RECORD OF DECISION SUMMARY

BYRON BARREL AND DRUM SITE

BYRON, GENESEE COUNTY, NEW YORK

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION II

NEW YORK

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ATTACHMENTS

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

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OCT 12 1989

Mr. Edward Belmore, P.E., Director
Bureau of Western Remedial Action
New York State Department of
Environmental Conservation
50 Wolf Road
Albany, N.Y. 12233-7010

Dear Mr. Belmore:

Enclosed, please find one copy of the Record of Decision (ROD) for the Byron Barrel and Drum Superfund site. The ROD was signed by Acting Regional Administrator William J. Muszynski on September 29, 1989.

I would like to take this opportunity to thank you and your staff for the assistance in preparing this ROD.

Sincerely yours,

William McCabe

William J. McCabe, Chief
New York/Caribbean Remedial Action Branch

Enclosure

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BUREAU OF WESTERN REMEDIAL ACTION
DIVISION OF HAZARDOUS
WASTE REMEDIATION

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Byron Barrel and Drum, Byron Township, Genesee County, New York

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Byron Barrel and Drum site. The selected remedial alternative was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Contingency plan (NCP). This decision is based on the administrative record for the site. The attached index identifies the items that comprise the administrative record upon which the selection of the remedial action is based.

The State of New York has concurred with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision, may present a current or potential threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy described in this document,in-situ soil flushing to remove volatile organic and inorganic contaminants from subsurface soils, represents the final remedial action for the site. It addresses residually contaminated soils at the site and contaminated groundwater in the underlying aquifer. Prior cleanup actions have resulted in the removal of drums containing hazardous substances and contaminated surface soil.

The major components of the selected remedy are:

- Performance of aquifer testing to assist in the optimization of the groundwater pumping and reinjection system;

- Dismantling of the maintenance building, and decontamination if necessary, with disposal of the debris at an off site landfill;

- Extraction and treatment of the groundwater via precipitation, sedimentation, and filtration to remove the heavy metals, and air-stripping and carbon adsorption to remove the volatile organics; underlying the site.

- Reinjection of treated groundwater to the aquifer and, if necessary, discharge of excess treated water to the closest surface water body;

- Further evaluation of elevated surface soil inorganic concentrations in an area where organic contamination is not present, to determine its ultimate disposition (i.e., off-site disposal or placement on the soil to be flushed);

- Disposal of the groundwater treatment residuals at an off-site Resource Conservation and Recovery Act Subtitle C disposal facility; and

- Appropriate environmental monitoring and review of the treatment process, including monitoring of residential wells, to ensure the effectiveness of the remedy.

DECLARATION

Consistent with CERCLA, as amended by SARA, and the NCP, I have determined that the selected remedy is protective of human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will not result in hazardous substances remaining on-site above health based levels, the five-year review will not apply to this action.

William J. Muszynski, P.E.
Acting Regional Administrator

9-29-89
Date

SITE NAME, LOCATION, AND DESCRIPTION

The Byron Barrel and Drum site is located in Genesee County, New York, approximately 3.6 miles northwest of the Township of Byron. The site occupies approximately 2 acres of an 8-acre parcel of property off Transit Road in a rural area (see Figure 1). Approximately 20 people live within one mile of the site. The nearest residence is approximately 0.2 miles from the site boundary. Two large vacant buildings are located on site.

The site was used as a salvage yard for heavy construction equipment such as graders, bulldozers, cement mixers, and cranes. Numerous pieces of such equipment are present on-site. In addition, metallic and nonmetallic debris litters the site. The site itself is relatively flat. Gravel was mined from a pit located on the site. The site is heavily vegetated except in the gravel pit and, to a lesser extent, along the access road.

The site is abutted by heavily wooded areas and is directly adjacent to an active vegetable farm. The agricultural land originated from swamp deposits and is locally referred to a "muckland." This land has been classified as prime agricultural land by the State of New York. The soils are apparently highly organic in nature.

The closest surface-water body is Oak Orchard Creek. It originates southwest of the site and flows in a generally northeasterly direction, approximately 1,000 feet west of the site.

Several large wetlands exist in the vicinity of the site. The nearest wetland is approximately 1 mile due south. In addition, a wildlife sanctuary, the Byron-Berge Swamp, exists approximately 4 miles to the east.

Groundwater is used as a potable water source by local residents and as a source of irrigation water by farmers.

The surficial geology of the region is characterized by glacial debris and drift deposited as part of the barred oscillation during the late Wisconsinan Age approximately 12,300 years ago. These deposits consist of eskers, moraines, terraces, coarse gravel and sand, low swampy basins, and muckland. Glacial till is characterized by silty clay and silty sand that is sparsely to moderately stony, very compact, and highly impermeable. The glacial till is generally found to be deposited directly on top of the bedrock.

The bedrock underlying the glacial till in this region is silurian in age and consists of massive argillaceous limestones, calcareous shales, and dolostones.

The natural overburden at the site consists of organic soil with silty sands that may incorporate finer or coarser material. This material comprises the aquifer of concern. The overburden is underlain by relatively impermeable glacial till that separates the over-burden and the underlying bedrock. The maximum depth at which bedrock was encountered was 99.5 feet, and the minimum depth was 72 feet. Groundwater encountered in the natural overburden ranged from less than 4 feet to more than 32 feet deep. Saturated thicknesses ranged from approximately 11.5 to 18.5 feet, caused by the undulating surface of the glacial till.

Groundwater flows in a north-northwest direction, eventually discharging to Oak Orchard Creek to the west.

A drainage system which prevents the water table from rising into the root zone of the crops is known to exist beneath the farmland adjacent to the site. Excess water collected via this system is discharged directly to Oak Orchard Creek.

Oak Orchard Creek flows northward, passes the site to the west, and terminates in low, swampy land after it exits the onion fields to the north. Oak Orchard Creek acts as a natural receiving channel for runoff from the onion fields. It contains standing water; the level of which changes with the increase/decrease of precipitation within the region.

Site History

The Byron Barrel and Drum site was discovered in early July 1982, when an unidentified individual reported the disposal of "approximately 400 55-gallon steel barrels that were filled with noxious-smelling chemicals" to the New York State Police Major Crimes Unit.

As a result of this report, a police investigation was initiated. A helicopter flight over the area on July 16, 1982 revealed the presence of a number of drums on the property. Further investigation revealed that Darrell Freeman, Jr., who owned the property, did not possess a permit from either the New York State Department of Environmental Conservation (NYSDEC) or the Environmental Protection Agency (EPA) for the storage or disposal of hazardous waste.

As a result of the investigation, a search warrant was issued. Two drum storage areas were located. The first area contained 121 barrels, and the second area contained 98 barrels. NYSDEC representatives obtained 11 drum waste samples during the search.

On July 23, 1982, various persons were interviewed regarding waste disposal activities at the site. A former employee of Mr. Freeman reported that he first noted approximately 80 drums on the Freeman property in the spring of 1978. These drums were located off the east side of the dirt road that runs through the Freeman property. The source further indicated that two more shipments of drums arrived at the site in the summer of 1979. These drums were unloaded and deposited at a site off to the west side of the dirt road behind a small clump of trees. These drum storage locations correspond to those identified during the police search. The source further reported that a fourth load of drums arrived sometime that summer. He did not witness their arrival, but noted that they were piled in front of two cement trucks in an area just south of the second disposal site.

Sometime during the fall of 1980, the source indicated that Mr. Freeman instructed him to go to the site of the fourth load of barrels and bury them. Apparently, Mr. Freeman instructed this individual to rip the drums open with a backhoe and bury them and mix them in with the dirt.

Wehran Engineering and Camp Dresser & McKee submitted a preliminary investigation report to NYSDEC in September 1983. The results of this investigation led to the site's inclusion on the Superfund National Priorities List in April 1984.

In March 1984, NYSDEC requested that EPA conduct an immediate removal action at the site with funds available under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Subsequently, EPA issued a notice to Mr. Freeman regarding the intent to conduct the removal operation. Mr. Freeman indicated that he wished to conduct the work on his own. When subsequent contact with Mr. Freeman and his attorneys did not result in progress on the action, EPA commenced removal work at the site in August, 1984.

The removal action included the removal and disposal of the drums and approximately 40 cubic yards of contaminated soil and debris. In addition, a monitoring well was installed near the burial area, and a groundwater sample was obtained. The removal action was completed by December 1984. Residential well sampling was conducted in the vicinity of the site in June 1986. Contaminants were not detected in the residential well samples.

In June 1987, a remedial investigation and feasibility study (RI/FS) was initiated at the site. The RI revealed that two major sources of contamination exist at the Byron Barrel and Drum site (see Figure 2). The first of these sources is located in the southwestern portion of a former drum storage and waste disposal area (Source Area 1). The second source is located in the southwestern portion of the property in the vicinity of the maintenance building (Source Area 2). This source is believed to

have originated from solvent spills. Subsurface contamination in both areas consists primarily of chlorinated aliphatic hydrocarbons, including 1,1,1-trichloroethane, 1,1-dichloroethane, trichloroethene, and 1,1-dichloroethene. In Source Areas 1 and 2, chromium and lead contamination was detected in soil samples in concentrations above background. Small quantities of elevated chromium and lead concentrations were also detected in surface soil samples from Source Area 3, which is located in the eastern portion of the site. No contamination with chlorinated aliphatics was detected in surface or subsurface soil in Source Area 3.

Groundwater contaminant plumes, consisting of chlorinated aliphatic hydrocarbons, were found to be originating from Source Areas 1 and 2. Source Area 2 also shows high levels of methyl ethyl ketone (MEK). There does not appear to be a groundwater contaminant plume emanating from Source Area 3.

Although groundwater in the vicinity of the site is used as a drinking water source, the hydrogeologic and groundwater quality investigations revealed that no migration of contaminants to the domestic wells has occurred.

ENFORCEMENT ACTIVITIES

In June 1984, EPA issued an Administrative Order requiring the property owner to take immediate corrective actions to clean up the site. The owner, however, did not comply with EPA's order.

In 1985, a Litigation Referral Package was prepared, requesting the initiation of a civil action against Mr. Freeman. This ongoing action seeks civil penalties, cost recovery, punitive treble damages, and a claim for future relief.

COMMUNITY PARTICIPATION

EPA and NYSDEC have kept the local citizens advised throughout the Superfund process at the Byron Barrel and Drum site.

The RI/FS report and the Proposed Plan for the site were released to the public in July 1989. These documents were made available to the public at information repositories maintained at the Gillam Grand Library and at the Byron Town Hall. A notice of availability from these documents was published in the Batavia Daily News on August 8, 1989. A public comment period was held from July 29, 1989 through August 31, 1989. In addition, a public meeting was held on August 16, 1989 to solicit comments on and to discuss the findings of the RI/FS report and the Proposed Plan. At this meeting, representatives from EPA and NYSDEC answered questions about the site and the remedial alternatives under consideration. Responses to comments and letters received during the public comment period, as well as questions raised at the public meeting,

public meeting, are summarized in the Responsiveness Summary, which is part of this Record of Decision (ROD).

SCOPE AND ROLE OF RESPONSE ACTION

Prior cleanup actions by EPA have already addressed most of the contamination at the Byron Barrel and Drum site. These actions have resulted in the removal of all drums and approximately 40 cubic yards of contaminated soil and debris. The low levels of soil contamination remaining at the site have been found to present minimal risk to human health. The remedy authorized by this ROD addresses the principal threat remaining at the site by treating the two plumes of contaminated groundwater, which currently exceed state and federal groundwater quality standards, and the low-level residual subsurface soil that has been releasing contaminants into the groundwater, through infiltra- tion of precipitation. In addition, inorganic concentrations above background levels in the groundwater and surface soil at the site will be addressed as part of the selected remedy.

The selected remedy will be a permanent solution for addressing the groundwater and the surface and subsurface soil contamination at the site. The federal and state groundwater quality standards will be achieved by removing the contaminants during treatment of the groundwater. Reinjection of the treated groundwater will remove contaminants from the surface and subsurface soils. Hence, the treatment of soils will result in the elimination of a long-term source of groundwater contamination, and it will mitigate the risk to public health and the environment associated with the migration of contaminants off-site.

The purpose of this response is to ensure protection of the groundwater from the continued release of contaminants from the soil, and to restore the groundwater to levels consistent with state and federal water quality standards. This will be the final response action for this site.

SUMMARY OF SITE CHARACTERISTICS

Approximately 200 55-gallon steel barrels that were filled with hazardous waste were abandoned at the Byron Barrel and Drum site from 1978 to 1980, when the site was used as a salvage yard for heavy construction equipment. Leakage and spillage from these drums appears to have been the primary source of contamination of the site. The drums and their contents were removed from the site by EPA in 1984. In addition, approximately 40 cubic yards of visibly-contaminated surface soil and debris were removed from the site during the same period.

Analyses of soil, groundwater, sediment, and surface water from the site and adjacent areas indicate that the environmental contamination at the Byron Barrel and Drum site consists primarily

of subsurface soil and groundwater contamination. Based on the absence of substantial soil contamination, it appears that the EPA removal action was effective in reducing contaminant releases. Chlorinated aliphatic hydrocarbons such as 1,1,1-trichloroethane, 1,1-dichloroethane, trichloroethene, and 1,1-dichloroethene are the primary contaminants. Various monocyclic aromatics such as toluene and xylenes were also detected, although groundwater contamination with these substances is minimal when compared to the contamination with chlorinated species.

SURFACE SOIL

A total of 25 surface soil samples were collected during the field investigation at the locations shown in Figure 3. The locations were selected based on the results of the soil-gas investigation and historical information. Of the 25 samples, 21 were collected on-site, and 4 were collected off-site to provide background information. Surface soil samples were collected to provide the necessary data to assess the risks posed by dermal contact, as well as to provide information on potential contamination migration via surface-water erosion of soil.

Surface soils at the Byron Barrel and Drum site contain only low levels of volatile organics (less than 50 parts per billion (ppb)), phthalate esters (less than 600 ppb), polynuclear aromatic hydrocarbons (less than 300 ppb), and benzoic acid (less than 500 ppb). By contrast, much higher concentrations of various pesticides, such as 4,4'-DDT, 4,4'-DDE, endrin, and dieldrin, were encountered. The highest concentrations of the pesticides were detected in surface soil samples which were collected from the adjacent farmland. On-site samples containing pesticides were obtained in proximity to the agricultural land and are believed to be present as a result of atmospheric transport of pesticides during their application to crops. Figure 3 summarizes the volatile organics detected in surface soil samples.

Although chromium and lead were detected in site surface soils above background, contamination with these substances is not pronounced. Figure 4 presents the analytical results for surface soil samples containing chromium and lead above background levels. As is evident from the Figure 4, chromium and lead contamination is greatest in Source Area 3.

Based on the results of a surface soil sampling program in Source Area 3, it is estimated that there are 1,100 cubic yards of contaminated soil in this area.

SUBSURFACE SOIL

As shown in Figure 5, test pits and trenches were dug at 46 locations, from which a total of 130 subsurface samples were

collected for analysis. No drums were detected in any of these test pits.

As shown in Figure 6, volatile organics were detected in subsurface soil samples at concentrations ranging from 5 ppb to 2,669 ppb. The most pronounced contaminants based on the mobile laboratory results are toluene, 1,1,1-trichloroethane, and trichloroethane. Concentrations of these ranged as high as 865 ppb, 551 ppb, and 2,669 ppb, respectively.

Twenty subsurface soil samples were also obtained. As can be seen by the analytical results summarized in Table 1, volatile organics are the primary contaminants detected, and toluene and trichloroethene were detected at relatively high concentrations (2,700 ppb and 2,800 ppb, respectively). In addition, several other volatile organics, notably xylenes and tetrachloroethene (PCE), were detected at high concentrations. Xylene concentrations ranged as high as 1,700 ppb, while PCE concentrations ranged as high as 4,400 ppb. All of these samples were collected from the southwestern portion of Source Area 1. In addition, phthalate esters were detected in several samples at concentrations ranging as high as 2,000 ppb (di-n-butylphthalate). Arochlor 1254 was detected in one test pit sample at a depth of 4 feet. PCBs were detected in drum samples collected by the NYSDEC prior to the removal action. The detection of PCB Arochlor 1254 at a concentration of 690 milligrams per kilogram (mg/kg) indicates that some release of PCBs occurred at the site. However, only one sample from Source Area 1 contained a PCB compound, and the available data indicate that PCB contamination is not extensive. PCBs were not identified in any of the other matrices sampled at the site (i.e., surface soil, sediment, groundwater, or surface water).

Based upon the sampling results in Source Area 1, it is estimated that there are 1,100 cubic yards of contaminated soil in this area.

The analytical results for subsurface soil samples obtained in Source Area 2 are depicted in Figure 7. Subsurface soil samples contained several chlorinated aliphatic hydrocarbons, including 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethene, 1,1-dichloroethene, and methylene chloride. TCA concentrations ranged as high as 410 ppb in these samples.

Based on the results of the subsurface soil sampling and analysis program in Source Area 2, it is estimated that approximately 3,000 cubic yards of contaminated unsaturated zone soil exists in this area.

Figure 8 depicts detections of chromium and lead above background soil concentrations. From this figure, it is apparent that subsurface contamination with these contaminants is not extensive in any of the source areas.

GROUNDWATER

The primary contaminant transport mechanism at the Byron Barrel and Drum site is associated with groundwater advection of dissolved contaminants. Two contaminant plumes originating in the vicinity of Source Areas 1 and 2 were noted to be migrating in the downgradient direction to the northwest. No evidence of contaminant migration toward residential wells to the southwest was observed during the RI. Based on the analytical results for monitoring well samples, it is apparent that these contaminant plumes are confined to the immediate proximity of the source areas. It is estimated that the contaminant plumes have migrated no further than 400 and 300 feet from the Source Areas 1 and 2, respectively. This phenomenon is a manifestation of the shallow hydraulic gradient and the relatively recent time frame of disposal activities (as late as 1982).

