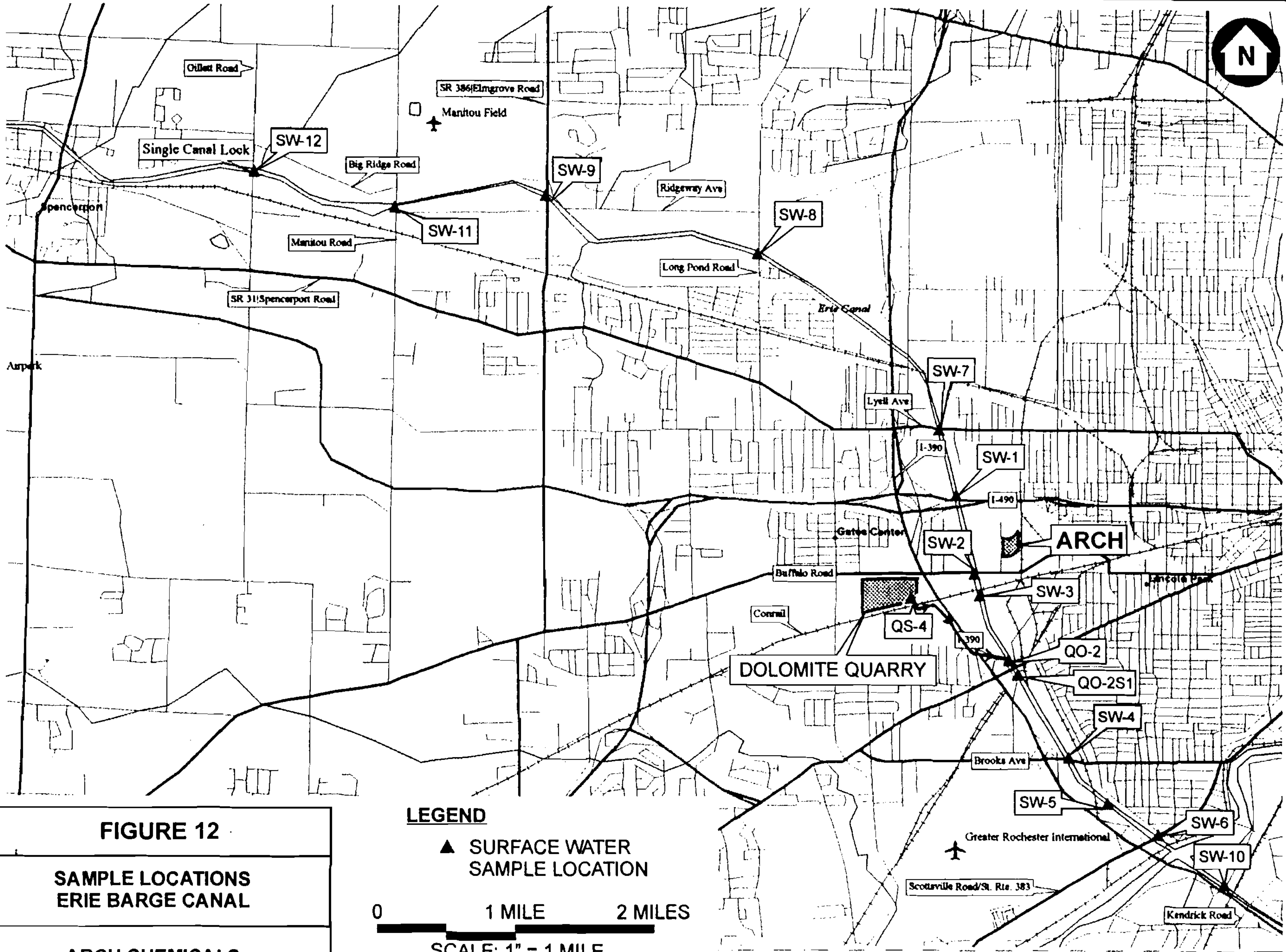


FIGURE 12

SAMPLE LOCATIONS
ERIE BARGE CANAL

ARCH CHEMICALS
ROCHESTER, N.Y.

