DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: Arch Chemical, Inc.
Facility Address: 100 McKee Road, Rochester, New York
Facility EPA ID #: NYD002220804

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

1. Has all available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been considered in this EI determination?

   (Note: This determination addresses contaminated media regulated under New York State's Inactive Hazardous Waste Disposal Site Remedial Program.)

   _X_ If yes - check here and continue with #2 below.

   _____ If no - re-evaluate existing data, or

   _____ if data are not available, skip to #8 and check the"IN" status code.

Facility Information:

Background:

The Arch Chemical 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). 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 New York State Registry of Inactive Hazardous Waste Disposal Sites.

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.

Remedial History:

1981 - Chloropyridines discovered offsite in Ness (now Lexington) Company wells; onsite groundwater investigation revealed significant groundwater contamination.

1983 - Several perimeter overburden monitoring wells were converted to pumping wells in an effort to contain shallow groundwater.

1984 - US Environmental Protection Agency completes site inspection; confirms soil and groundwater contamination.

1985 - Site listed on New York Sate (NYS) Registry of Inactive Hazardous Waste Sites as a Class 2A; in 1986, changed to a Class 2 site: significant threat to public health and/or environment.

1987 - Olin signs order to investigate bedrock groundwater.

1988-1990 - Groundwater investigation reveals significant contamination in bedrock; five bedrock wells are converted to pumping wells.

1993 - Olin and New York State Department of Environmental Conservation (NYSDEC or DEC) sign consent order to conduct a Remedial Investigation/Feasibility Study.

1993-1997 - Multi-phased Remedial Investigation conducted; contamination, primarily chloropyridines, tracked offsite to the Dolomite Products Quarry in the Town of Gates and the Erie Canal.

1999 - Three bedrock extraction wells (PW-10, 11, and 12) added to groundwater extraction system. Annual volume of pumped groundwater exceeds 10 million gallons per year with contaminant mass removal estimated at over 1000 pounds per year.

1999-2001 - Feasibility Study completed; remedy divided into two Operable Units (OU-1 Source Areas and OU-2 Groundwater).

2002 - Record of Decision (ROD) for OU-2 (Groundwater) issued. For on-site, the ROD specified; onsite enhancement of the existing groundwater extraction system; treatment and discharge to the sanitary sewer; institutional controls; and long-term monitoring. For offsite, the ROD specified; groundwater pumping at the quarry rim, treatment if necessary to meet discharge criteria, natural attenuation, annual notification of property owners, groundwater use limitations, and long-term monitoring.

2003-2004 - Remedial Design and ROD modification request by Arch to eliminate offsite pumping well at quarry due to declines in chloropyridines in quarry seeps and discharge. Request is being evaluated with additional data gathering.

2005 - New extraction wells (PW-13 and PW-14) installed onsite and vapor intrusion investigation is ongoing.

Geology

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.

References: See Question No. 8 for all references.

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

__X__ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

_____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale:

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 and plant washdown of chemical spills and overflow in the Well B-17 Area (this and other areas of concern are described below and depicted in Figure 2).

Well B-17 Area - Leakage from process waste sewers and floor drains (repaired in 1988); plant spills and washdown directed to outside soils (practice stopped in mid-1970s).

Former Lab and Off-specification Waste Disposal Area - From 1950s to 1970, wastes were disposed in a pit; in 1983 visible waste was excavated and disposed off-site during boiler room construction.

Pretreatment Plant Area - Historic leaks/spills may have occurred as indicated by available groundwater data.

Tank Farm Area - The tank farm is currently lined and bermed to contain possible leaks or spills but historic leaks/spills may have occurred.

Groundwater sampling has been ongoing at the facility since the early 1980s and a wide variety of contaminants, including Semi-Volatile Organic Compounds (SVOCs), Volatile Organic Compounds (VOCs), and inorganics (primarily metals) have been detected in overburden and bedrock groundwater. Chloropyridines are the most frequently detected organic chemicals.