Four distinct rounds of groundwater sampling were conducted at the Byron Barrel and Drum site. The first two rounds were conducted during the course of the monitoring well installation program. The second complete sampling round included analysis for volatile organics. The analytical results for groundwater sampling rounds 3 and 4 are summarized in Tables 2 and 3, respectively.

As shown in Tables 2 and 3, a number of volatile organic chemicals were detected in site groundwater samples during the third and fourth sampling rounds. Volatile organics detected frequently and/or at high concentrations include 1,1,1-trichloroethane, 1,1-dichloroethane, tetrachloroethene, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethene. Concentrations of these compounds ranged as high as 4,400 ppb, 290 ppb, 82 ppb, 3,300 ppb, 41 ppb, and 110 ppb, respectively. Of these compounds, all but 1,2-dichloroethene are considered major site contaminants. Only one sample was found to contain 1,2-dichloroethene at a concentration above 1 ppb, which is the sample mentioned above. Methylene chloride was detected in one of three samples at a concentration of 2.8 ppb.

Figures 9 and 10 summarize the results for the predominant site groundwater contaminants for the third and fourth sampling rounds, respectively.

In addition to the organic contaminants detected in site groundwater samples, a number of inorganic constituents were detected above background levels. Table 4 provides a summary of the inorganic sample results for the upgradient monitoring well (MW-4A) versus the site monitoring well samples. Chemicals detected at concentrations significantly above background include aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, sodium, vanadium, and zinc. It should be noted that groundwater samples

were not filtered prior to acidification. Hence, these results are indicative of total inorganics in the water samples, including those present in suspended solids. The average concentrations presented in Table 4 indicate that there is little difference between the overall site concentrations and background levels. With the exception of sodium, mercury, and zinc, the average background concentrations exceed the site average values. Figure 11 displays the results for chromium and lead detected above background (upgradient) levels. Based on these results, it appears that lead contamination exists in all source areas.

The analytical results for groundwater samples collected during the supplemental activities are summarized in Figure 12. Groundwater contamination consists of chlorinated aliphatics and ketones. Organic contamination with 1,1,1-trichloroethane and MEK is most pronounced. Concentrations of TCA ranged as high as 2,500 ppb while concentrations of MEK ranged as high as 3,000 ppb.

The estimated extent of the contaminant plumes originating from Source Areas 1 and 2 is depicted in Figure 13. There is not a contaminant plume originating from Source Area 3.

SURFACE WATER AND SEDIMENT

Surface water and sediment samples obtained from a drainage ditch adjacent to the site property contained relatively low levels of organic chemicals. There is no evidence of any downstream impact on Oak Orchard Creek, the primary receiving surface water body. Several sediment samples from another drainage ditch that runs east to west, just north of the site, contained relatively high levels of toluene, acetone, and MEK. However, based upon surface drainage patterns and the absence of potential discharge of contaminated groundwater to this drainage channel, it is not believed that this contamination is site related.

SUMMARY OF SITE RISKS

Organic chemicals at the Byron Barrel and Drum site, that were apparently released through spillage and leakage of waste chemicals stored in above ground drums, have contaminated the soil and the groundwater underlying the site. Predominant transport routes identified for the migration of those contaminants to other environmental media include: 1) volatilization of the volatile organic compounds from the soil and subsequent releases (emissions) to air; 2) movement through soils (percolation) to groundwater; and 3) release to surface water, in the Oak Orchard Creek adjacent to the site, through discharge of the contaminated groundwater. Based on the nature of contamination at the Byron Barrel and Drum site and various site-specific conditions, only groundwater transport is considered a major contaminant migration route. The major portion of contamination is contained in saturated subsurface soils and groundwater.

CONTAMINANT IDENTIFICATION

The risk assessment for the site has identified 35 contaminants of concern. These include 16 non-carcinogenic and 19 carcinogenic compounds. Because chemicals having nonthreshold effects can cause adverse effects even at low concentrations, all of the organic carcinogenic substances detected in groundwater were included as indicator compounds, regardless of their frequency of occurrence or concentrations. With the exception of various pesticides, virtually all of the organic chemicals detected at the site and in the study area were included as indicator chemicals. Background levels of pesticides are substantially greater than any levels detected on site (i.e., approximately one order of magnitude). Several of the pesticides were detected only in background locations. Site samples containing pesticides were generally from locations near the adjacent farmland, suggesting that aerial application or spray application of pesticides on windy days resulted in the low-level pesticide contamination on-site. In view of the presence of background contamination, the various pesticides were not included as indicator chemicals.

Chromium and lead were included as indicator chemicals as a result of their detection in surface soils above background. In addition, polynuclear aromatic hydrocarbons and phthalate esters were included as a result of their presence in surface soils.

The indicator chemicals chosen for the Byron Barrel and Drum site are summarized in Table 5.

EXPOSURE ASSESSMENT

The following potential exposure routes were identified for the Byron Barrel and Drum site:

- Direct dermal contact at the source
- Accidental ingestion of contaminated soil at the source
- Inhalation of contaminated fugitive dust
- Inhalation of volatile emissions
- Household use of groundwater

Several other exposure routes were also considered for inclusion but were dismissed based on site-specific conditions. For example, root uptake of contaminants by the adjacent crops was considered possible. However, through direct visual inspection it was determined that the crops grown in the adjacent field have shallow root zones (i.e., less than six inches). The drainage system in the field appears to be effective in preventing groundwater from reaching the root zone.

Furthermore, exposure through contact and non-contact recreation in the surface water bodies were also discounted based on the size of the drainage ditches and Oak Orchard Creek.

For each of the exposure routes two cases are considered for each pathway; the first is a maximum-case scenario and the second is an average case scenario.

Direct Dermal Contact

The site is presently unfenced. Therefore, human receptors may come in direct contact with contaminated soil or waste. Trespassing adolescents and adult hunters are considered the most likely receptors via direct dermal contact.

Accidental Ingestion of Soil

Because the site is unfenced, it is considered possible that receptors may be exposed through accidental ingestion of contaminated soil. Pica ingestion is generally a tendency exhibited only by children of ages between 6 months and 6 years. Adult and adolescent receptors could also be exposed in an incidental manner through hand-to-mouth contact (e.g., smoking, eating, etc.).

Inhalation of Fugitive Dust

Human receptors reside in the vicinity of the Byron Barrel and Drum site. Although site vegetation will impede the emission of particulates via wind erosion, several sources may be susceptible to fugitive dust emission. Therefore, the potential for inhalation of fugitive dust exists in the vicinity of the site, and this contaminant release mechanism and subsequent exposure route was considered.

A particulate emission model suggested in the April 1989 EPA Superfund Exposure Assessment Manual was used to generate the downwind contaminant concentrations.

Inhalation of Volatile Emissions

Doses resulting from the inhalation of volatilized soil contaminants can be significant for downwind receptors. Although surface soil contamination appears negligible at the Byron Barrel and Drum site, this exposure route has also been considered.

Household Use of Groundwater

There are numerous routes of exposure associated with household use of contaminated water. Receptors may be exposed via ingestion and inhalation of volatiles emitted from showers, dishwashers, washing machines, and other turbulent sources, as well as through

dermal contact during bathing, dishwashing, car washing, etc. However, previous experience has shown that ingestion and inhalation of volatiles during showering are the predominant exposure mechanisms in the home. Dermal uptake is essentially negligible; similarly, doses incurred through inhalation from all other sources (i.e., dishwashers, washing machines, etc.) generally amount to less than 10 percent of the dose incurred through ingestion and shower inhalation. Therefore, only ingestion and inhalation of volatiles during showering are assessed quantitatively for this exposure route.

Three distinct groundwater use scenarios were considered: (1) doses based on maximum observed monitoring well concentrations; (2) doses based on average monitoring well concentrations; and (3) doses based on concentrations detected in distinct residential wells.

Table 6 provides a summary of the various exposure routes and input parameters considered.

TOXICITY ASSESSMENT SUMMARY

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

RISK CHARACTERIZATION SUMMARY

Risk characterization for the Byron Barrel and Drum site included an assessment of risk associated with exposures to non-carcinogens and carcinogens. Non-carcinogenic risks were assessed using a hazard index computed from expected daily intake levels (subchronic and chronic) and reference levels (representing acceptable intakes).

Potential carcinogenic risks were computed by multiplying chronic (long-term) intake levels to a respective carcinogenic potency factor.

The quantified carcinogenic and non-carcinogenic risk estimates associated with various soil and air exposure routes are summarized in Tables 7 and 8, respectively. Whereas, Tables 9 and 10 summarize the carcinogenic and non-carcinogenic risk estimates associated with the various groundwater use scenarios, including those based on maximum monitoring well concentrations, arithmetic average monitoring well concentrations, and maximum residential well concentrations.

Excess lifetime cancer risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$ or 1.0 E-06). An excess lifetime cancer risk of 1.0E-06 indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Potential concern for non-carcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

The context within which to judge the relative risk from each of the pathways has been established by EPA. For carcinogens, the target risk range is a E-07 to E-04 excess lifetime cancer risk. For non-carcinogens, where the sum of expected dose/Rfd ratios exceeds unity (1.0), observed concentrations pose unacceptable risks of exposure.

In conclusion, with the possible exception of inorganics located in Source Area 3, surficial contamination at the Byron Barrel and Drum site poses minimal risks to human receptors. The cumulative

Hazard Index from dermal contact, accidental ingestion, and inhalation of volatiles and dust is 4.9×10^{-3}, which is well below 1.0. The cumulative incremental cancer risk through these exposure routes is 6.5×10^{-7} (1 in 1.5 million), which falls well within the EPA target risk range of 10^{-7} to 10^{-4}.

The Hazard Index for groundwater use based on residential well concentrations is 2.2×10^{-1}, which is below unity. The incremental cancer risk for groundwater use based on residential well concentration is 3.4×10^{-7} (1 in 2.9 million), which falls well within the target risk range.

However, the Hazard Index for groundwater use based on maximum monitoring well concentrations exceeds 1.0. Therefore non-carcinogenic effects would be likely if the aquifer at the Byron Barrel and Drum Site were developed for potable use. Similarly, the incremental cancer risk based on maximum monitoring well concentrations exceeds the upper bound of the target risk range (2.4×10^{-3}). An incremental maximum cancer risk of 1 in 420 would be incurred if the aquifer is developed for potable purposes under future conditions.

ENVIRONMENTAL ASSESSMENT

Table 11 presents a comparison of the maximum contaminant concentrations in surface waters to the Federal Ambient Water Quality Criteria for the protection of aquatic life and to the state surface water standards. Oak Orchard Creek is currently a Class D stream but may be upgraded to Class C. Class D surface waters are suitable for contact recreation and allow for survival of aquatic life. Class C surface waters are suitable for fishing, contact recreation, and fish propagation. None of the organics were found at concentrations that exceed the Ambient Water Quality Criteria. Of the inorganics in the site surface waters, only copper exceeds the federal and state standards for chronic toxicity, based on a calculated hardness of 763 milligram per liter (mg/l). No acute standards are exceeded. In addition, the maximum concentrations of zinc and vanadium exceed the state standards for chronic toxicity to aquatic life. However, the stream is very small and receives runoff from a large area of agriculture. It is likely that aquatic life is more susceptible to the presence of pesticides.

During the course of the RI, it was noted that the aquatic ecosystem appears healthy (based on visual observations). No stressed flora or fauna were noted in either the drainage ditches or in Oak Orchard Creek. The site itself also appears to support a healthy population of mammals and reptiles. Species observed in the vicinity of the site included garter snakes, rabbits, white tail deer, and muskrats.

CLEANUP LEVELS FOR THE CONTAMINATED MEDIA

Cleanup levels based on public health and environmental concerns and on a review of Applicable or Relevant and Appropriated Requirements (ARARs) were developed at the Byron Barrel and Drum site. For both source control (soil cleanup) and management migration (groundwater cleanup) measures. ARARs were used to determine the appropriate extent of site remediation, to scope and formulate remedial response actions, and to govern the implementation and operation of the selected action. CERCLA requires that primary consideration be given to remedial response actions that attain or exceed ARARs. The purpose of this requirement is to make CERCLA response actions consistent with other pertinent federal and state environmental requirements.

A requirement under CERCLA may be either "applicable" or "relevant and appropriate" to a site-specific remedial action, but not both. Currently, the only enforceable regulatory standards promulgated under the Safe Drinking Water Act are the Maximum Contaminant Levels (MCLs) for the protection of human health. However, MCLs have not been specified for the majority of the indicator chemical at the site. Therefore, only regulatory guidelines were used for comparative purposes to infer health risks and environmental impacts. Relevant regulatory guidelines include Ambient Water Quality Criteria, Maximum Contaminant Level Goals (MCLGs), and EPA Drinking Water Health Advisories. The ARARs identified for the contaminated media at the Byron Barrel and Drum site are summarized below.

Soil

In order to provide protectiveness for future ingestion of groundwater, it is necessary to remediate volatile organic contaminants detected in the subsurface soil. The subsurface soil contamination does not pose a public health threat under existing or anticipated future conditions. There are not any ARARs for soil remediation, therefore, the cleanup levels have been derived so that contaminants must be remediated to concentrations where leaching into groundwater will result in levels below MCLs. Table 13 presents a range of cleanup goals for vadose zone subsurface soils.

The soil cleanup levels were back-calculated from groundwater cleanup levels using an unsaturated/saturated zone linkage model and theoretical distribution coefficients between the solid and aqueous phases.

The soil cleanup levels were compared to the contaminant concentrations identified in each soil boring sample. Any samples with contaminant concentrations below the cleanup levels are considered clean. The depth of contamination varies with each

borehole. For a conservative estimate, it is assumed that contamination has reached the groundwater table which is approximately eight feet deep with the Source Areas 1 and 2 and four feet in Source Area 3.

Groundwater

The groundwater at the Byron Barrel and Drum site was classified by New York State as class "GA", which indicates that the water is suitable as a drinking water supply. The RI has determined that contaminants from the site have contaminated the groundwater. The two existing groundwater plumes originating from Source Areas 1 and 2 present a risk of off-site migration of contaminants to the nearby Oak Orchard Creek. The remedial response action, therefore, includes the following:

- ensure protection of groundwater and surface water from the continued release of contaminants from soils; and

- restore groundwater to levels consistent with state and federal ARARs.

The federal and New York State ARARs associated with quality of groundwater suitable for drinking at the Byron Barrel and Drum site are listed in Table 13. A comparison of the concentrations of the contaminants of concern in the groundwater to these ARARs reveals that most volatile organic compounds exceed the regulatory concentrations. As a result, the groundwater cleanup levels should meet the most stringent of the federal and state ARARs listed in Table 13. For those compounds having only non-carcinogenic effects, cleanup levels have been derived so that the total non-carcinogenic risk (Hazard Index) does not exceed unity (i.e., a value of 0.9 was used as the target Hazard Index). The sources of each of the various cleanup levels are provided in footnotes to Tables 13.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or, the environment.

DOCUMENTATION OF SIGNIFICANT CHANGES

There are no significant changes from the preferred alternative presented in the Proposed Plan.

DESCRIPTION OF ALTERNATIVES

All of the drums and approximately 40 cubic yards of contaminated surficial soil and debris have been removed from the site. The levels of subsurface soil contamination on-site, with the possible exception of inorganics located in Source Area 3, present risk

levels which are within EPA's acceptable range. However, contaminants remaining at the site have contaminated the underlying groundwater, exceeding federal and state groundwater quality standards. Specifically, Source Area 1 and Source Area 2 are releasing organic contaminants into the groundwater through infiltration of precipitation. The two plumes exceed ARARs and pose a risk of off-site migration of contaminants to the nearby Oak Orchard Creek. There does not appear to be a groundwater contaminant plume emanating from Source Area 3. The alternatives described below address the remaining subsurface soil contamination at the site and the contamination in the groundwater underlying the site.

A total of eight alternatives were evaluated in detail for remediating the site. Five remedial alternatives address the contaminated subsurface soils that contribute to groundwater contamination at the Byron Barrel and Drum site. In addition, six alternatives address the contamination in the groundwater beneath the site. These alternatives are as follows:

ALTERNATIVE 1 - NO ACTION WITH MONITORING

The Superfund program requires that the "no-action" alternative be considered at every site. Under this alternative, EPA would take no further action to control the source of contamination. However, long-term monitoring of the site would be necessary to monitor contaminant migration. Monitoring can be implemented by using previously-installed monitoring wells and residential wells.

Because this alternative would result in contaminants remaining on-site, CERCLA requires that the site be reviewed every five years. If justified by the review, remedial actions would be implemented at that time to remove or treat the wastes.

The present worth cost of this alternative for a 20-year period is approximately $265,000. The time to implement this alternative is two months.

ALTERNATIVE 2 - DEED AND GROUNDWATER-USE RESTRICTIONS

This alternative would not require implementation of remedial actions to address groundwater or subsurface soil contamination. Deed restrictions would be imposed to prevent excavation in areas of contamination. Groundwater-use restrictions would be implemented in the affected area to prevent the use of contaminated groundwater for drinking or irrigation purposes. These institutional controls would also alert future property owners to potential site-related risks. A long-term monitoring program would also be implemented. Deed and groundwater restrictions can be implemented by state and local officials. Groundwater monitoring can be performed using previously-installed monitoring wells and residential wells.

The present worth cost of this alternative, for a 20-year period, is approximately $279,000. The time to implement this alternative would be 2 months.