SOURCE: DeLorme Mapping 1995

W2001008

Table 1

Nature and Extent of Contamination

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCGs/Background	SCG/ Bkgd. (ppb)
Groundwater	Volatile Organic Compounds (VOCs)	Carbon Tetrachloride	ND to 620,000	42 of 60	5
		Chloroform	ND to 320,000	40 of 60	7
		Methylene Chloride	ND to 78,000	32 of 60	5
		Tetrachloroethene	ND to 2,000	24 of 60	5
		Trichloroethene	ND to 1,000	15 of 60	5
	Semivolatile Organic Compounds (SVOCs)	2-Chloropyridine	ND to 400,000	52 of 60	50
		3-Chloropyridine	ND to 19,000	39 of 60	50
		4-Chloropyridine	ND to 1,300	12 of 60	50
		2,6-Chloropyridine	ND to 44,000	48 of 60	50
Surface Water	Semivolatile Organic Compounds (SVOCs)	2-Chloropyridine	0.0001 to 4.7	20 of 48	
		3-Chloropyridine	0.001 to 0.12	12 of 48	
		2,6-Chloropyridine	0.0003 to 1.0	18 of 48	
MEDIUM	**CATEGORY**	**CONTAMINANT OF CONCERN**	**CONCENTRATION RANGE (ppm)**	**FREQUENCY of EXCEEDING SCGs/Background**	**SCG/ Bkgd. (ppm)**
Soils	VOCs	Carbon Tetrachloride	ND to 4200	12 of 55	0.6
		Chloroform	ND to 380	8 of 55	0.3
		Methylene Chloride	ND to 2.8	4 of 55	0.1
		Tetrachloroethene	ND to 520	6 of 55	1.4
		Trichloroethene	ND to 73	3 of 55	0.7

Table 1 (Continued)

Nature and Extent of Contamination

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppm)	FREQUENCY of EXCEEDING SCGs/Background	SCG/ Bkgd. (ppm)
Soil	SVOCs	2-Chloropyridine	ND to 300	21 of 55	0.9
		3-Chloropyridine	ND to 34	18 of 55	0.8
		4-Chloropyridine	ND to 1100	17 of 55	
		2,6-Chloropyridine	ND to 170	24 of 55	
		Trichloroethene	ND to 73	3 of 55	0.7
Soils	Metals	Mercury	0.04 to 214	12 of 18	0.1
		Chromium	5 to 180	6 of 18	10
		Zinc	24 to 640	18 of 18	20
		Lead	5 to 530	2 of 18	400
		Arsenic	1.7 to 12	3 of 18	7.5

ND = Not Detected

ppb = parts per billion

ppm = parts per million

SCGs = Standards, Criteria, and Guidance (empty box indicates no SCG established)

(**Note**: This table summarizes the major contaminants of concern; a number of site contaminants are not listed above.)

Table 2

Remedial Alternative Costs

Remedial Alternative	Capital Cost	Annual O&M	Total Present Worth
No. 1 - No Action	$0	$0	$0
No. 2 - Existing Groundwater Extraction System, Institutional Controls, Monitoring	$ 28,000	$ 373,000	$ 5,760,000
No. 3 - Enhanced Groundwater Extraction System, Institutional Controls, and Monitoring	$ 380,000	$ 455,000	$7,373,000
No. 4 - Dual-Phase Extraction, Enhanced Groundwater Extraction System, Institutional Controls, and Monitoring	$ 410,000	$ 470,000	$7,634,000

(Note: Present Worth Calculations assume a 5% discount rate)

TABLE 3
COMPARISON OF MAY 2001
CHLOROPYRIDINES AND VOLATILE ORGANICS CONCENTRATIONS
IN GROUNDWATER TO PREVIOUS RESULTS (ug/L)

ARCH ROCHESTER
SEMI-ANNUAL GROUNDWATER MONITORING REPORT - SPRING 2001

WELL	SELECTED CHLOROPYRIDINES						SELECTED VOCs					
	# EVENTS (PRIOR 5 YRS)	HISTORIC MAXIMUM	5-YEAR MEAN	MAY-2001 RESULT	=< MEAN OR ND	> MEAN	# EVENTS (PRIOR 5 YRS)	HISTORIC MAXIMUM	5-YEAR MEAN	MAY-2001 RESULT	=< MEAN OR ND	> MEAN
ON-SITE WELLS/LOCATIONS												
B-17	9	28,000,000	310,000	137,000	X		7	345,000	118,000	38,000	X	
BR-102	9	2,100	640	860		X	8	3900	430	150	X	
BR-3	8	6,500,000	130,000	7,400	X		6	600,000	320,000	490,000		X
BR-5A	11	1,700	120	230		X	6	9400	1,100	210	X	
BR-6A	9	93,000	30,000	17,000	X		8	26,000	10,000	10,000	X	
BR-7A	9	510,000	15,000	9,900	X		7	3000	800	260	X	
BR-8	10	57,000	7,600	11,000		X	1	6900	4	ND	X	
BR-9	4	720	630	470	X		4	160	130	39	X	
E-1	8	18,000	3,300	20,000		X	7	5,300	1,000	2,800		X
E-3	9	600	34	56		X	4	12000	240	1.6	X	
PW10*	3	160,000	97,000	2,200	X		3	120,000	83,000	36,000	X	
PW11*	1	27,000	NA	3,000	X		1	ND	ND	ND	X	
PW12	8	11,000	3000	290	X		7	120,000	9,700	4,800	X	
PZ-106	5	110,000	12,000	11,000	X		5	960,000	380,000	820,000		X
PZ-107	5	11,000	1,700	2,300		X	5	12,000	1,100	110	X	
S-3	3	6,800	410	21,000		X	2	260	150	1,200		X