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 (standard for each type of chloropyridine is 50 ppb) and up to 345,000 ppb of total VOCs (standard for most VOCs is 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

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[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

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 as high as 1,000,000 ppb (primarily carbon tetrachloride, chloroform, and carbon disulfide) and chloropyridines as high as 110,000 ppb). These results suggest the presence of a Dense Non-Aqueous Phase Liquid (DNAPL) source in the subsurface of this area. Other wells in this vicinity, such as overburden wells E-1 and S-3 on the southeast site perimeter, have shown elevated concentrations (greater than 20,000 ppb total chloropyridines and VOCs) in recent sampling events.

At the Lab/Off-spec Waste Disposal Area, a groundwater sample from a temporary sampling point detected 260,000 ppb of carbon tetrachloride and 80,000 ppb of chloroform (standard is 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 Tank Farm Area, 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.

Offsite, west of the main source area, monitoring well cluster 106 has shown persistently elevated levels of chloropyridines (5000 to 20,000 ppb). A perimeter pumping well has been installed to address this gap in containment. VOCs, on the other hand, generally diminish to low levels in offsite wells. Further afield, chloropyridines show significant offsite migration in bedrock in a general southwest direction and terminating in the Gates Dolomite quarry. Contaminant migration offsite is controlled by dewatering operations at the quarry (in effect, a very large collector well).

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, relatively low volatility, and relatively slow rates of degradation.

3. Has the migration of contaminated groundwater stabilized (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

__X__ If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater

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[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the horizontal or vertical dimensions of the "existing area of groundwater contamination").

____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination") - skip to #8 and enter "NO" status code, after providing an explanation.

____ If unknown - skip to #8 and enter "IN" status code.

Rationale:

Analytical and piezometric data collected from offsite wells over a 10 year period (1995-2005, as reported in the Remedial Investigation, the ROD, and in semi-annual sampling reports) indicate that the offsite chloropyridine plume terminates at the Gates Dolomite quarry with a general downward trend in concentrations noted over this period. Monitoring wells, BR-119D, BR-120D, BR-121D (which define the southwest extent of the plume) and BR-124D (which defines the southern extent of the plume) have not shown detections of chloropyridines. Also significant decreases have been reported in chloropyridine concentrations in the quarry seep and the quarry discharge outfall at the Erie Canal. Similar trends have been noted in most other offsite wells. These decreases are interpreted to be a result of more effective containment at the site perimeter. With the addition of two more extraction wells in the spring of 2005, containment and mass removal is expected to increase even further. Arch annually collects and treats about 12 to 14 million gallons of contaminated groundwater (with discharge to the Monroe County sewer system) for a mass removal of about 1000 pounds (lbs) of chloropyridines and 500 lbs of VOCs per year. While complete capture of site contaminants at the site perimeter does not appear feasible, dewatering operations at the quarry induce inward hydraulic gradients over a wide area, collecting in the process, the offsite chloropyridine plume.

4. Does "contaminated" groundwater discharge into surface water bodies?

__X__ If yes - continue after identifying potentially affected surface water bodies.

_____ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

____ If unknown - skip to #8 and enter "IN" status code.

Rationale:

Chloropyridines have been detected in samples from the Gates Dolomite quarry seeps, the quarry dewatering ponds, the quarry discharge channel along I-390, the quarry discharge point at the Erie Canal, and the Erie Canal. Significant groundwater discharge is evident along a bedding-plane fracture in the east wall of the Gates Dolomite quarry. This influx of groundwater flows to two dewatering ponds in the southeast corner of quarry, which collect groundwater, precipitation, and runoff from the whole quarry. 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.

Data indicate that the quarry discharge, which contained about 200 ppb of chloropyridines at the Erie Canal outfall when initially sampled in 1995, was 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 Arch site but groundwater and surface water sampling indicates that this potential source is not significant.