ALTERNATIVE 3 - DEED RESTRICTIONS AND GROUNDWATER PUMPING, TREATMENT, AND DISCHARGE TO SURFACE WATER

This alternative would not require implementation of remedial actions to address subsurface soil contamination. Deed restrictions would be imposed to prevent excavation in areas of subsurface soil contamination. Groundwater would be collected using a series of extraction wells and pumped to an on-site treatment system.

To treat the volatile organic contaminants (VOCs) in the extracted groundwater, an air stripping column and activated carbon adsorber would be constructed at the site. The air and VOC mixture exiting the air stripper would be treated by a vapor phase carbon adsorption unit. The clean air would be emitted to the atmosphere. It is anticipated that a carbon adsorption unit would be necessary for the removal of the MEK, since air stripping would not remove this contaminant from the groundwater. In addition, inorganic contaminants in the groundwater would be removed by precipitation prior to air stripping. Discharge piping would be installed to pump the treated water to the drainage ditch located north of the onion field or to Oak Orchard Creek. All air and surface water discharges would comply with state and federal standards.

Environmental monitoring would be required during the life of the treatment process. In addition, monitoring of the groundwater at the site and its environs would continue for at least five years after the completion of the remediation to ensure that the goals of the remedial action have been met. Pre-construction, construction and post-construction air monitoring would also be performed.

The present worth cost of this alternative is approximately $4,874,000. The time to reduce the groundwater contaminant concentrations to levels based on ARARs is estimated to be 20 years.

ALTERNATIVE 4 - SOIL CAPPING AND GROUNDWATER PUMPING, TREATMENT, AND DISCHARGE TO SURFACE WATER

This alternative is similar to Alternative 3, except that synthetic membrane caps would be installed over the areas of soil contamination.

Under this alternative, the maintenance building would be dismantled, and decontaminated if necessary, and disposed of off-site. Prior to capping, the areas would be graded to control surface

water runoff and erosion. A protective soil cover would be placed over the synthetic membrane, topsoil would be spread, and the capped areas would be revegetated.

The groundwater pumping, treatment, and discharge scenario would be the same as that discussed for Alternative 3. Monitoring would be the same as in Alternative 3.

The present worth cost of this alternative is approximately $5,143,000. Two months would be required to construct the cap. The time to reduce the groundwater contaminant concentrations to levels based on ARARs is estimated to be 20 years.

ALTERNATIVE 5 - SOIL EXCAVATION AND OFF-SITE DISPOSAL AND GROUNDWATER PUMPING, TREATMENT, AND DISCHARGE TO SURFACE WATER

This alternative is similar to Alternatives 3 and 4, except that contaminated soil would be excavated and hauled to an off-site Resource Conservation and Recovery Act (RCRA) landfill for disposal.

Under this alternative, the maintenance building would be dismantled and decontaminated if necessary, and disposed of off-site. Contaminated subsurface soil would be excavated, loaded into trucks, and hauled to an approved off-site RCRA landfill for disposal. (So as to comply with RCRA land disposal requirements, treatment of the contaminated soil might be required prior to disposal.) The excavations would be backfilled with clean fill material from an off-site source. These areas would be covered with a layer of topsoil and revegetated.

The groundwater pumping, treatment, and discharge scenario would be the same as for Alternative 3. Monitoring would be the same as Alternative 3.

The present worth cost of this alternative is approximately $7,929,000. Two months will be required to remove the contaminated soil. The time to reduce groundwater contaminant concentrations to levels based on ARARs is 20 years.

ALTERNATIVE 6 - SOIL EXCAVATION AND THERMAL DESORPTION AND GROUNDWATER PUMPING, TREATMENT, AND DISCHARGE TO SURFACE WATER

This alternative is similar to Alternatives 3, 4, and 5, except that contaminated subsurface soil would be excavated and treated on-site using low-temperature thermal desorption to remove volatile organic contaminants.

Under this alternative, the maintenance building would be dismantled, and decontaminated if necessary, and disposed of off-site. Contaminated soil would be excavated and hauled to a mobile thermal desorption unit that would be set up at the site. Treated soil

would be used to backfill the excavations. The areas would be covered with a layer of topsoil and revegetated. Because of the presence of inorganic constituents in the soil, which thermal desorption would not remove, treatment of the residual by chemical fixation might be necessary before backfilling to comply with RCRA land disposal requirements.

The groundwater pumping, treatment, and discharge scenario would be the same as for Alternative 3. Monitoring would be the same as in Alternative 3.

The present worth cost of this alternative is approximately $6,899,000. Two months would be required to complete soil treatment. The time to reduce groundwater contaminant concentrations to levels based on ARARs is estimated to be 20 years.

ALTERNATIVE 7 - IN-SITU SOIL VAPOR EXTRACTION AND GROUNDWATER PUMPING, TREATMENT, AND DISCHARGE TO SURFACE WATER

This alternative is similar to Alternatives 3, 4, 5, and 6, except that contaminated subsurface soil would be treated by in-situ vapor extraction using air extraction and injection wells.

Under this alternative, the maintenance building would be dismantled and decontaminated if necessary, and disposed of off-site. Vapor extraction wells would be installed at the centers of Source Area 1 and 2. Air injection wells would be installed around the perimeters of the Source Areas 1 and 2. A vacuum would be induced and the air that would be collected would be treated using vapor-phase carbon adsorption. A synthetic membrane would be used to prevent air leakage from the soil surface between the air extraction and injection wells.

The groundwater pumping, treatment, and discharge scenario would be the same as for Alternative 3. Monitoring would be the same as Alternative 3.

The present worth cost of this alternative is approximately $5,200,000. Six months would be required to reduce soil contaminants to levles that would achieve groundwater ARARs. The time to reduce groundwater contaminant concentrations to levels based on ARARs would be 20 years.

ALTERNATIVE 8 - IN-SITU SOIL FLUSHING AND GROUNDWATER PUMPING, TREATMENT, AND RECHARGE

This alternative is similar to Alternative 3, except that a portion of the treated groundwater would be recharged to the aquifer in the areas of subsurface soil contamination. This alternative would attempt to restore groundwater quality and flush the residual contaminants from the subsurface soil.

The maintenance building would be dismantled, and decontaminated if necessary, and disposed of off-site.

Monitoring would be the same as for Alternative 3.

The present worth cost of this alternative is approximately $5,572,000. The time to reduce soil contaminant concentrations to levels that would achieve groundwater ARARs is estimated to be in 10 years. The time to reduce groundwater contaminant concentrations to levels based on ARARs is 20 years.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative is assessed against nine evaluation criteria, namely short-term effectiveness, long-term effectiveness and permanence, reduction of toxicity, mobility or volume, implementability, cost, compliance with applicable or relevant and appropriate requirements (ARARs), overall protection of human health and the environment, state acceptance, and community acceptance.

Each criterion will be briefly addressed, in order, with respect to the preferred alternatives for both soil and groundwater.

A. Overall Protection of Human Health and the Environment.

Alternative 8 would eliminate the potential risk to human health and the environment. The reinjection of treated groundwater into the aquifer would flush volatile organic contaminants from the subsurface soil, thereby eliminating the potential risk associated with any excavation under future land-use scenarios.

Alternatives 3, 4, 5, 6, 7, and 8 would be protective of human health and the environment, but Alternative 8 provides a higher degree of confidence in its ability to permanently remove the contaminants from the soil.

Under Alternatives 1, 2, and 3, residual subsurface contaminants would continue to leach into the groundwater, and continued off-site migration of contaminants would result.

The aquifer at the site has a low yield due to its low transmissivity. Because increasing the pumping rate would cause excessive drawdown of the water table, Alternatives 3, 4, 5, 6, 7, and 8 would take an estimated 20 years to decrease ground- water contaminant concentrations to levels based on ARARs. Alternative 1 would not reduce the present and future risk to human health and the environment. Although, under Alternative 2, the risk to human health would be potentially eliminated by restricting groundwater use and soil disturbance, the risk to the environment would remain unchanged.

B. Compliance with ARARs

All technologies proposed in Alternatives 3 through 8 would be designed and implemented to satisfy all action, contaminant, and location-specific requirements. Since no federal or New York State regulations specify clean-up levels for contaminants in the soil, soil cleanup levels were calculated such that the aquifer will be protective of public health and the environment. Alternative 8 would achieve the federal and state groundwater quality standards for the organic contaminants and would remove subsurface soil contamination. Alternatives 1 and 2 are not effective in complying with groundwater ARARs.

Alternative 1 would not comply with state or federal drinking water standards or criteria required for protection of the groundwater resources. This is in contrast to Alternative 2, which would not comply with chemical-specific ARARs for ingestion of groundwater, but would meet all other ARARs.

C. Long-term Effectiveness and Permanence

Alternative 8 would effectively treat the most mobile wastes in on-site soil, thus, effectively reducing the source of groundwater contamination. Alternative 8 is considered most effective since recirculating the groundwater would prevent potential aquifer drawdown and would enhance the removal of contaminants adsorbed to the saturated soil.

Under Alternative 6, which include excavation, thermal desorption, and back-filling, inorganic contamination in subsurface soil would not be removed. Hence, further treatment might be necessary before ultimate disposal of the soil could occur.

Alternatives 3 through 8 would effectively reduce the potential risks associated with the migration of contaminants in the groundwater by extracting and treating them. Alternative 3 would not be as effective in mitigating the leaching of subsurface soil contaminants with subsequent migration to groundwater.

Alternatives 1 and 2 would not be effective in mitigating potential risks associated with future development of the aquifer and future land-use scenarios, including excavation in areas of subsurface soil contamination. In addition, the contaminants would be left untreated in the subsurface soil and groundwater and a long-term monitoring program would be implemented to determine if the contamination was migrating from the site.

D. Reduction of Toxicity, Mobility, or Volume

Alternative 8, as well as Alternatives 3 through 7, would reduce the toxicity, mobility, and volume of the organic contaminants in

the groundwater. Under Alternative 8, the recharge of the treated effluent would result in in-situ flushing of subsurface soil contaminants that then would be collected by the extraction system and treated. In contrast, Alternatives 6 and 7 would reduce toxicity by in-situ vapor extraction and thermal treatment, respectively. Alternatives 3 through 5 do not employ treatment to reduce the toxicity, mobility, or volume of soil contaminants. However, in Alternative 4, capping would reduce the mobility of subsurface soil contaminants.

Alternatives 1 and 2 do not reduce the toxicity, mobility, or volume of contaminants.

E. Short-Term Effectiveness

Alternatives 4 through 8 would effectively reduce the potential risks posed by groundwater contamination. For all of the groundwater treatment remedies (Alternatives 3 through 8), an estimated pumping time of 20 years would be required to attain ARARs for groundwater.

Under Alternatives 4 through 8, dust may be generated during excavation and other material handling activities; therefore, dust control procedures would be needed. Air monitoring would be required to determine whether steps are needed to protect on-site workers and the general public from adverse air emissions.

Alternatives 3 through 8 include activities that could result in potential exposure of workers and residents to volatilized contaminants during the installation of the groundwater extraction and reinjection systems. The threat to on-site workers, however, would be mitigated through the use of protective equipment.

There would be minimal risk to the public and on-site workers during implementation of Alternatives 3 and 8. In contrast, Alternative 5 could pose a risk to the public if a spill occurred during off-site transport.

Groundwater sampling under Alternatives 1 and 2 would not result in a risk to the public, on-site workers, or the environment. However, workers would need protective clothing during sampling of on-site wells.

F. Implementability

The technologies and process options proposed in Alternatives 3 through 8 for pumping and treatment are all demonstrated and commercially available. These systems are reliable, if properly maintained.

All components of Alternative 8 utilize relatively common construction equipment and materials and could be easily

implemented. Also, in-situ soil flushing has been successfully pilot tested and has performed on a full-scale basis for similar organic contaminants. In contrast, the treatment technology for Alternative 7 (in-situ soil vapor extraction), although successfully demonstrated for the removal of volatile organics from unsaturated soil, has had limited use to date. Furthermore, in-situ soil vapor extraction is currently available from only a few vendors nationwide.

All components of Alternatives 1 and 2 would be relatively easy to implement. Groundwater monitoring can be performed using previously installed monitoring wells and residential wells.

Under Alternative 4, approximately 2 months would be required to construct the cap. It would take approximately 6 months to remove the contaminated soil under Alternative 5 (excavation and landfilling), Alternative 6 (excavation and thermal desorption), and Alternative 7 (in-situ vapor extraction). Under Alternative 3, the cap could be constructed within 2 months. It would take an estimated 10 years to remediate the soil under Alternative 8 (soil flushing). The groundwater treatment scenario for Alternatives 3 through 8 would require an estimated 20 years for the groundwater to meet state and federal standards.

Table 14 summarizes the implementation times for the eight alternatives for comparison purposes.

G. Cost

Only those technologies considered to be cost-effective and appropriate to the magnitude of the problem were considered for site remediation. Since groundwater pumping, treatment, and discharge scenarios, with the exception of Alternative 8 in which treated groundwater is reinjected into the aquifer, are similar for Alternatives 3 through 8, the estimated cost associated with groundwater remediation for any of these alternatives will be approximately $4,874,000. Therefore, the difference in cost within each alternative reflects the soil remediation component which varies from capping in Alternative 4 to excavation and off-site disposal in Alternative 5.

The capital cost of Alternative 8 (in-situ soil flushing) is estimated to be $1,917,000. Annual operation and maintenance costs are estimated to be $259,700. Alternative 8 is cost-effective because it has been determined to provide overall effectiveness proportional to its cost, the net present worth value being $5,572,000. The capital cost and present worth associated with Alternative 5 (off site disposal) are $3,899,00 and $7,929,000, respectively. The operation and maintenance costs for Alternative 5 are $285,800. It should be noted that Alternatives 5 and 8 are the only alternatives which address both organic and inorganic contamination present in both groundwater and subsurface soil.

Under Alternatives 4, 6, and 7 inorganic and organic contamination will be addressed in groundwater; however, only organic contamination will be addressed in subsurface soil. For Alternative 4 (capping) the capital cost will be $1,716,000, while the present worth cost will be $5,143,000. The operation and maintenance cost of capping will be $237,400. The associated capital cost and present worth for Alternative 6 (thermal treatment) will be approximately $3,319,000 and $6,899,000, respectively. The operation and maintenance costs for thermal treatment will be $249,700. As for in-situ vapor extraction, Alternative 7, capital cost and present worth will be $1,761,000 and $5,200,000, respectively. Operation and maintenance costs are estimated at $238,400 for the in-situ soil vapor extraction alternative.

Table 14 summarizes the costs for the eight alternatives for comparison purposes.

H. State Acceptance

Since groundwater in the vicinity of the site is used as a drinking water source, the primary remedial action objective for the Byron Barrel and Drum site is the restoration and protection of the aquifer. Remedial alternatives that restore contaminated groundwater to concentrations attaining federal and state standards, and to some extent ensure protection of groundwater and surface water from continued release of contaminants from soils, are preferred by the State of New York.

Accordingly, under Alternatives 3 through 8, the restoration of the aquifer at the site will be achieved by effectively treating and removing groundwater contaminants and, hence, by eliminating the potential risks to human health and the environment. However, NYSDEC has concurred that Alternative 8 represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for final remediation for the site.

I. Community Acceptance

Although groundwater ARARs are being violated at the site, the RI and risk assessment have indicated that the site does not pose a current threat to public health, since the contaminant plumes are not currently threatening residential wells. As a result, the community has expressed concern that remediation is unnecessary.

In addition, the Byron Town Board passed a resolution recommending that only institutional controls (deed restrictions in areas of subsurface soil contamination and groundwater use restrictions in the aquifer area) be employed at the site.

THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, both EPA and NYSDEC have determined that for Source Areas 1 and 2, Alternative 8, in-situ soil flushing and groundwater pumping, treatment, and recharge, is the most appropriate remedy for the Byron Barrel and Drum site.

The major components of the selected remedy are:

- Dismantling, and decontamination if necessary of the maintenance building, with disposal of the debris at an off-site landfill;

- Extraction and treatment of the groundwater, via precipitation, sedimentation, and filtration to remove the heavy metals, and air-stripping and carbon adsorption to remove volatile organics underlying the site.

- Reinjection of treated groundwater to aquifer and, if necessary, discharge of excess treated water to the closest surface water body;

- Further evaluation of elevated surface soil inorganic concentrations in Source Area 3, where organic contamination is not present, to determine its ultimate disposition (i.e., off site disposal or placement on the soil to be flushed);

- Disposal of the groundwater treatment residuals at an off-site RCRA Subtitle C disposal facility; and

- Appropriate environmental monitoring, including monitoring of residential wells, to ensure the effectiveness of the remedy.

Based upon modeling conducted during the RI/FS, it has been estimated that 20 years will be required to remediate the aquifer. Aquifer testing will be performed in an attempt to optimize the pumping and reinjection system so as to minimize the time required to remediate the aquifer. In addition, an annual review will be conducted of the plume removal so that the system can operate in the most efficient manner.

The contaminated media present at the Byron Barrel and Drum site that will be addressed under the selected remedy are:

- Unsaturated subsurface soil in Source Areas 1 and 2;

- Saturated subsurface soil and groundwater originating from Source Areas 1 and 2; and

- Surface soil in Source Area 3.

Contaminated groundwater will be removed from the sand and gravel unit of the aquifer by a system of extraction wells. It will be treated on-site using a combination of precipitation, sedimentation, and filtration for the removal of heavy metals, and air stripping and carbon adsorption for the removal of organic contaminants. Then, the treated groundwater will be reinjected into the aquifer underlying the site. The exact number and location of the extraction wells, the pumping routes, and the type of the reinjection system (wells, french trench, etc.) will be determined during the design phase.

Approximately 4,100 cubic yards of contaminated soil from Source Areas 1 and 2 will be treated via in-situ soil flushing. In addition, approximately 1,100 cubic yards of contaminated soil from Source Area 3 will be further evaluated during the remedial design to determine the ultimate disposition of the inorganic contamination.