TABLE 4
COMPARISON OF MAY 2001
CHLOROPYRIDINES AND VOLATILE ORGANICS CONCENTRATIONS
IN GROUNDWATER TO PREVIOUS RESULTS (ug/L)

ARCH ROCHESTER
SEMI-ANNUAL GROUNDWATER MONITORING REPORT - SPRING 2001

WELL	SELECTED CHLOROPYRIDINES						SELECTED VOCs					
	# EVENTS (PRIOR 5 YRS)	HISTORIC MAXIMUM	5-YEAR MEAN	MAY-2001 RESULT	=< MEAN OR ND	> MEAN	# EVENTS (PRIOR 5 YRS)	HISTORIC MAXIMUM	5-YEAR MEAN	MAY-2001 RESULT	=< MEAN OR ND	> MEAN
OFF-SITE WELLS/LOCATIONS												
BR-103	9	400	29	ND	X		6	1	ND	ND	X	
BR-104	10	3,100	15	ND	X		7	9	ND	ND	X	
BR-105	10	24,000	2,500	1,300	X		7	310	9.2	7.5	X	
BR-105D	10	10,000	3,300	3,900		X	7	230	56	1.3	X	
BR-106	10	21,000	8,000	9,800		X	6	6,300	1,300	ND	X	
BR-108	9	1,700	260	15	X		6	ND	ND	ND	X	
BR-112A	9	47	24	ND	X		3	ND	ND	ND	X	
BR-112D	10	310	89	92		X	3	4	4.3	1.3	X	
BR-113	9	8	4	ND	X		1	ND	ND	NA		
BR-113D	10	490	160	140	X		1	3	2.8	NA		
BR-114	10	450	150	47	X		5	5	2.5	12		X
BR-124D	7	65	65	NA	X		7	ND	ND	ND	X	
MW-106	9	130,000	21,000	20,000	X		6	89	6.0	ND	X	
MW-108	5	28	12	ND	X		5	ND	ND	ND	X	
MW-114	10	18	13	ND	X		5	11	7.5	14		X
NESS-E	12	5,000	970	480	X		6	700	3.0	ND	X	
NESS-W	11	2,100	950	120	X		6	89	1.1	ND	X	

Note: 1) Number of samples and mean reflect 5-year sampling period from March 1996 through November 2000.
Historic maximum based on all available results from March 1990 through November 2000.
2) Chloropyridines represented by: 2-Chloropyridine, 2,6-Dichloropyridine, and 3-Chloropyridine, p-Fluoroaniline, and Pyridine.
3) Selected VOCs represented by Carbon Tetrachloride, Chloroform, Methylene Chloride, Tetrachloroethene, and Trichloroethene.
4) X = Comparison of May 2001 concentration to 5-year mean.
5) NA = Not analyzed or not applicable
ND = Not detected
* = PW10 and PW11 were first sampled in January 1999 and May 2000, respectively.

APPENDIX A

<u>RESPONSIVENESS SUMMARY</u>

Arch Chemicals, Inc. (formerly Olin Corporation)
Proposed Remedial Action Plan (OU -2)
City of Rochester, Monroe County, New York
Site No. 828018A

The Proposed Remedial Action Plan (PRAP) for the Arch Chemicals site, was prepared by the New York State Department of Environmental Conservation (NYSDEC) and issued to the local document repository on February 26, 2002. This Plan outlined the preferred remedial alternative proposed for the remediation of contaminated groundwater (OU - 2) at and near the Arch Chemicals site. The selected remedy is:

- <u>Onsite Groundwater</u> - Groundwater Pumping/Hydraulic Control, Treatment, Discharge to Publicly-Owned Treatment Works (POTW), Institutional Controls, and Long-term Monitoring.

- <u>Offsite Groundwater</u> - Groundwater Pumping at the Quarry Boundary, Treatment if Necessary to Meet Discharge Criteria, Natural Attenuation, Groundwater Notifications, and Long-term Monitoring.

The release of the PRAP was announced via a notice to the mailing list, informing the public of the PRAP's availability.

A public meeting was held on March 18, 2002 which included a presentation of the Remedial Investigation (RI) and the Feasibility Study (FS) as well as a discussion of the proposed remedy. The meeting provided an opportunity for citizens to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. The public comment period for the PRAP ended on March 27, 2002.