5. Is the discharge of "contaminated" groundwater into surface water likely to be "insignificant" (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

__X__ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

____ If unknown - enter "IN" status code in #8.

Rationale:

Given that chloropyridine concentrations have declined significantly at all surface water sampling locations since sampling commenced in 1995, the discharge of contaminated groundwater is considered to be "insignificant". For example, recent sampling results from the main quarry seep have leveled off at less than 200 ppb total chloropyridines (down from a peak of about 5000 ppb). Likewise, sample results from the quarry discharge channel and canal surface water have declined to non-detection levels (down from peaks of 200 ppb and 45 ppb, respectively). These declines in chloropyridine concentrations appear to reflect more effective hydraulic control (increased pump rates and additional pumping wells) at the plant site.

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[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

The Human Health Risk Assessment concluded that total chloropyridine concentrations of 37 ppb or less are protective of human health. The only sampling point currently above this level is the quarry seep location. The quarry owners and workers have been advised to avoid direct contact with this seepage and its location in an inactive and relatively inaccessible area of the quarry discourages such contact.

6. Can the discharge of "contaminated" groundwater into surface water be shown to be "currently acceptable" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

___ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment,[5] appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/ habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

___ If no - (the discharge of "contaminated" groundwater can not be shown to be "currently acceptable") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

____ If unknown - skip to 8 and enter "IN" status code.

7. Will groundwater monitoring / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

__X__ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not

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[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

____ If no - enter "NO" status code in #8.

____ If unknown - enter "IN" status code in #8.

Rationale:

Groundwater monitoring has been ongoing since the 1980s and will continue indefinitely as specified in the March 2002 ROD. Currently, monitoring is conducted semi-annually with the collection of groundwater samples from a comprehensive network of monitoring wells on and offsite.

Results to date show a general decreasing or stable trend in contaminant concentrations with some excursions noted in source areas. The recently upgraded groundwater recovery system at the site perimeter is expected to further reduce offsite migration and quarry dewatering provides a downgradient hydraulic barrier.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

__X__ YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the Arch Chemical, Inc. site, located at 100 McKee Road, Rochester, NY. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater". This determination will be re-evaluated when the State becomes aware of significant changes at the facility.

____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

____ IN - More information is needed to make a determination.

Completed by: _____ Date 9/26/05
James Craft
Engineering Geologist 2
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Supervisor: _____ Date 9/26/05
Bart Putzig, P.E.
Engineer 3
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Director: _____ Date 9/24/05
Edwin Dassatti, P.E.
Bureau of Hazardous Waste and Radiation Management
Division of Solid and Hazardous Materials

References:

Hydrogeological Investigation at Olin - Rochester Plant Site (September 1982)

Order on Consent - Bedrock Groundwater Investigation, Index No. C8-0003-85-06 (May 4, 1987)

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

Order on Consent - Remedial Investigation / Feasibility Study, Index No. B8-0343-90-08 (August 23, 1993)

Supplemental Human health Risk Evaluation (November 1996)

Final Phase II RI Report (October 1997)

Feasibility Study Report (January 2000)

Record of Decision (March 2002)

Quarterly RI/FS Progress Reports

Locations where References may be found:

Reference materials are available at the Region 8 office at 6274 E. Avon-Lima Road, Avon, NY 14414 and NYSDEC Central Office at 625 Broadway, Albany, NY 12233.