Air monitoring will be performed prior to, during, and following construction at the site. Environmental monitoring will be required during the life of the treatment process.

While the levels of contaminants present in the subsurface soils do not pose a risk to public health, localized "hot spots" in Source Areas 1 and 2 may be contributing to the contamination of the aquifer. The concentrations of contaminants present in the aquifer exceed state and federal standards. Flushing the residual contaminants from the soil would prevent possible leaching of contaminants into the aquifer once groundwater treatment ceases.

Groundwater treatment will continue until the federal and state standards for the organic contaminations have been achieved and until the levels of inorganic constituents are returned to background.

Remediation Goals

The risk assessment has concluded that the Hazard Index for groundwater use based on maximum monitoring well concentrations exceeds 1.0. Therefore, non-carcinogenic effects would be likely if the aquifer at the Byron Barrel and Drum Site were developed for potable use. Similarly, the incremental cancer risk based on maximum monitoring well concentrations exceeds the upper bound of the target risk range (2.4×10^{-3}). An incremental maximum cancer risk of 1 in 420 would be incurred if the aquifer is developed for potable purposes under future conditions.

The purpose of this response action is to restore the groundwater underlying the site to levels consistent with state and federal ARARs and to ensure protection of the ground and surface water (in

Oak Orchard Creek adjacent to the site) from the continued release of contaminants from soils. Since no federal or state ARARs exist for soil remediation, the action level for the organic and inorganic contaminants in soil was determined through a site-specific analysis. This analysis used fate and transport modeling to determine levels to which contaminants in soils should be reduced in order to ensure no leaching of contaminants to groundwater above MCL levels.

STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedial action for this site must comply with applicable or relevant and appropriate environmental standards established under federal and state environmental laws unless a statutory waiver is justified. The selected remedy also must be cost effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment

The low levels of soil contamination remaining at the site, following the removal of all above-ground drums and 40 cubic yards of contaminated soil and debris, present minimal risk to human health. The selected remedy further protects human health and the environment through the removal and treatment of contaminants via precipitation, sedimentation, and filtration to remove inorganics and air stripping and carbon adsorption to remove organic contaminants in groundwater. In addition, treatment of the contaminated subsurface soils through the in-situ soil flushing process will remove the most mobile wastes from the soil, resulting in the elimination of a long-term source of groundwater contamination, and it will mitigate the risks to public health and the environment associated with the migration of those contaminants off-site. There are no short-term threats associated with the selected remedy that cannot be readily controlled.

Compliance With Applicable or Relevant and Appropriate Requirements

The selected remedy, in-situ soil flushing of contaminated soils along with air stripping and carbon adsorption of the groundwater will comply with all chemical-, action-, and location-specific ARARs.

Regulations in 40 CFR 144, the Underground Injection Control (UIC) program, may be appropriate for discharge of the treatment plant effluent to the subsurface. The UIC program prohibits injection activities that allow movement of contaminants into underground sources of drinking water, which may result in violations of MCLs or result in adverse health effects. The treatment plant was designed so that the effluent would meet 10^{-6} incremental cancer risks and a cumulative Hazard Index below unity. Because the groundwater recovery wells are designed to capture all released contaminants, and since the remedial action will continue until the remedial objectives for both groundwater and soil are attained, this alternative complies with the intent of the UIC program.

State ARARs include State Permit Discharge Elimination System regulations (6 NYCRR Part 750 through 758), groundwater quality standards (6 NYCRR 703.5), air regulations (6 NYCRR Parts 200, 201, 212, and 257), and effluent standards and/or limitations for discharge to groundwater (6 NYCRR Parts 703.6 and 703.7). ARARs and federal, and NY State Air Guide-1, and the treatment systems will be designed to meet state and federal monitoring during the remedial action would be conducted to demonstrate that remedial objectives for both subsurface soil and groundwater are obtained. guidelines for the control ambient air quality standards (40CFR 50.6, 50.7, 50.12) are also applicable.

Cost-Effectiveness

The selected remedy is cost effective because it has been determined to provide overall effectiveness proportional to its cost; the net present worth value being $5,572,000. The cost of the soil treatment component of the selected remedy is only 23 percent of the cost of the excavation and off-site disposal alternative and only 34 percent of the cost of the alternative involving on-site incineration, yet the selected remedy mitigates as effectively as those alternatives all the risks posed by the contaminants at the site. The cost of the groundwater component of the selected remedy is approximately $4,874,000, similar to the cost for the groundwater components of the other alternatives, offering the same degree of certainty with regard to the effective removal of all the organic and inorganic contaminants from the contaminated groundwater.

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

EPA and New York State have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final source control operable unit at the Byron Barrel and Drum site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA and

NYSDEC have determined that this selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, and cost, also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

The selected remedy is as effective as the other remedial action alternatives in the short-term offering the additional advantage of on-site treatment, thereby reducing potential risks to residents along transportation routes. The implementability of the selected remedy is comparable to the other alternatives. The selected remedy is also the least costly treatment option and also is less expensive than off-site disposal.

The selection of treatment of the contaminated groundwater is consistent with program expectations that indicate that highly toxic and mobile waste are a priority for treatment and often necessary to ensure the long-term effectiveness of a remedy. All the alternatives that consider remedial action are reasonably comparable with respect to long-term effectiveness and implementability, therefore, the major tradeoffs that provide the basis for the selection of the remedy are reduction in toxicity, mobility or volume, and cost effectiveness. The selected remedy can be implemented with less risk to the area of residents and at less cost than the other remedial action alternatives and is, therefore, determined to be the most appropriate solution for the contaminated groundwater at the Byron Barrel and Drum site.

With regard to implementability, the components of the selected remedy are easily implemented, proven technologies and are readily available.

Preference for Treatment as a Principal Element

By treating the contaminated soils via in-situ soil flushing and by treating the groundwater by air stripping and carbon adsorption the selected remedy addresses the principal threats posed by the site through the use of treatment technologies. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

APPENDIX 1 - TABLES

TABLE 1

OCCURRENCE AND DISTRIBUTION OF SUBSURFACE SOIL CONTAMINANTS
CONTRACT LABORATORY PROGRAM SAMPLES(1)
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Contaminant	Contract Required Detection Limit (CRDL) (µg/kg)	No. of Positive Detections/ No. of Samples	Concentration Range (µg/kg)(2)	Arithmetic Average Concentration (µg/kg)(3)	Geometric Mean Concentration (µg/kg)(4)
acetone	10	1/20	270	14	6.1
toluene	5	9/20	6.0-2,700	240	13
ethylbenzene	5	2/20	33-51	4.2	3.3
xylenes	5	3/20	7.0-1,700	89	4.3
1,1,1-trichloroethane	5	4/20	17-150	16.1	4.8
1,1,2-trichloroethane	5	1/20	12	0.6	2.7
tetrachloroethene	5	10/20	3.0-4,400	280	11
trichloroethene	5	10/20	13-2,800	220	18
1,1-dichloroethene	5	2/20	2.0-10	0.6	2.6
methylene chloride	5	5/20	25-190	24	5.8
1,3-dichloropropene	5	1/20	7	0.35	2.6
bis(2-ethylhexyl)phthalate	330	4/20	80-1,700	100	180
di-n-butylphthalate	330	8/20	1,200-2,000	700	420
naphthalene	330	1/20	95	4.8	160
pyrene	330	1/20	79	4.0	160
4,4'-DDT	16	1/20	12	0.6	8.2
4,4'-DDE	16	1/20	7	0.35	7.9
PCB 1254	160	1/20	690	35	89
aluminum	200	20/20	1,370-5,640	3,300	3,100
antimony	60	1/20	10.4	0.52	1.1
arsenic	10	17/20	1.3-2.9	1.7	1.8

TABLE 1
OCCURRENCE AND DISTRIBUTION OF SUBSURFACE SOIL CONTAMINANTS
CONTRACT LABORATORY PROGRAM SAMPLES(1)
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK
PAGE TWO

Contaminant	Contract Required Detection Limit (CRDL) (µg/kg)	No. of Positive Detections/ No. of Samples	Concentration Range (µg/kg)(2)	Arithmetic Average Concentration (µg/kg)(3)	Geometric Mean Concentration (µg/kg)(4)
barium	200	20/20	6.8-69	36	31
cadmium	5	1/20	1.2	0.06	1.0
calcium	5,000	20/20	1,670-91,600	39,000	26,000
chromium	10	9/20	1.7-15.5	2.7	2.1
cobalt	50	19/20	1.7-8.2	3.8	3.5
copper	25	17/20	3.2-12.8	6.7	5.5
iron	100	20/20	3,210-12,300	7,200	6,900
lead	5	10/20	4.7-22.6	4.6	2.8
magnesium	5,000	20/20	1,970-26,500	11,000	9,100
manganese	15	20/20	137-536	310	290
nickel	40	9/20	3.7-8.8	2.9	2.2
potassium	5,000	16/20	240-699	380	130
silver	10	2/20	57.7-144	10	1.6
sodium	5,000	11/20	61.4-756	77	12
vanadium	50	20/20	4.0-14.4	8.5	8.1
zinc	20	20/20	17.4-122	57	50

(1) Organic analyses conducted using EPA Methods 624 (volatiles), 625 (extractables), and 608 (pesticides/PCBs).
(2) Concentration range for positive detections only.
(3) Calculated using "ϕ" for nondetections.
(4) Calculated using 1/2 the CLP CRDL for nondetections.

TABLE 2

OCCURRENCE AND DISTRIBUTION OF GROUNDWATER CONTAMINANTS
ROUND 3 MONITORING WELL SAMPLES(1)
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Contaminant	Contract Required Detection Limit (CRDL) (µg/L)	No. of Positive Detections/ No. of Samples	Concentration Range (µg/L)(2)	Arithmetic Average Concentration (µg/L)(3)	Geometric Mean Concentration (µg/L)(4)
toluene	5	2/20	1.0	0.10	2.3
xylenes	5	3/20	2.0-3.0	0.35	2.5
1,3-dichlorobenzene	5	4/20	2.0-3.0	0.45	4.2
1,4-dichlorobenzene	5	1/20	2.0	0.10	4.8
1,1,1-trichloroethane	5	11/20	9.0-4,400	380	33
1,1-dichloroethane	5	10/20	1.0-290	18	4.5
tetrachloroethene	5	1/20	82	4.1	3.0
trichloethene	5	4/20	5.0-3,300	170	4.3
1,2-dichloroethene	5	1/20	110	5.5	3.0
1,1-dichloroethene	5	9/20	2.0-41	5.3	4.4
N-nitrosodiphenylamine	10	2/20	2.0	0.20	4.6
arsenic	10	20/20	2.0-26	9.6	7.8
barium	200	20/20	84-2,870	840	610
beryllium	5	5/20	3.0-5.0	0.90	2.7
cadmium	5	20/20	3.0-24	11	9.2
calcium	5,000	20/20	125,000-549,000	420,000	390,000

TABLE 2
OCCURRENCE AND DISTRIBUTION OF GROUNDWATER CONTAMINANTS
ROUND 3 MONITORING WELL SAMPLES(1)
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK
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Contaminant	Contract Required Detection Limit (CRDL) (µg/L)	No. of Positive Detections/ No. of Samples	Concentration Range (µg/L)(2)	Arithmetic Average Concentration (µg/L)(3)	Geometric Mean Concentration (µg/L)(4)
chromium	10	19/20	13-89	40	33
cobalt	50	20/20	5.0-105	31	23
copper	25	20/20	31-618	160	110
iron	100	20/20	5,794-44,300	28,000	25,000
lead	5	20/20	13-260	97	73
magnesium	5,000	20/20	34,200-151,000	91,000	83,000
manganese	15	20/20	552-9,460	3,900	3,000
mercury	0.2	5/20	0.2-0.5	0.07	0.13
nickel	40	20/20	30-144	71	64
potassium	5,000	20/20	2,580-8,920	4,400	4,100
silver	10	1/20	6	0.30	5.0
sodium	5,000	20/20	3,300-37,900	11,000	7,900
vanadium	50	18/20	12-54	27	27
zinc	20	20/20	62-2,020	570	380

(1) Organic analyses conducted using EPA Methods 624 (volatiles), 625 (extractables), and 608 (pesticides/PCBs).
(2) Concentration range for positive detections only.
(3) Calculated using "ϕ" for nondetections.
(4) Calculated using 1/2 the CLP CRDL for nondetections.

TABLE 3

OCCURRENCE AND DISTRIBUTION OF GROUNDWATER CONTAMINANTS
ROUND 4 MONITORING WELL SAMPLES(1)
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Contaminant	Method Detection Limit (MDL) (µg/L)	No. of Positive Detections/ No. of Samples	Concentration Range (µg/L)(2)	Arithmetic Average Concentration (µg/L)(3)	Geometric Mean Concentration (µg/L)(4)
benzene	0.2	1/20	0.50	0.025	2.3
toluene	0.2	5/20	0.3-1.0	0.14	1.7
chlorobenzene	0.2	2/20	0.046-0.22	0.013	1.8
1,2-dichlorobenzene	0.4	1/20	0.026	0.0013	2.0
1,3-dichlorobenzene	0.4	2/20	0.02-0.041	0.003	1.6
1,4-dichlorobenzene	0.3	8/20	0.016-0.91	0.054	0.46
1,1,1-trichloroethane	0.03	11/20	15-760	150	26
1,1,2-trichloroethane	0.02	8/20	0.013-3.7	0.19	0.49
1,1-dichloroethane	0.07	11/20	0.12-16	3.5	2.7
tetrachloroethene	0.03	1/20	51	2.6	2.9
trichloroethene	0.12	4/20	5.9-2,800	140	4.2
1,2-dichloroethene	0.10	1/20	0.93	0.047	2.4
1,1-dichloroethene	0.13	11/20	0.46-6.1	1.6	2.4
vinyl chloride	0.18	1/20	0.06	0.003	4.0
chloroform	0.05	3/20	0.026-0.13	0.0095	1.4
bromodichloromethane	0.10	2/20	0.021-0.024	0.0022	1.6
2-chloroethylether	0.13	1/20	60	3.0	5.7
aluminum	200	20/20	1,460-279,000	51,000	24,000
arsenic	10	1/20	41.3	2.1	5.6
barium	200	20/20	120-5,230	870	480

TABLE 3
OCCURRENCE AND DISTRIBUTION OF GROUNDWATER CONTAMINANTS
ROUND 4 MONITORING WELL SAMPLES(1)
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK
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Contaminant	Method Detection Limit (MDL) (µg/L)	No. of Positive Detections/ No. of Samples	Concentration Range (µg/L)(2)	Arithmetic Average Concentration (µg/L)(3)	Geometric Mean Concentration (µg/L)(4)
beryllium	5	20/20	1.1-22.6	4.3	2.8
cadmium	5	3/20	4.7-21.4	1.8	3.1
calcium	5,000	20/20	71,4000-2,070,000	460,000	290,000
chromium	10	20/20	37.8-479	130	100
cobalt	50	18/20	7.5-377	57	33
copper	25	20/20	9.5-2,110	350	120
iron	100	20/20	2,530-666,000	110,000	50,000
lead	5	18/20	4.5-631	110	35
magnesium	5,000	20/20	10,900-500,000	120,000	78,000
manganese	15	20/20	132-19,800	3,300	1,600
mercury	0.2	3/20	0.40-0.70	0.085	0.13
nickel	40	20/20	8.9-606	120	75
potassium	5,000	20/20	1,710-35,300	11,000	8,100
silver	10	11/20	4.1-8.9	2.7	4.9
sodium	5,000	19/20	2,110-50,800	11,000	7,700
vanadium	50	20/20	4.5-574	110	51
zinc	20	20/20	24.6-7,580	1,300	370

(1) Organic analyses conducted using EPA Methods 601/602 (volatiles).
(2) Concentration range for positive detections only.
(3) Calculated using "0" for nondetections.
(4) Calculated using 1/2 the CLP CRDL for nondetections.

TABLE 4

INORGANIC RESULTS FOR UPGRADIENT AND
SITE GROUNDWATER SAMPLES
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Chemical	Maximum Concentration (µg/l)		Average Concentration (µg/l)(3)	
	Upgradient(1)	Site(2)	Upgradient(1)	Site(2)
aluminum	58,900	279,000	29,450	28,072
arsenic	8.0	24	4.0	3.967
barium	1,490	5,230	1,159.5	1,003.3
beryllium	4.6	22.6	4.3	2.8
cadmium	20	24	10	6.8
calcium	549,000	2,070,000	494,000	449,160
chromium	171	479	130	87.8
cobalt	65	377	64.05	48.8
copper	406	2,110	395	295.4
iron	159,000	666,000	96,300	77,575
lead	170	631	147.5	117.96
magnesium	151,000	500,000	147,000	102,932
manganese	8,340	19,800	5,755	3,939
mercury	-	0.7	-	0.0933
nickel	143	606	141.5	97.38
potassium	12,900	35,300	9,500	7,475
silver	6.0	8.9	5.6	1.3
sodium	9,370	50,800	9,190	10,769
vanadium	129	574.0	87	72.2
zinc	917	7,580	835	1,116

(1) Upgradient samples from MW-4A.
(2) Site samples do not include wells 4A, 11B, 12B, 13B, or 14B.
(3) Average concentrations determined using only one of any two duplicate samples collected.