This Responsiveness Summary responds to all questions and comments raised at the March 18, 2002 public meeting as well as all written comments received during the public comment period.

The following are the comments received at the public meeting, with the NYSDEC's responses:

<u>COMMENT #1:</u> Arch should be commended for their efforts to investigate and remediate this problem.

<u>RESPONSE #1</u>: Comment noted; the NYSDEC acknowledges and appreciates the company's cooperation and efforts to date.

<u>COMMENT #2:</u> What is NAPL?

<u>RESPONSE #2:</u> NAPL stands for Non-Aqueous Phase Liquids which are organic liquids with low solubilities in water. As such, these liquids form separate phases (don't mix) in water. NAPL lighter than water (LNAPL, such as oil and gasoline), float and NAPL denser than water (DNAPL, such as chlorinated solvents, like trichloroethene and carbon tetrachloride), sink in water. When released to the subsurface, NAPL can migrate rapidly through pore spaces in soil and rock and form very long-term sources of groundwater contamination. Based on significant and persistent groundwater contamination, the occasional observation of NAPL in wells, and the considerable contaminant mass removed by pumping annually (>1000 pounds), considerable NAPL must exist in source areas beneath the Arch site. These source areas will be addressed in a future PRAP as Operable Unit No. 1. Complex distributions ofNAPL in the subsurface can greatly complicate cleanup efforts.

The following is the sole written comment received with the NYSDEC response:

COMMENT #3: We are next door neighbors to Arch Chemicals at 58 McKee Road. I am writing to comment on the proposed remedy for Operable Unit No. 2 (groundwater contamination). We have no objection to the proposed Remedial Plan, provided it ensures the health and safety of our employees, and will continue to reduce contaminant levels on our property.

However, we are concerned that the remedy for Operable Unit No. 1 - Soil and Bedrock Contamination - has been postponed. As you know, the real goal of the State's Superfund program is to achieve "pre-disposal conditions." 6 N.Y.C.R.R. §375-1.10(b). We urge the Department to proceed expeditiously with requiring source treatment or removal in order to achieve a permanent cleanup, and stop the generation of further groundwater contaminants.

RESPONSE #3: The Department agrees that source remediation is necessary in order to achieve a permanent cleanup. The problem at Arch and at hundreds of similar sites state- and nation-wide has been locating and treating/removing source contamination (DNAPL) deep in the subsurface. The situation at Arch is further complicated by the location of the main source area beneath the main plant and associated pipe networks and structures (see figure 2) and the properties of the main contaminants, chloropyridines (low volatility and resistance to chemical oxidation and biological degradation). Treatability studies conducted during the FS showed low effectiveness for the potential remedial techniques: vacuum extraction and insitu chemical oxidation.

As noted above in Response #2 and in the Contaminant Fate and Transport section on page 7, DNAPL presents very persistent sources of contaminants to groundwater and significant technical challenges for effective remediation. For example, a significant proportion of the DNAPL mass may have diffused into the bedrock matrix where it cannot be readily extracted. While emerging technologies are evaluated to deal with this difficult problem (such as thermally-enhanced vacuum extraction), the current groundwater extraction and treatment system and the enhancements of this remedy (OU-2; groundwater interceptor trench and additional bedrock pumping wells) will gradually remove contaminant mass from source areas via dissolution into groundwater and subsequent capture by the extraction wells. Despite the additional time required to further assess potential remedies for source areas (OU-1), the selected remedy is protective of public health and the environment.

APPENDIX B

Administrative Record

Arch Chemicals, Inc. (formerly Olin Corporation)
City of Rochester, Monroe County, New York
Site No. 828018A

REPORTS:

1. Hydrogeological Investigation at Olin - Rochester Plant (September 1982)
2. Update Report (November 1985)
3. Groundwater Investigation - Olin Chemicals Group - Rochester Plant Site (September 1990)
4. Phase I Remedial Investigation (RI) Report (August 1995)
5. Phase II RI Report (May 1996)
6. Phase II RI Report Addendum (June 1996)
7. Supplemental Human Health Risk Evaluation (November 1996)
8. Final Phase II RI Report (October 1997)
9. Quarterly RI/FS Progress Reports (1993 - 2002)
10. Feasibility Study Report (January 2000)
11. Proposed Remedial Action Plan for OU - 2 (February 2002)

LEGAL AGREEMENTS:

Subject of Order: Bedrock Groundwater Investigation (Index No. C8-0003-85-06)
Date: May 4, 1987

Subject of Order: Remedial Investigation/ Feasibility Study (Index No. B8-0343-90-08)
Date: August 23, 1993