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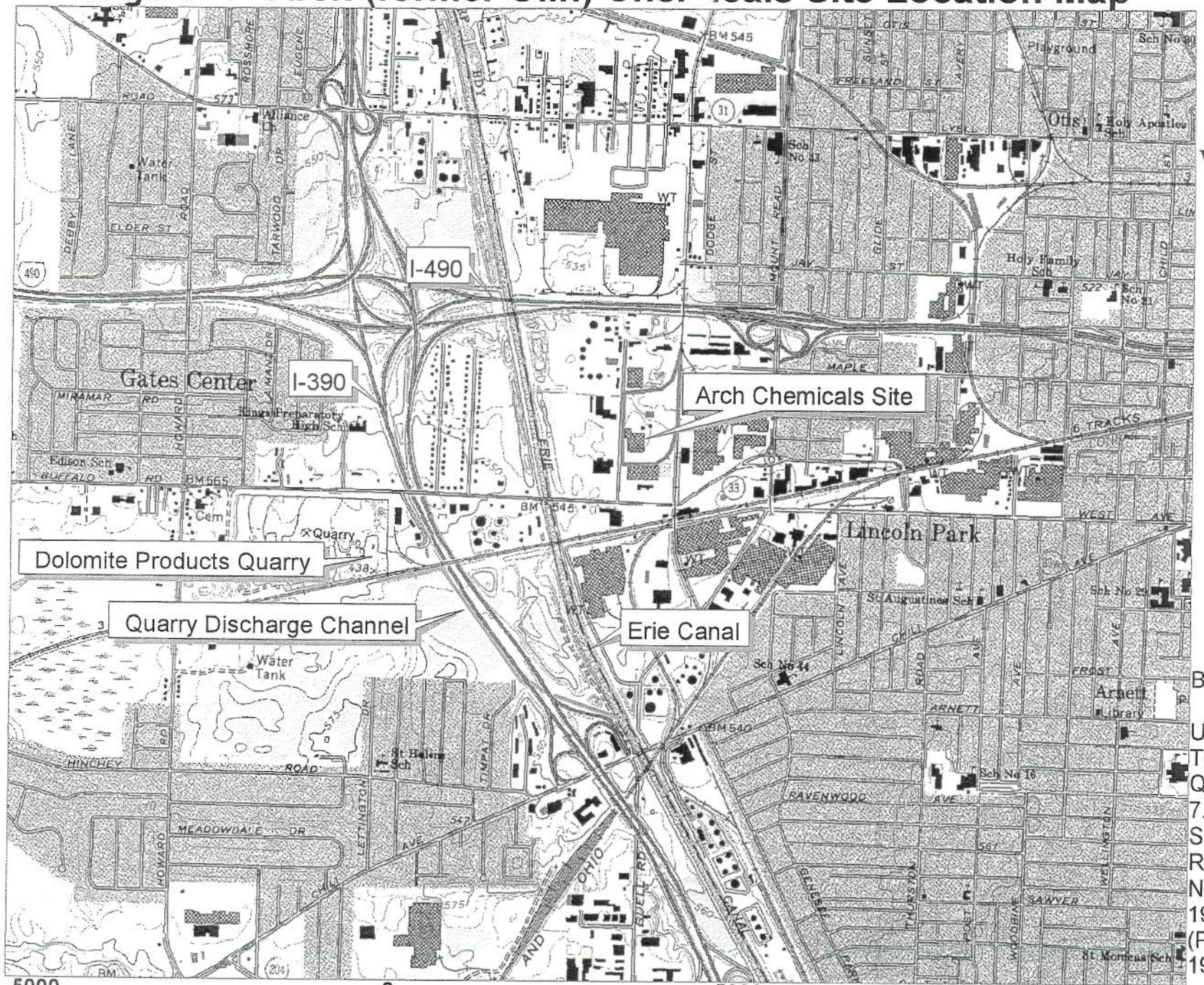