TABLE 5

INDICATOR CHEMICALS
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Carcinogens	Noncarcinogens
benzene	acetone
1,4-dichlorobenzene	2-butanone
1,1,2-trichloroethane	4-methyl-2-pentanone
1,1-dichloroethane	toluene
1,2-dichloroethane	xylenes
tetrachloroethene	chlorobenzene
trichloroethene	1,2-dichlorobenzene
1,1-dichloroethene	1,3-dichlorobenzene
carbon tetrachloride	phenol
chloroform	4-methylphenol
methylene chloride	di-n-butyl phthalate
chloromethane	1,1,1-trichloroethane
bromodichloromethane	1,2-dichloroethene
chlorodibromomethane	benzoic acid
benzo(a)pyrene	chromium
benzo(a)anthracene	lead
benzo(b)fluoranthene	
bis(2-ethylhexyl)phthalate	
N-nitrosodiphenylamine	

TABLE 6

EXPOSURE ROUTES AND INPUT PARAMETERS
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Matrix	Exposure Route	Input Parameters
Soil	Dermal Contact	Maximum Surface Soil Concentrations Average Surface Soil Concentrations Soil Adherence Factor: 1 mg/cm^2 Exposed Surface Area of Skin: Adult - 2,950 cm^2 Adolescent - 2,330 cm^2 Relative Absorption Fraction: Volatiles - 10% Semivolatiles - 5% Inorganics - 5% Body weight: Adult - 70 kg Adolescent - 45 kg Exposure Frequency: 30 days/year
Soil	Accidental Ingestion	Maximum Surface Soil Concentrations Average Surface Soil Concentrations Soil Ingestion Rate: 100 mg/day Body Weight: Adult - 70 kg Adolescent - 45 kg Exposure Frequency: 30 days/year
Air	Dust Inhalation	Maximum Surface Soil Concentrations Average Surface Soil Concentrations Breathing Rate: Adult - 20 m^3/day Child - 10 m^3/day Disturbance Frequency: 30 events/month Vegetative Cover Factor: 0 Source Surface Area: 400 m^2 Body Weight: Adult - 70 kg Child - 10 kg Exposure Frequency: 365 days/year

TABLE 6
EXPOSURE ROUTES AND INPUT PARAMETERS
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK
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Matrix	Exposure Route	Input Parameters
Air	Volatile Inhalation	Maximum Surface Soil Concentrations Average Surface Soil Concentrations Breathing Rate: Adult - 20 m^3/day Child - 10 m^3/day Source Surface Area: 2,000 m^2 Body Weight: Adult - 70 kg Child - 10 kg Exposure Frequency: 365 days/year
Water	Ingestion/Inhalation	Maximum Monitoring Well Concentrations Average Monitoring Well Concentrations Maximum Residential Well Concentrations Ingestion Rate: Adult - 2 L/day Child - 1 L/day Inhalation Rate: Adult - 20 m^3/day Child - 10 m^3/day Body Weight: Adult - 70 kg Child - 10 kg Exposure Frequency: 365 days/year

TABLE 7

NONCARCINOGENIC RISK ESTIMATES
SOIL AND AIR EXPOSURE ROUTES
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Indicator Chemical	Dose/Reference Dose							
	Dermal Contact(1)		Accidental Ingestion(1)		Dust Inhalation(2)		Volatile Inhalation(2)	
	Maximum-Case	Average-Case	Maximum-Case	Average-Case	Maximum-Case	Average-Case	Maximum-Case	Average-Case
1,1,1-trichloroethane	9.5×10^{-9}	3.5×10^{-10}	4.1×10^{-9}	1.5×10^{-10}	4.9×10^{-12}	1.8×10^{-13}	2.4×10^{-5}	8.8×10^{-7}
tetrachloroethene	3.0×10^{-7}	1.1×10^{-8}	1.3×10^{-7}	4.7×10^{-9}	5.1×10^{-11}	1.9×10^{-12}	2.6×10^{-5}	9.7×10^{-7}
trichloroethene	-(3)	-	-	-	-	-	-	-
chloroform	8.5×10^{-8}	1.1×10^{-8}	3.7×10^{-8}	4.7×10^{-7}	-	-	-	-
benzoic acid	2.6×10^{-8}	3.0×10^{-9}	2.2×10^{-8}	2.6×10^{-9}	-	-	-	-
benzo(a)anthracene	-	-	-	-	-	-	-	-
benzo(b)fluoranthene	-	-	-	-	-	-	-	-
benzo(a)pyrene	-	-	-	-	-	-	-	-
bis(2-ethylhexyl)phthalate	5.9×10^{-6}	9.0×10^{-7}	5.0×10^{-6}	7.7×10^{-7}	-	-	-	-
di-n-butyl phthalate	1.4×10^{-7}	1.6×10^{-8}	1.2×10^{-7}	7.4×10^{-9}	-	-	-	-
chromium (III)	1.7×10^{-4}	1.5×10^{-5}	1.5×10^{-4}	1.3×10^{-5}	-	-	-	-
lead	4.1×10^{-3}	2.6×10^{-4}	3.5×10^{-4}	2.3×10^{-4}	-	-	-	-
Total (Hazard Index)	4.3×10^{-3}	2.8×10^{-4}	5.1×10^{-4}	2.4×10^{-4}	5.6×10^{-11}	2.1×10^{-12}	5.0×10^{-5}	1.9×10^{-6}

(1) Risk estimates based on adolescent receptors exposed at the source.
(2) Risk estimates based on child receptors exposed at downwind locations.
(3) - Not applicable: Reference Dose unavailable for ingestional and/or inhalational exposure.

TABLE 8

CARCINOGENIC RISK ESTIMATES
SOIL AND AIR EXPOSURE ROUTES
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Indicator Chemical	Incremental Cancer Risk							
	Dermal Contact(1)		Accidental Ingestion(1)		Dust Inhalation(2)		Volatile Inhalation(2)	
	Maximum-Case	Average-Case	Maximum-Case	Average-Case	Maximum-Case	Average-Case	Maximum-Case	Average-Case
1,1,1-trichloroethane	-	-	-	-	-	-	-	-
tetrachloroethene	7.1×10^{-11}	2.6×10^{-12}	2.4×10^{-11}	8.9×10^{-13}	2.8×10^{-15}	1.0×10^{-16}	1.4×10^{-9}	5.3×10^{-11}
trichloroethene	1.8×10^{-10}	4.4×10^{-12}	3.5×10^{-11}	1.5×10^{-12}	7.3×10^{-14}	3.1×10^{-15}	1.7×10^{-7}	7.2×10^{-9}
chloroform	2.4×10^{-12}	3.1×10^{-13}	8.2×10^{-13}	1.1×10^{-13}	1.9×10^{-14}	2.5×10^{-15}	1.3×10^{-7}	1.7×10^{-8}
benzoic acid	-	-	-	-	-	-	-	-
benzo(a)anthracene	1.7×10^{-9}	6.2×10^{-11}	1.1×10^{-9}	4.2×10^{-11}	1.1×10^{-12}	4.0×10^{-14}	5.3×10^{-16}	2.0×10^{-17}
benzo(b)fluoranthene	2.2×10^{-8}	1.5×10^{-9}	1.5×10^{-8}	9.9×10^{-10}	1.4×10^{-11}	9.4×10^{-13}	1.5×10^{-13}	9.9×10^{-15}
benzo(a)pyrene	1.1×10^{-8}	4.2×10^{-10}	7.7×10^{-9}	2.9×10^{-10}	7.3×10^{-11}	2.7×10^{-12}	8.6×10^{-15}	3.2×10^{-16}
bis(2-ethylhexyl)phthalate	7.6×10^{-10}	1.2×10^{-10}	5.2×10^{-10}	8.0×10^{-11}	-	-	-	-
di-n-butyl phthalate	-	-	-	-	-	-	-	-
chromium (III)	-	-	-	-	-	-	-	-
lead	-	-	-	-	-	-	-	-
Total	3.6×10^{-8}	2.1×10^{-9}	2.4×10^{-8}	1.4×10^{-9}	2.9×10^{-7}	3.7×10^{-8}	3.0×10^{-7}	2.4×10^{-8}

(1) Risk estimates based on adult receptors exposed at the site.
(2) Risk estimates based on adult receptors exposed at downwind locations.
(3) - Not applicable: Surface soil indicator chemical has no known carcinogenic effects or will not be subject to volatile emissions (metals).

TABLE 9

NONCARCINOGENIC RISK ESTIMATES
GROUNDWATER USE
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Indicator Chemical	Dose/Reference Dose		
	Maximum Monitoring Well Concentrations(1)	Average Monitoring Well Concentrations(2)	Residential Well Concentrations
benzene	-(3)	-	-
toluene	1.1×10^{-4}	1.6×10^{-5}	-
xylenes	1.7×10^{-4}	2.0×10^{-5}	-
chlorobenzene	1.1×10^{-3}	1.8×10^{-4}	-
1,2-dichlorobenzene	2.8×10^{-6}	1.4×10^{-7}	-
1,4-dichlorobenzene	-	-	-
1,1,2-trichloroethane	2.6×10^{-3}	1.4×10^{-4}	-
1,1,1-trichloroethane	1.6×10^{0}	1.5×10^{-1}	-
1,2-dichloroethane	-	-	-
1,1-dichloroethane	8.3×10^{-2}	5.0×10^{-3}	-
tetrachloroethene	2.5×10^{-1}	1.2×10^{-2}	7.5×10^{-4}
trichloroethene	-	-	-
1,1-dichloroethene	1.3×10^{-1}	1.7×10^{-2}	-
vinyl chloride	-	-	-
carbon tetrachloride	-	-	3.8×10^{-4}

TABLE 9
NONCARCINOGENIC RISK ESTIMATES
GROUNDWATER USE
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK
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Indicator Chemical	Dose/Reference Dose		
	Maximum Monitoring Well Concentrations(1)	Average Monitoring Well Concentrations(2)	Residential Well Concentrations
chloroform	1.5×10^{-3}	2.7×10^{-5}	-
methylene chloride	1.3×10^{-3}	-	-
bromodichloromethane	-	-	-
dibromochloromethane	2.0×10^{-5}	-	-
N-nitrosodiphenylamine	-	-	-
chromium	1.4×10^{-2}	2.5×10^{-3}	-
lead	1.3×10^{1}	2.4×10^{0}	8.2×10^{-2}
Total (Hazard Index)	1.5×10^{1}	2.6×10^{0}	8.3×10^{-2}

(1) Based on four rounds of monitoring well sampling and analysis.
(2) Based on round 3 and round 4 monitoring well sampling and analysis.
(3) - Not applicable: No Reference Dose available or contaminant not detected.

TABLE 10

CARCINOGENIC RISK ESTIMATES
GROUNDWATER USE
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Indicator Chemical	Incremental Cancer Risk		
	Maximum Monitoring Well Concentrations(1)	Average Monitoring Well Concentrations(2)	Residential Well Concentrations
benzene	4.0×10^{-7}	2.0×10^{-8}	-
toluene	-(3)	-	-
xylenes	-	-	-
chlorobenzene	-	-	-
1,2-dichlorobenzene	-	-	-
1,4-dichlorobenzene	7.8×10^{-7}	3.9×10^{-9}	-
1,1,2-trichloroethane	5.0×10^{-6}	2.6×10^{-7}	-
1,1,1-trichloroethane	-	-	-
1,2-dichloroethane	9.4×10^{-7}	-	-
1,1-dichloroethane	4.3×10^{-4}	2.6×10^{-5}	-
tetrachloroethene	7.1×10^{-5}	3.5×10^{-6}	2.2×10^{-7}
trichloroethene	1.0×10^{-3}	5.0×10^{-5}	9.7×10^{-8}
1,1-dichloroethene	9.3×10^{-4}	1.2×10^{-4}	-
vinyl chloride	2.5×10^{-6}	1.2×10^{-7}	-
carbon tetrachloride	-	-	3.1×10^{-8}

TABLE 10
CARCINOGENIC RISK ESTIMATES
GROUNDWATER USE
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK
PAGE TWO

Indicator Chemical	Incremental Cancer Risk		
	Maximum Monitoring Well Concentrations(1)	Average Monitoring Well Concentrations(2)	Residential Well Concentrations
chloroform	4.4×10^{-7}	8.1×10^{-9}	-
methylene chloride	7.5×10^{-7}	-	-
bromodichloromethane	4.9×10^{-7}	4.7×10^{-9}	-
dibromochloromethane	1.9×10^{-7}	-	-
N-nitrosodiphenylamine	1.6×10^{-7}	1.6×10^{-8}	-
chromium	-	-	-
lead	-	-	-
Total	2.4×10^{-3}	2.0×10^{-4}	3.4×10^{-7}

(1) Based on four rounds of monitoring well sampling and analysis.
(2) Based on round 3 and round 4 monitoring well sampling and analysis.
(3) - Not applicable: Contaminant not detected or noncarcinogenic.

TABLE 11

COMPARISON OF MAXIMUM SURFACE WATER CONTAMINANT CONCENTRATIONS
AND AMBIENT WATER QUALITY CRITERIA
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Chemical	Maximum Surface Water Concentration (µg/L)	Ambient Water Quality Criteria(1) (µg/L)		NY State Surface Water Standard (µg/L)	
		Acute	Chronic	Class D	Class C
toluene	9	17,500	--		
1,1,1,-trichloroethane	7	18,000	--		
1,2-dichloroethene	0	11,600	--		
chloromethane	39	11,000	--		
phenol	13	10,200	2,560	5.0	5.0
4-methylphenol	62	--	--		
arsenic	31.9	360	190	360	190
copper	97	120	67	120	67
lead	28.2	1,082	48	1,082	48
nickel	17	7,913	880	8,641	448
vanadium	51			190	14
zinc	391	654	592	1,735	30

(1) Ambient water quality criteria for the protection of freshwater aquatic life. Inorganics are based on a calculated hardness of 763 mg/L.

TABLE 12

SOURCE CONTROL (SOIL) CLEANUP LEVELS
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Chemical	Soil Cleanup Level (µg/kg)		
	ARAR-Based(1)	Risk-Based (10^{-6})(2)	Risk-Based (10^{-4})(3)
ethylbenzene	56,000	52,000 (5)	52,000 (5)
toluene	45,000	36,000 (5)	36,000 (5)
xylenes	8,200	58,000 (5)	58,000 (5)
1,1,1-trichloroethane	2,300	5,500 (5)	5,500 (5)
tetrachloroethene	140 (4)	8.4	840
trichloroethene	47	4.9	490

(1) Cleanup level based on groundwater cleanup level corresponding to the MCL or MCLG unless otherwise noted.
(2) Cleanup level based on a cumulative incremental cancer risk of 10^{-6} (groundwater use) unless noted otherwise.
(3) Cleanup level based on a cumulative incremental cancer risk of 10^{-4} (groundwater use) unless noted otherwise.
(4) Cleanup level based on an assumed groundwater cleanup level of 5 µg/l (similarity to other chlorinated aliphatics)
(5) Cleanup level based on a Hazard Index below 1 (i.e., 0.9).

TABLE 13

MANAGEMENT OF MIGRATION (GROUNDWATER) CLEANUP LEVELS
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Chemical	ARAR-Based(1) (µg/l)
benzene	5/ND(2)
toluene	2,000(50)(3)
xylenes	440(50)
chlorobenzene	488(20)(4)
1,2-dichlorobenzene	620/4.7
1,4-dichlorobenzene	75/4.7
1,1,2-trichloroethane	5(0.6)(5)
1,1,1-trichloroethane	200(50)
1,2-dichloroethane	5(0.8)
1,1-dichloroethane	5(50)(5)
tetrachloroethene	5(0.7)(6)
trichloroethene	5/10
1,1-dichloroethene	7(0.07)
vinyl chloride	2/5
chloroform	100/100
methylene chloride	100(50)
bromodichloromethane	100(50)
chlorodibromomethane	100(50)
N-nitrosodiphenylamine	4.9(50)(4)
2-butanone	172(7)
carbon tetrachloride	5

(1) ARAR-based cleanup levels based on MCLs/MCLGs unless noted otherwise.
(2) The first value is the Federal ARAR-based value. The second is the State Ambient Water Quality Standard for Class GA groundwater (ND - not detectable).
(3) Value in parentheses is the State Ambient Water Quality guideline.
(4) AWQC for the protection of public health through drinking water exposure.
(5) Based on MCL/MCLG for 1,2-dichloroethane.
(6) Based on MCL/MCLG for trichloroethene.
(7) EPA Lifetime Drinking Water Health Advisory.