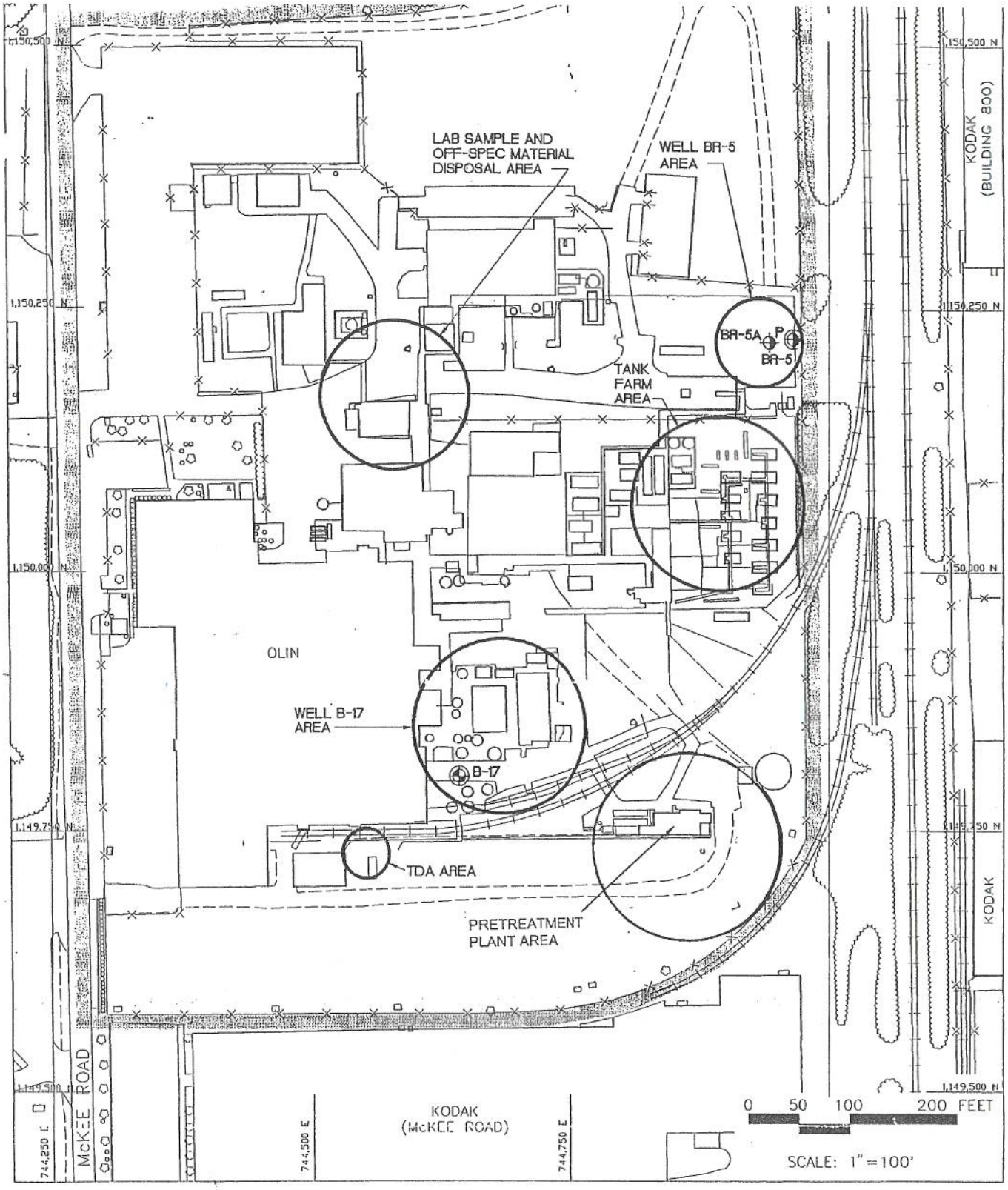
Figure 1 - Arch (former Olin) Chemicals Site Location Map



Base Map:

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



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LEGEND

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

FIGURE 2

LOCATION OF IDENTIFIED AND POTENTIAL CONTAMINANT SOURCE AREAS

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

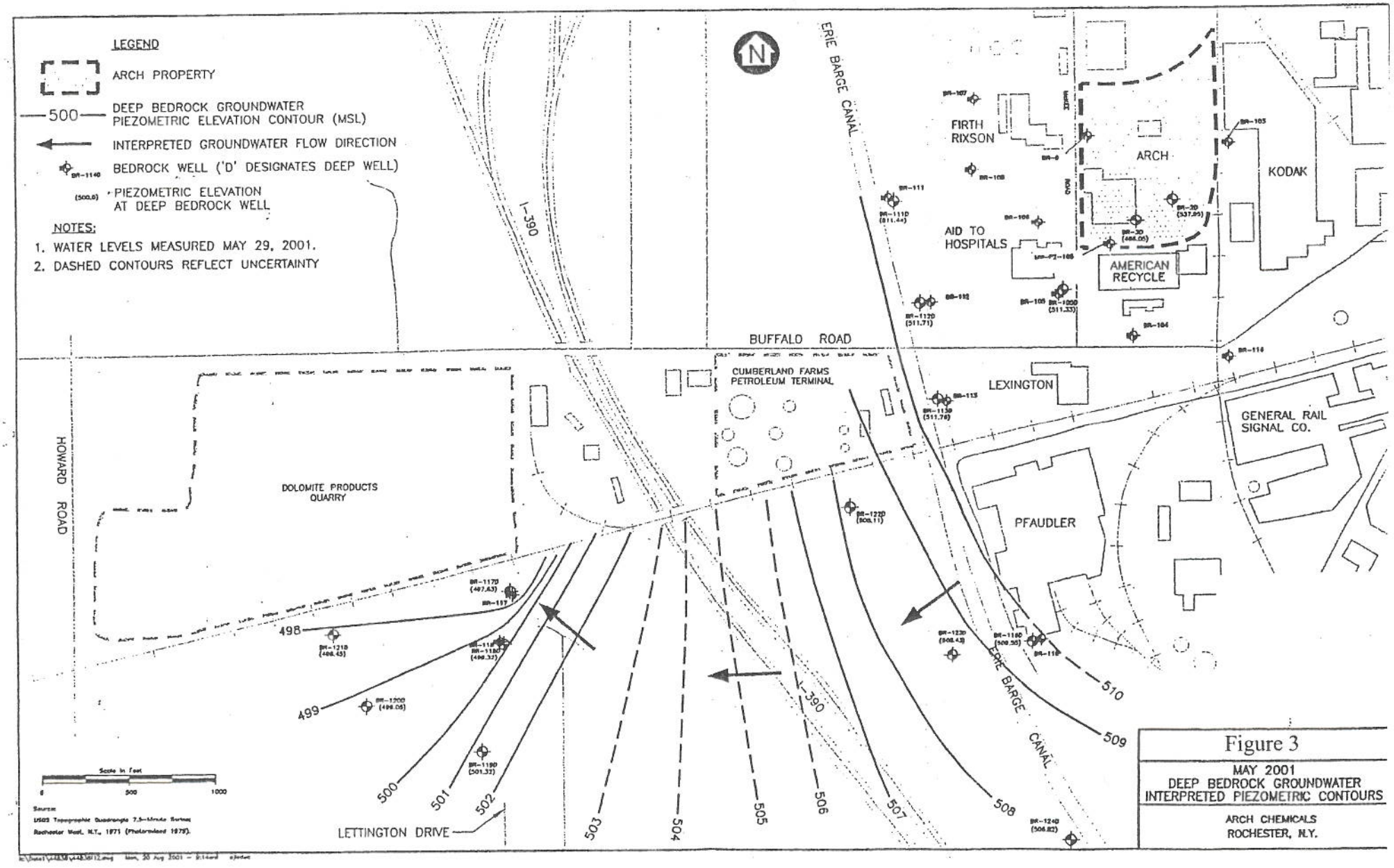

Figure 3

MAY 2001
DEEP BEDROCK GROUNDWATER
INTERPRETED PIEZOMETRIC CONTOURS

ARCH CHEMICALS
ROCHESTER, N.Y.