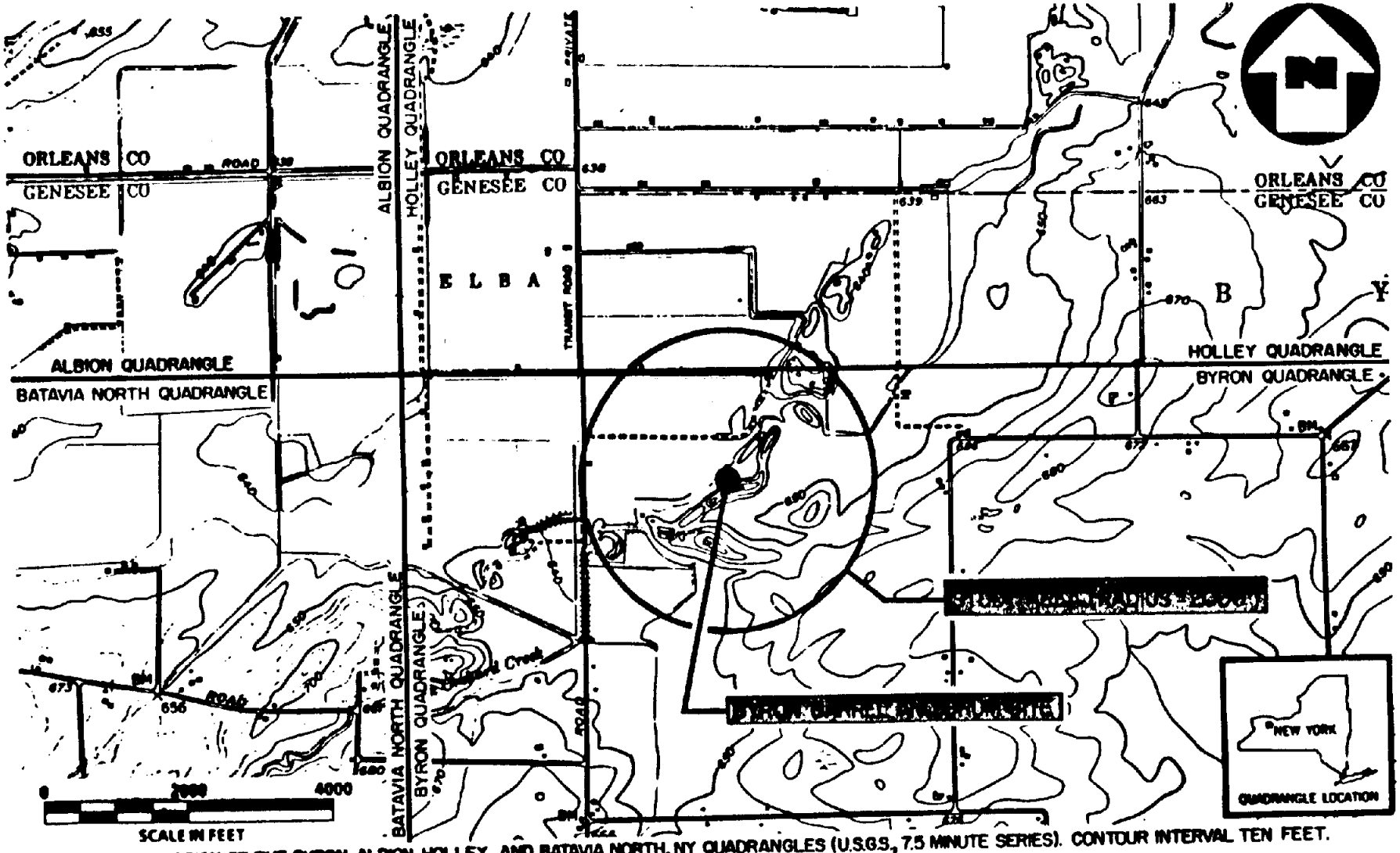
TABLE 14

COMPARATIVE COST ANALYSIS OF ALTERNATIVES
BYRON BARREL AND DRUM SITE
BYRON, NEW YORK

Alternative 1 No Further Action with Monitoring	Alternative 2 Deed and Groundwater Use Restrictions	Alternative 3 Groundwater Pumping, Treatment, and Discharge to Surface Water	Alternative 4 Capping, Groundwater Pumping, Treatment, and Discharge to Surface Water
COSTS			
Capital: $0	Capital: $15,000	Capital: $1,506,000	Capital: $1,716,000
Annual O&M: $13,600	Annual O&M: $13,600	Annual O&M: $232,700	Annual O&M: $237,400
Present Worth: $265,000	Present Worth: $279,000	Present Worth: $4,874,000	Present Worth: $5,143,000
TIME TO IMPLEMENT			
Soil: -	Soil: -	Soil: -	Soil: 2 months
Groundwater: -	Groundwater: -	Groundwater: 20 years	Groupdwater: 20 years

Alternative 5 Offsite Disposal, Groundwater Pumping, Treatment, and Discharge to Surface Water	Alternative 6 Thermal Treatment, Groundwater Pumping, Treatment, and Discharge to Surface Water	Alternative 7 In-Situ Vapor Extraction, Groundwater Pumping, Treatment, and Discharge to Surface Water	Alternative 8 In-Situ Soil Flushing, Groundwater Pumping, Treatment and Discharge to the Subsurface
COSTS			
Capital: $3,899,000	Capital: $3,319,000	Capital: $1,761,000	Capital: $1,917,000
Annual O&M: $285,800	Annual O&M: $249,700	Annual O&M: $238,400	Annual O&M: $259,700
Present Worth: $7,929,000	Present Worth: $6,899,000	Present Worth: $5,200,000	Present Worth: $5,572,000
TIME TO IMPLEMENT			
Soil: 2 months	Soil: 2 months	Soil: 6 months	Soil: <10 years
Groundwater: 20 years	Groundwater: 20 years	Groundwater: 20 years	Groundwater: 20 years

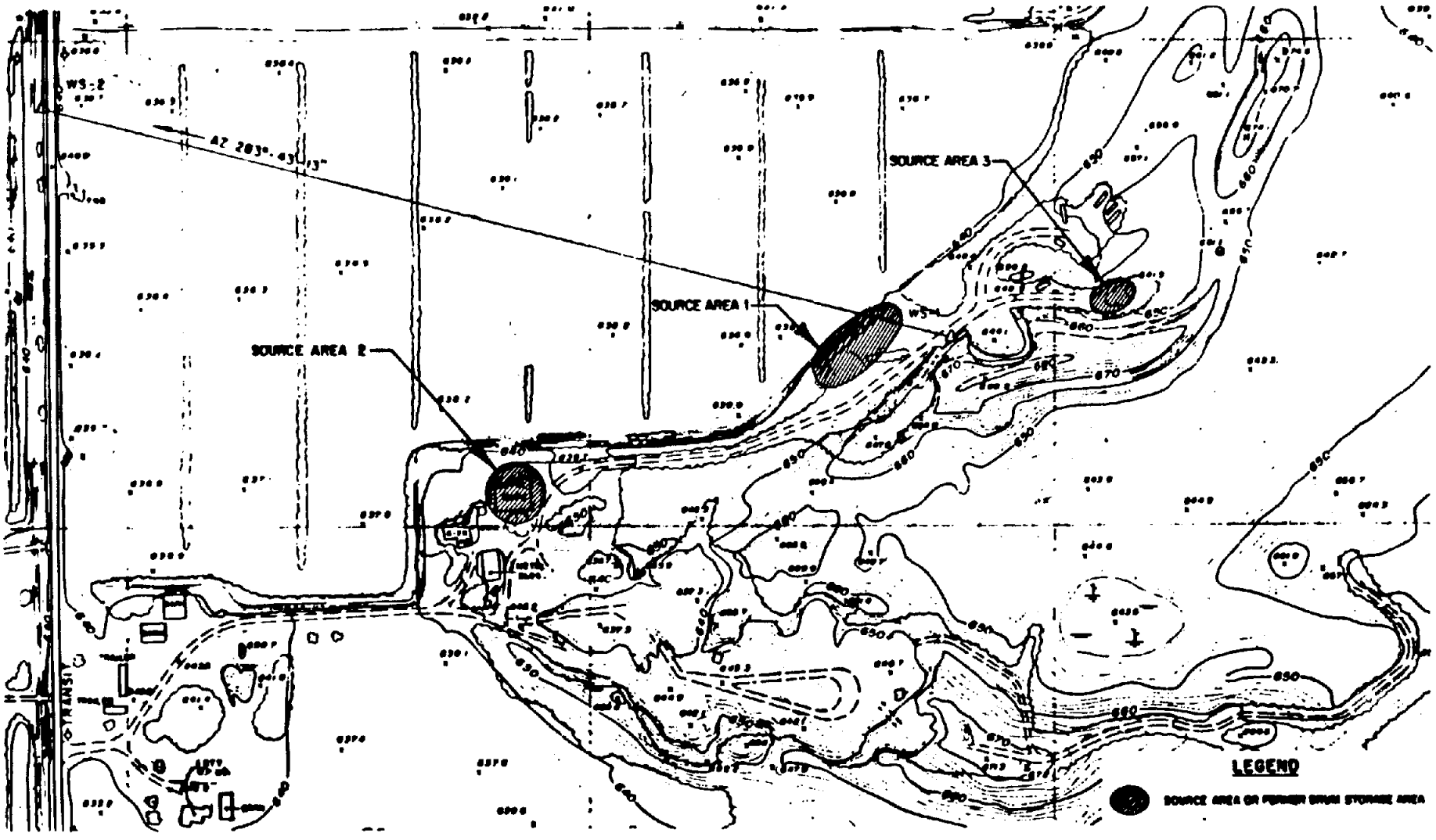
APPENDIX 2 - FIGURES



BASE MAP IS A PORTION OF THE BYRON, ALBION, HOLLEY, AND BATAVIA NORTH, NY QUADRANGLES (U.S.G.S., 7.5 MINUTE SERIES). CONTOUR INTERVAL TEN FEET.

FIGURE 1

LOCATION MAP
BYRON BARREL AND DRUM SITE, BYRON, NY



LOCATION OF SOURCES/FORMER DRUM STORAGE AREAS
BYRON BARREL AND DRUM SITE, BYRON, NY

SCALE IN FEET

FIGURE 2

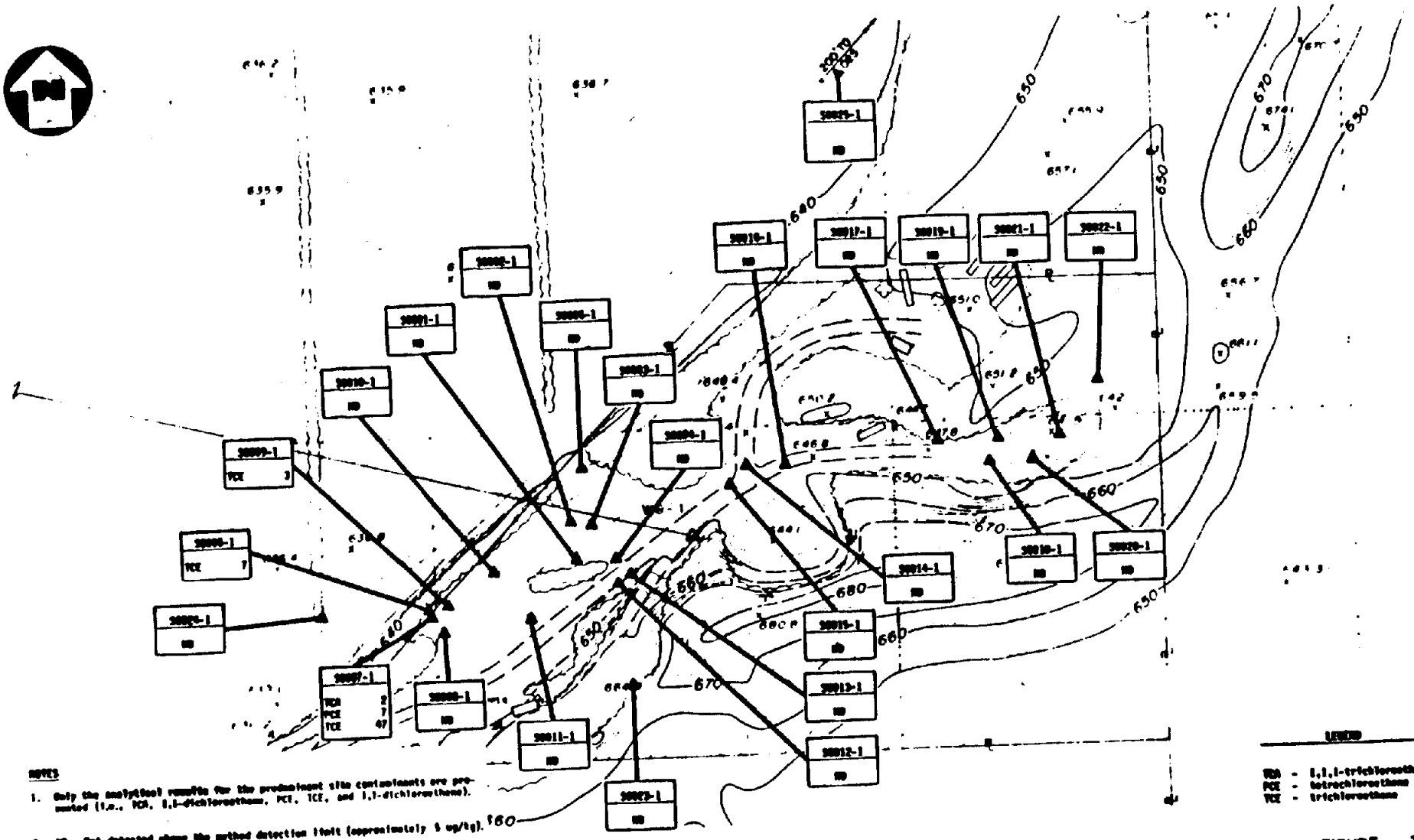


FIGURE 3

CHLORINATED ALIPHATIC SURFACE SOIL CONTAMINATION (ug/kg)
BYRON BARREL AND DRUM SITE, BYRON, NY

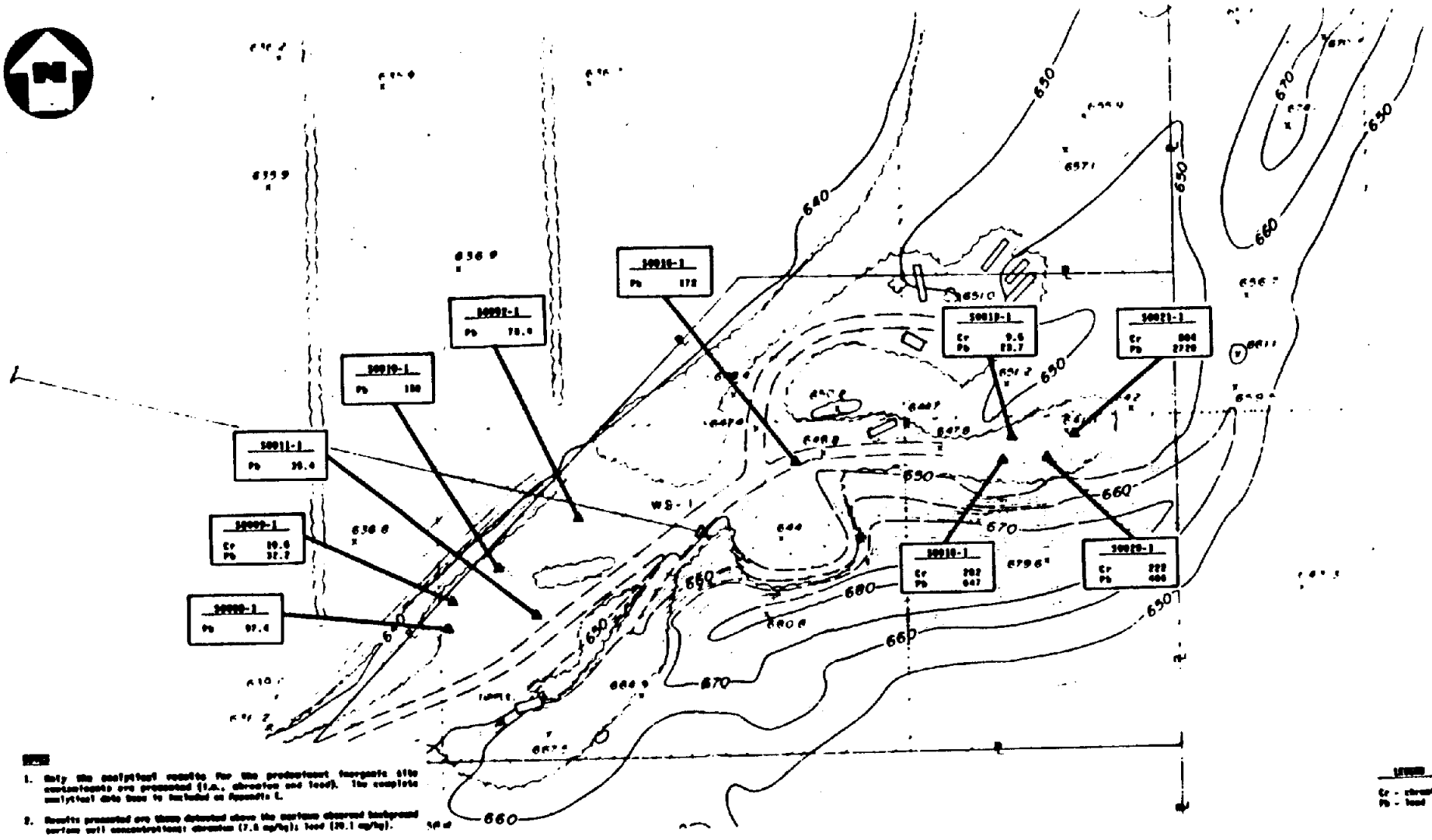


FIGURE 4

INORGANIC SURFACE SOIL CONTAMINATION (mg/kg)
BYRON BARREL AND DRUM SITE, BYRON, NY

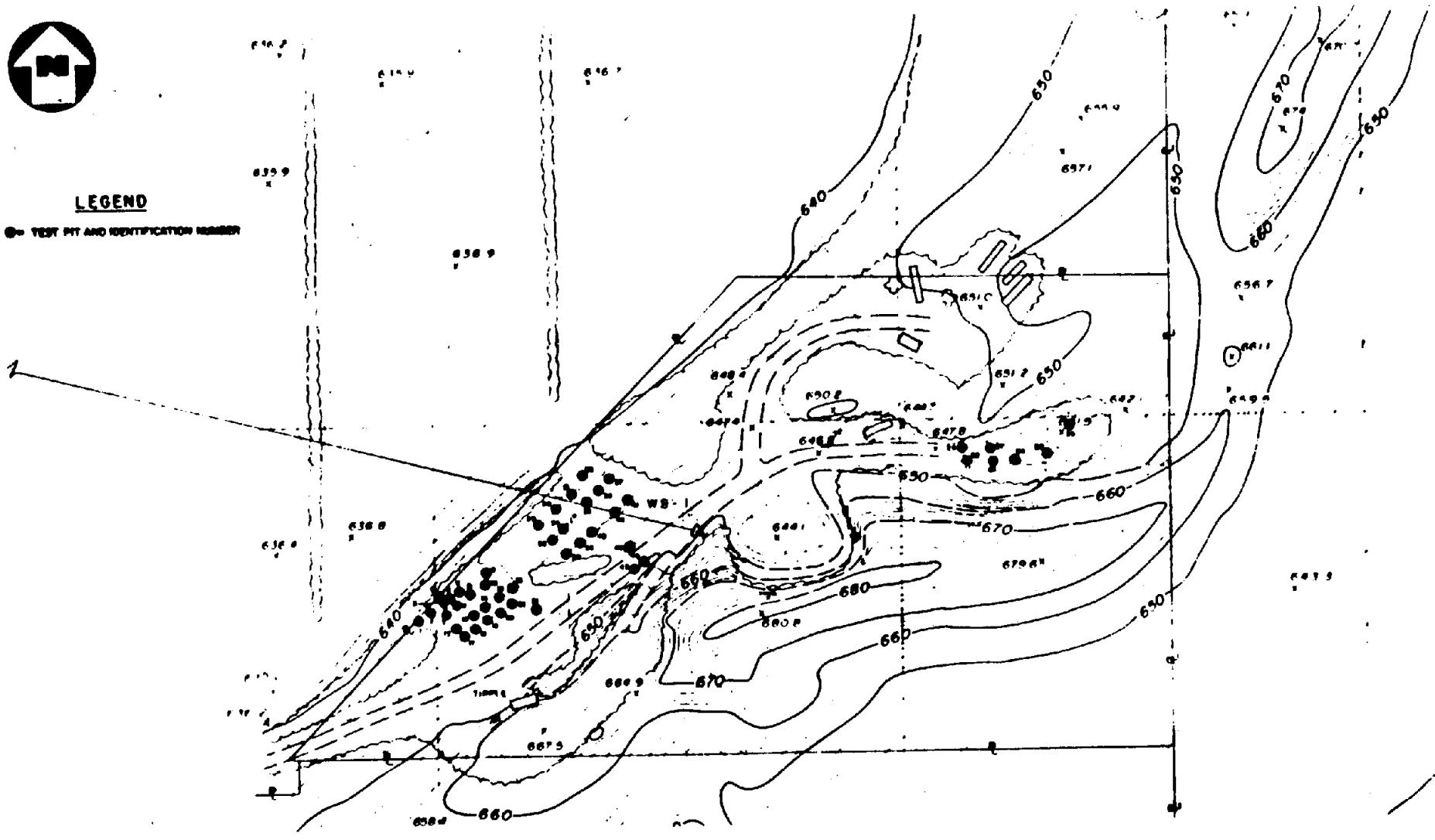


FIGURE 5

LOCATION OF TEST PITS
BYRON BARREL AND DRUM SITE, BYRON, NY

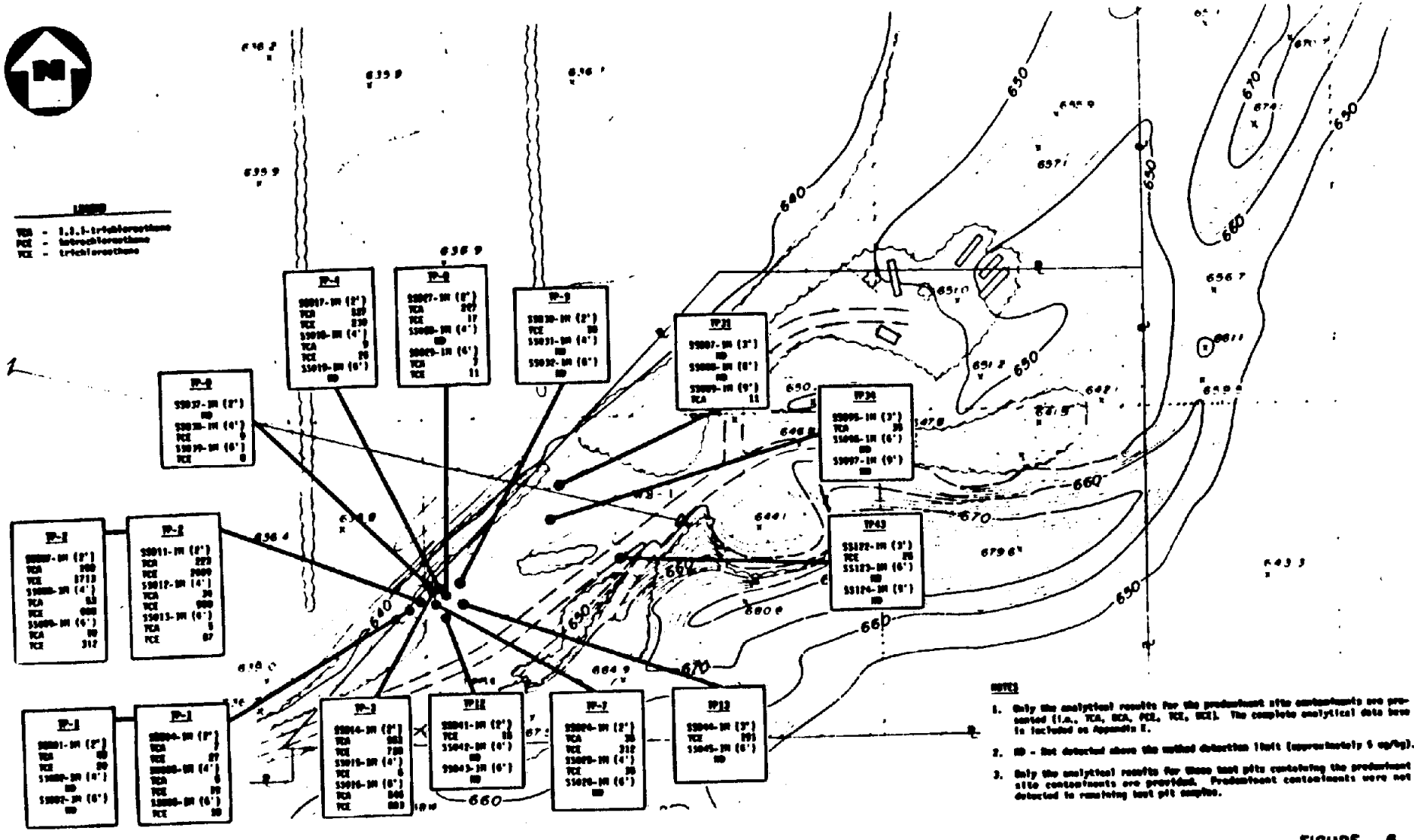


FIGURE 6

CHLORINATED ALIPHATIC SUBSURFACE SOIL CONTAMINATION (ug/kg)
- MOBILE LABORATORY RESULTS -
BYRON BARREL AND DRUM SITE, BYRON, NY

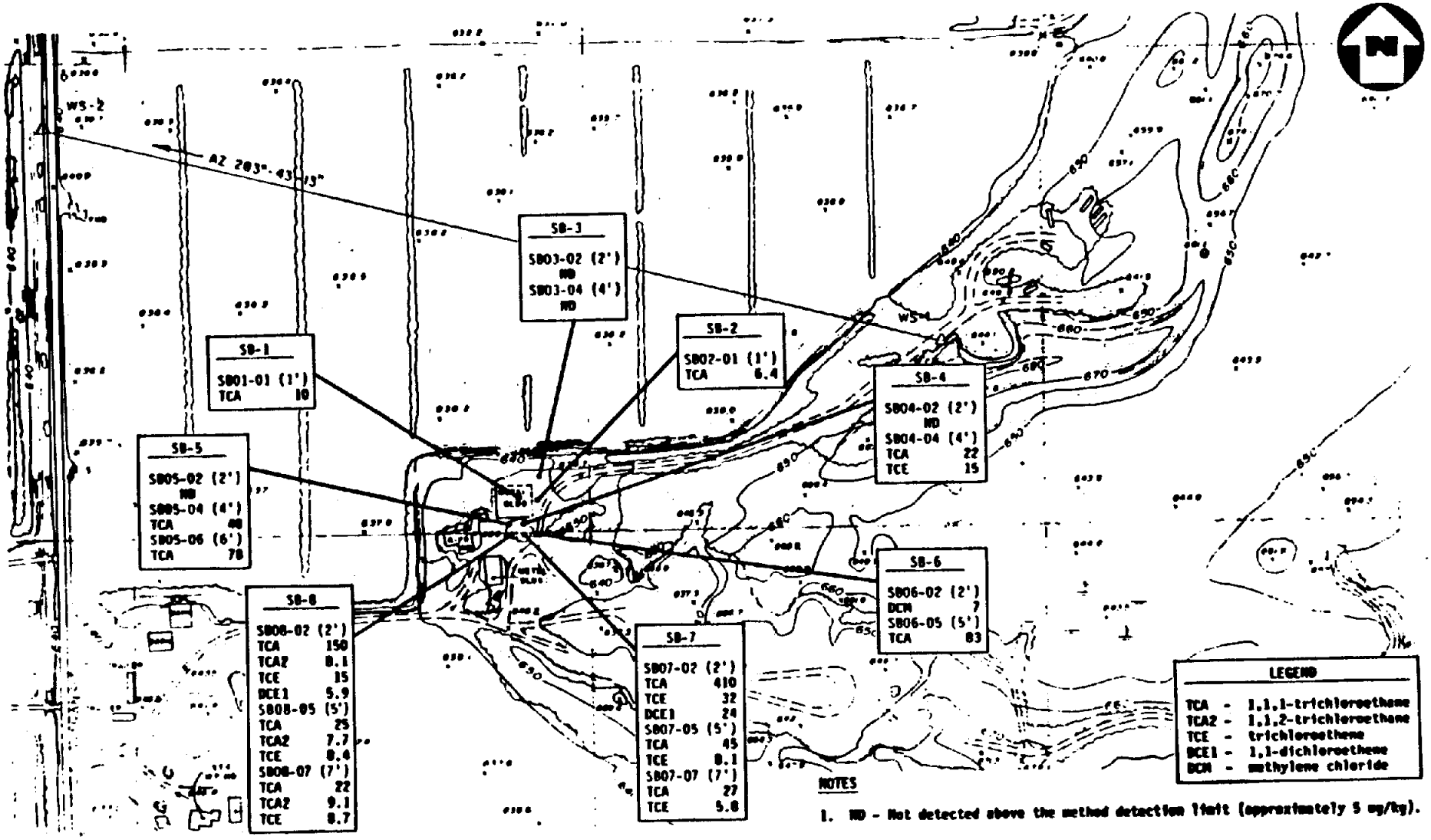


FIGURE 7

CHLORINATED ALIPHATIC SUBSURFACE SOIL CONTAMINATION (µg/kg)
MAINTENANCE BUILDING SOURCE
BYRON BARREL AND DRUM SITE, BYRON, NY