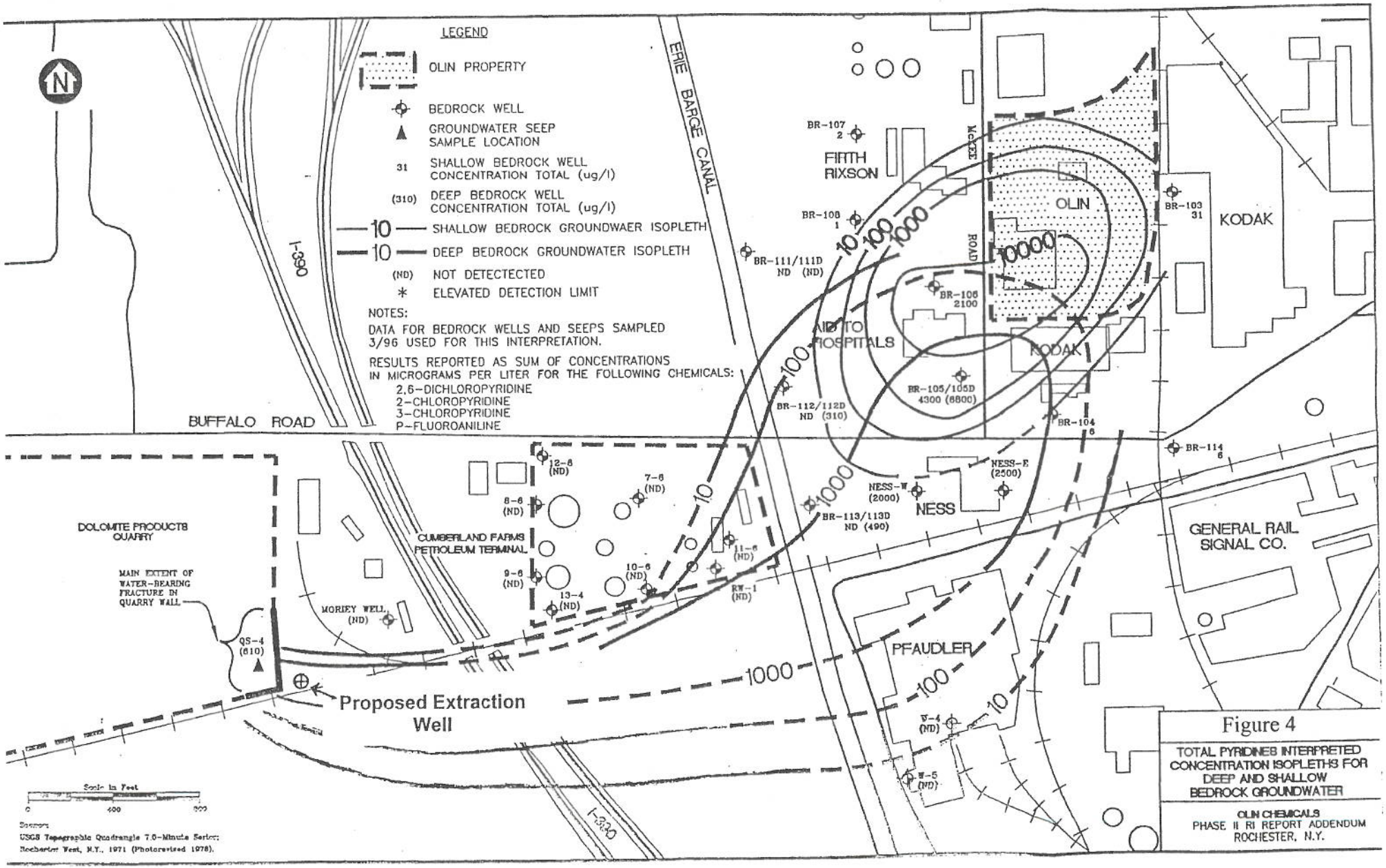

Figure 4

TOTAL PYRIDINES INTERPRETED CONCENTRATION ISOPLETHS FOR DEEP AND SHALLOW BEDROCK GROUNDWATER

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