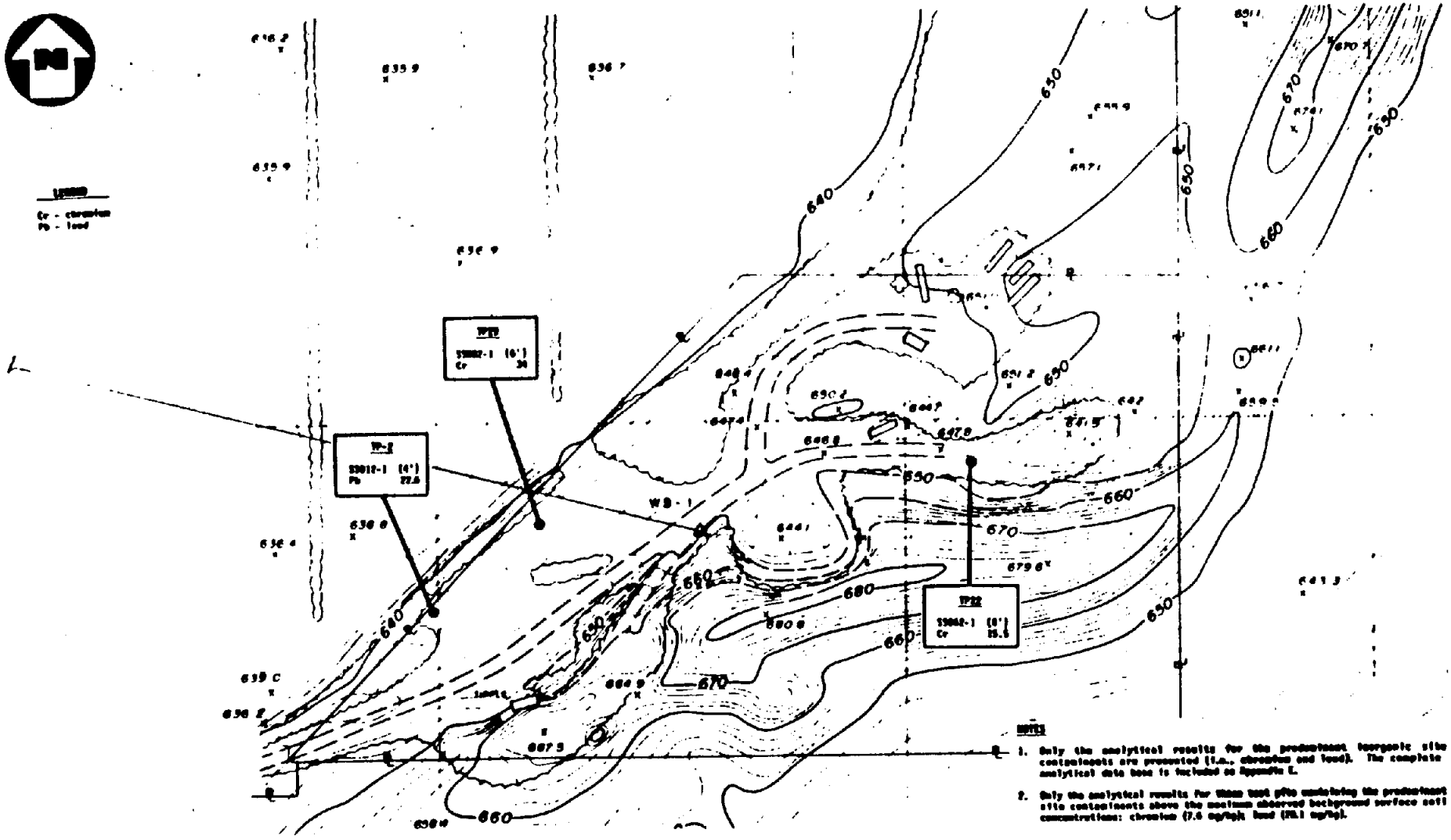


FIGURE 8

INORGANIC SUBSURFACE SOIL CONTAMINATION (mg/kg)
BYRON BARREL AND DRUM SITE, BYRON, NY

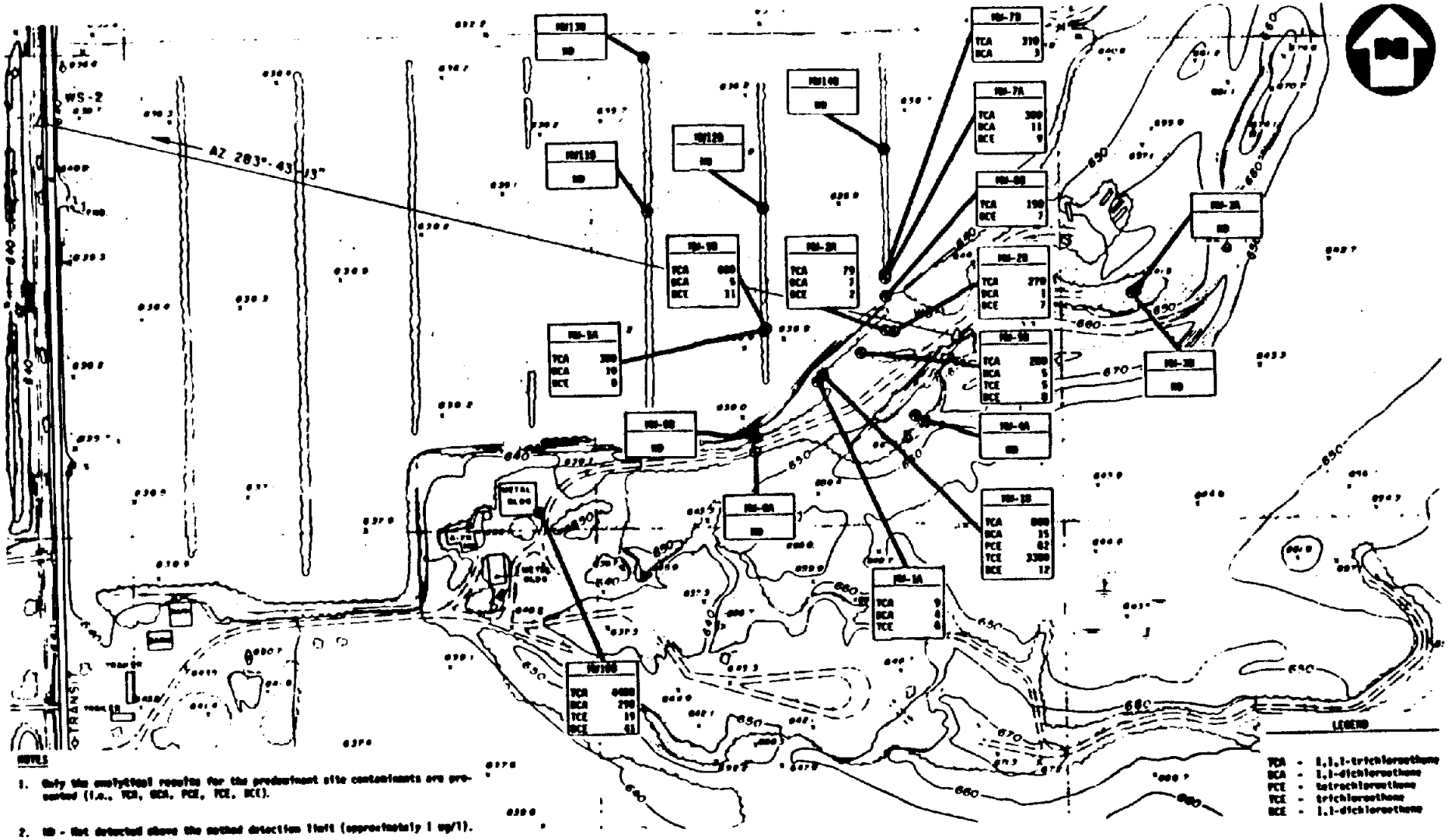


FIGURE 9

CHLORINATED ALIPHATICS DETECTED IN MONITORING WELL SAMPLES (ug/l)-11/7-9/88
BYRON BARREL AND DRUM SITE, BYRON, NY

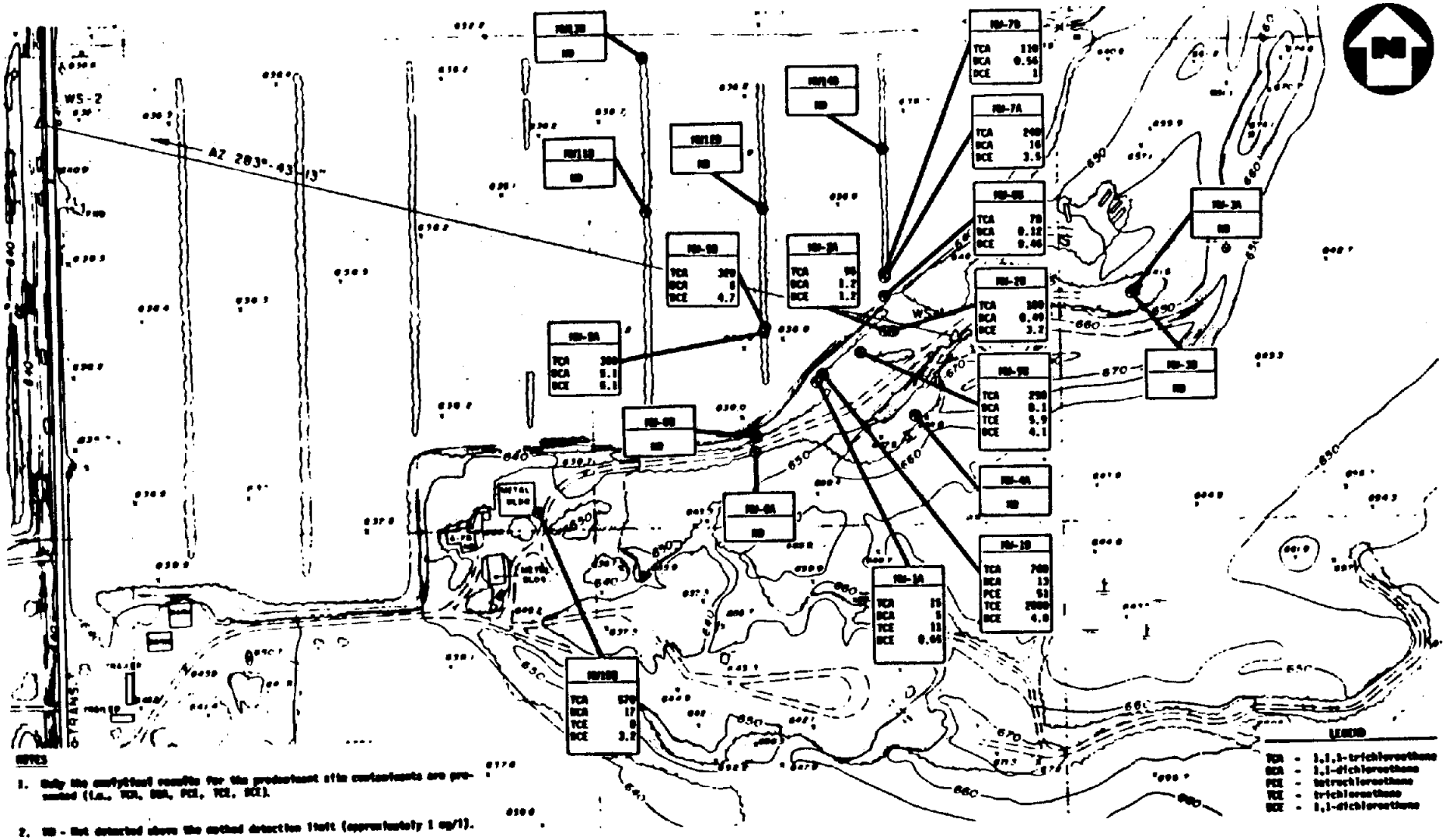
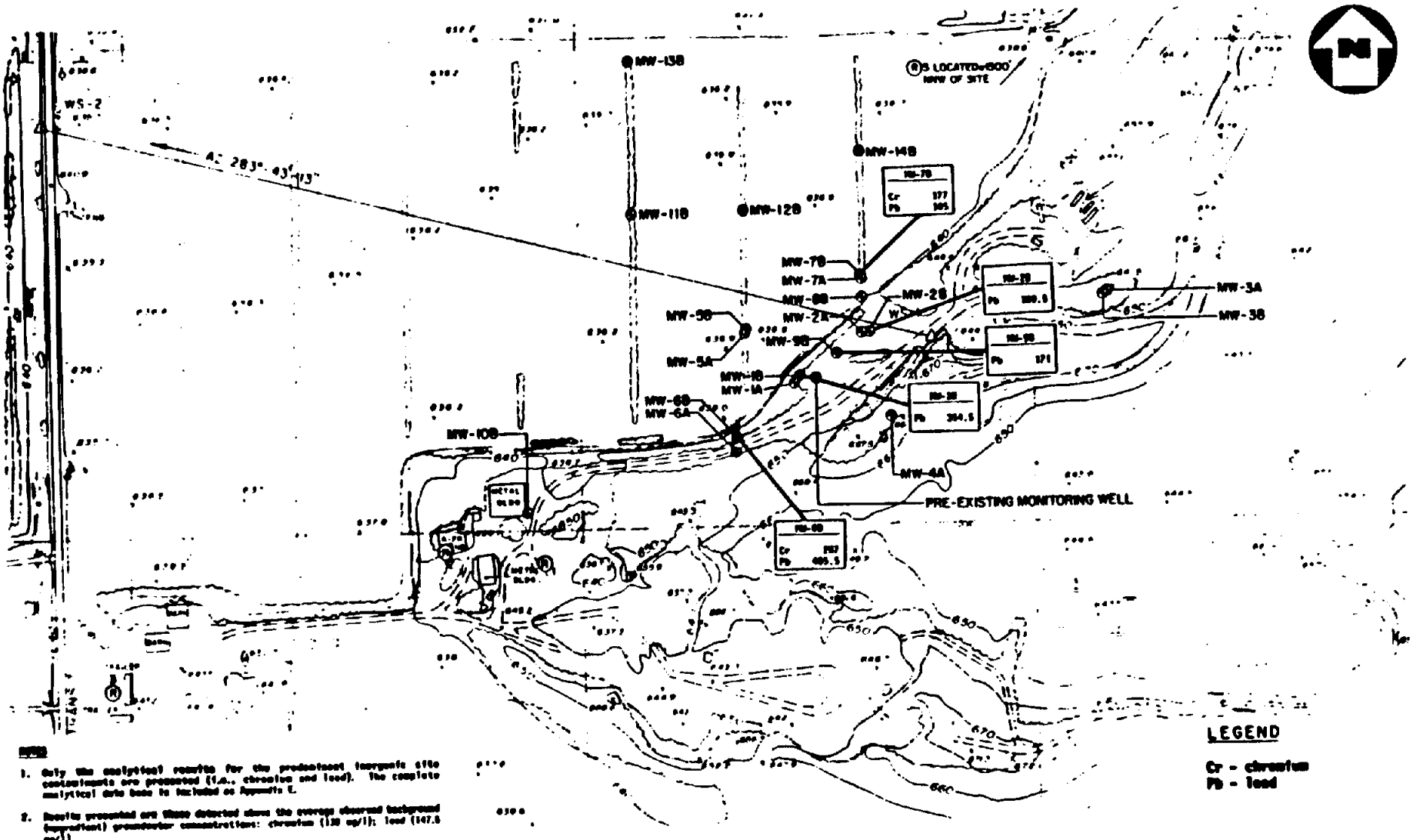


FIGURE 10

CHLORINATED ALIPHATICS DETECTED IN MONITORING WELL SAMPLES (ug/l)-12/13-14/88
BYRON BARREL AND DRUM SITE, BYRON, NY



NOTES

1. Only the analytical results for the predominant inorganic site contaminants are presented (i.e., chromium and lead). The complete analytical data base is included as Appendix E.

2. Results presented are those detected above the average observed background (upgradient) groundwater concentrations: chromium (130 ug/l); lead (147.5 ug/l).

FIGURE 11

INORGANIC CONTAMINANTS DETECTED IN MONITORING WELL SAMPLES (ug/l)
BYRON BARREL AND DRUM SITE, BYRON, NY

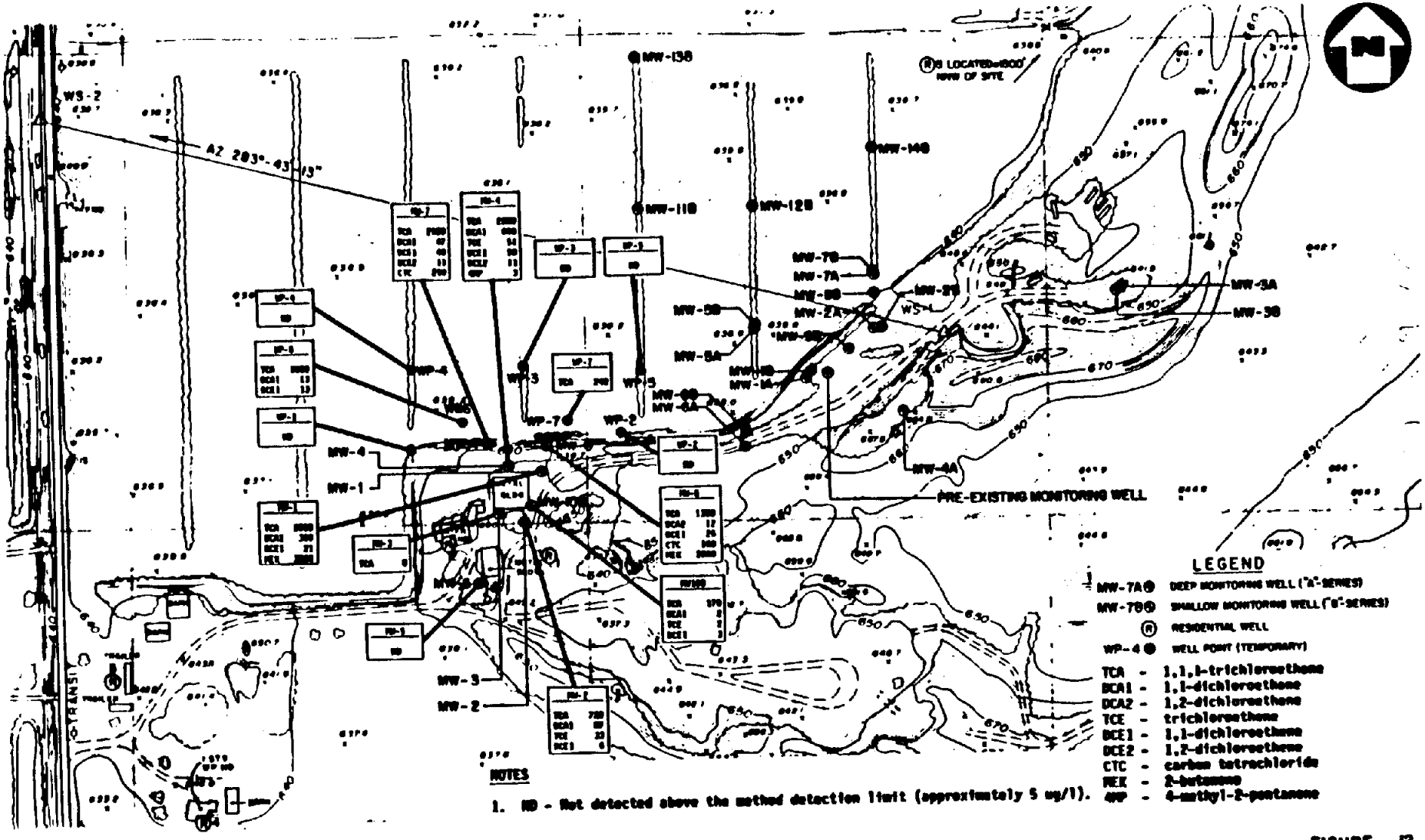


FIGURE 12

CHLORINATED ALIPHATICS AND KETONES DETECTED
IN MONITORING WELL AND WELL POINT SAMPLES (ug/l) - 4/21/89 TO 5/11/89
BYRON BARREL AND DRUM SITE, BYRON, NY

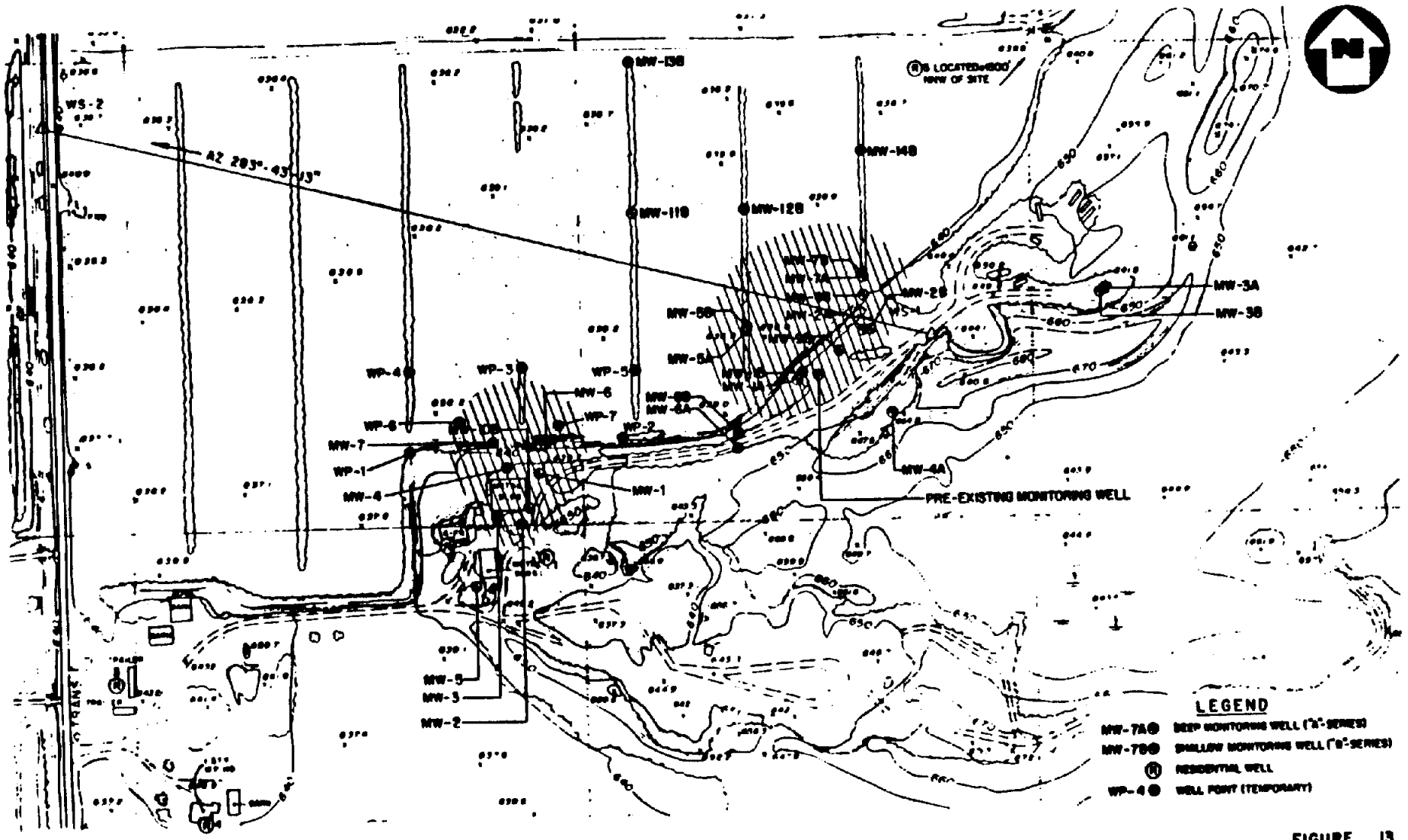


FIGURE 13

ESTIMATED EXTENT OF CONTAMINANT PLUMES
BYRON BARREL AND DRUM SITE, BYRON, NY

APPENDIX 3 - ADMINISTRATIVE RECORD INDEX

XXXVII. SECTION HEADINGS

The section headings set forth in this Consent Decree are included for convenience of reference only and shall be disregarded in the construction and interpretation of any of the provisions of this Consent Decree.

XXXVIII. SERVICE OF PROCESS

Settling Defendants shall identify, on the attached signature page, the name and address of an agent who is authorized to accept service of process by mail on behalf of Settling Defendants with respect to all matters arising under or relating to this Consent Decree. Settling Defendants hereby agree to accept service in this manner and to waive the formal service requirements set forth in Rule 4 of the Federal Rules of Civil Procedure, including service of a summons, and any applicable local rules of this Court.

APPROVED and ENTERED this ____ day of _____, 19__.

_____
UNITED STATES DISTRICT JUDGE