

2021 Hazardous Waste Scanning Project

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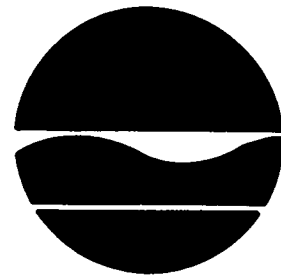
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**REMEDIAL INVESTIGATION
AND FEASIBILITY STUDY**

**PHASE I/PHASE II REMEDIAL
INVESTIGATION REPORT**

**Union Road Site
Town of Cheektowaga,
Erie County, New York
(Site Registry No. 9-15-128)**

Volume I



Dvirka and Bartilucci

Consulting Engineers

JUNE 1991

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

PHASE I/PHASE II REMEDIAL INVESTIGATION REPORT

VOLUME I

**UNION ROAD SITE
TOWN OF CHEEKTOWAGA
ERIE COUNTY, NEW YORK**

(SITE REGISTRY NO. 9-15-128)

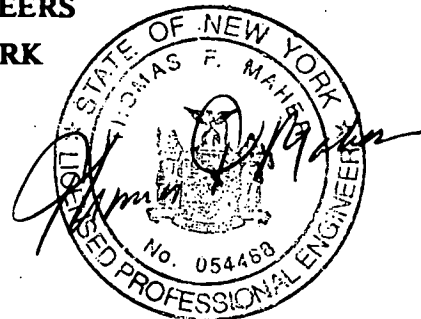
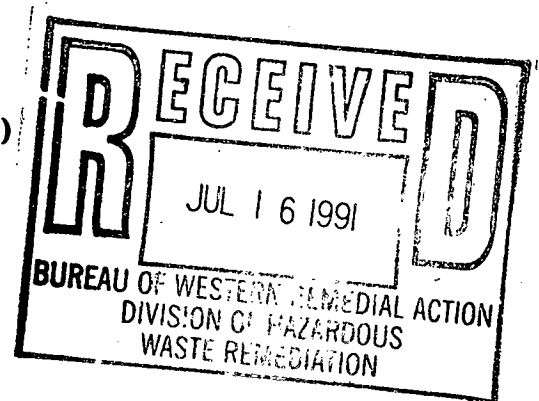
PREPARED FOR

**NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION**

BY

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JUNE 1991



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Summary



S.0 EXECUTIVE SUMMARY

As part of the State of New York's program to clean up inactive hazardous waste sites, the New York State Department of Environmental Conservation (NYSDEC) has undertaken a Remedial Investigation and Feasibility Study (RI/FS) for the Union Road Site located in Erie County, New York. The registry number for this New York State Superfund Site is 9-15-128. The RI/FS for this site is being performed with funds allocated under the New York State Superfund Program.

The Union Road Site was the former location of a large railroad facility which comprised a classification yard, maintenance facilities and waste disposal area. This facility was operated for approximately 40 years from about 1915 to 1955.

The Union Road Site is located approximately eight miles east of the City of Buffalo in the Town of Cheektowaga, on property about one mile east of Union Road, between Losson and French Roads. The site is presently owned by the Witben Realty Corporation whose parent company is the Universal Marion Corporation. The site was formerly owned (and operated) by the New York Central Railroad (NYCRR) and was taken over by the Penn Central Railroad after NYCRR went bankrupt.

The purpose of the overall RI/FS process is to perform a Remedial Investigation (RI) to determine the nature and extent of contamination at the site, the sources of contamination, the risk to public health and the environment, and to perform a Feasibility Study (FS) which will identify and evaluate mitigation alternatives, and recommend a cost-effective, environmentally sound and long-term remedial action, if necessary.

This document, entitled, "Phase I/Phase II Remedial Investigation Report for the Union Road Site," presents a detailed description of the activities and results of both the first and second phases of the field investigation program undertaken as part of a multi-phased RI/FS prepared in accordance with the Federal Superfund Amendments and Reauthorization Act (SARA) and the NYSDEC Superfund Program.

The Phase I Remedial Investigation (Phase I RI) involved the analysis of existing information and environmental data in combination with a baseline field investigation and sampling program. The purpose of this phase was to provide an initial determination regarding the location and characterization of sources of contamination and to begin defining migration pathways, extent of contamination and exposed populations, as well as

to assist in refining the type and location of additional sampling for subsequent investigation, if required. The Phase I RI also gathered data to evaluate the need to consider the waste lagoon (commonly referred to as the "Tar Pit") or other areas at the site as an operable unit as defined under the National Contingency Plan, which involves temporary containment or permanent remediation as an interim action while the remainder/subsequent phases of the RI/FS continue.

The Phase II Remedial Investigation (Phase II RI) provided confirmation of the nature and source(s) of contamination, as well as the contaminant migration pathways, and exposed and potential receptors. The Phase II RI also delineated the extent of contamination and defined the volumes of waste and contaminated soil and water which will need to be addressed in the development of a long-term remedial action plan for the site.

The Remedial Investigation field program for the Union Road Site involved site mobilization, aerial photography, topographic mapping, geophysical surveys (resistivity, terrain conductivity and magnetometry), excavation of 21 test pits and trenches, sampling of surficial and subsurface soil and buried waste, sampling of the waste lagoon and drums, sampling of surface water and sediments, construction of 50 soil/waste borings and 17 marsh borings, installation of 18 monitoring wells and 7 piezometers, sampling of borehole soil and ground water, and air monitoring.

In addition to the main site, eight off-site areas of concern, which were suspected as being additional sites for previous waste disposal as part of railroad operations or other independent activities, were investigated. Field work for a number of these "Satellite Sites" comprised geophysical surveys (terrain conductivity and magnetometry for two sites), test pit excavation (two sites) and soil/sediment and waste sample collection (six sites), the results of which are contained in a separate document entitled "Satellite Site Report".

In total, for the main/Union Road Site and the Satellite Sites, 145 environmental samples were collected, of which 96 were analyzed for the complete NYSDEC Target Compound List (TCL) +30 parameters, which includes volatile and semi-volatile organic compounds, pesticides and polychlorinated biphenyls (PCBs), and metals. In addition, select samples were analyzed for Hazardous Waste Characteristics and EP Toxicity, Toxicity Characteristics Leaching Procedure and asbestos. One composite sample obtained from the waste lagoon/Tar Pit was also analyzed for a Treatability Screen.

Also as part of the Remedial Investigation and as a result of the operable unit assessment conducted as part of the Phase I RI, during conduct of the Second Phase RI, a chain-link fence was constructed around the waste lagoon and contiguous surface and marsh areas which were found to be significantly contaminated, and booms were placed in the marsh and at the marsh outlets to mitigate the release of oil from the waste lagoon and adjacent marsh. In addition, hazardous waste warning signs were placed along the banks of the creeks adjacent to the site where waste material was found, and waste deposits and contaminated soil (approximately 1,700 cubic yards) were removed from the banks of Slate Bottom Creek, the results of which are contained in a separate document entitled "Interim Remedial Measure Report - Waste and Contaminated Soil Removal from the Banks of Slate Bottom Creek."

A summary of the findings, conclusions and recommendations of the Remedial Investigation, which includes the Baseline Human Health Risk Assessment, Environmental Assessment and Biological Study Program contained in reports under separate cover, are provided below. This summary is presented according to the operable units defined in the Operable Unit Assessment Report, and for which remedial alternatives were identified and screened on a preliminary basis in the Phase I/Phase II Feasibility Study Report, both of which are also contained under separate cover.

o Waste Source Materials

- Tar Pit - The Tar Pit is an exposed waste lagoon containing elevated concentrations of total volatile organic compounds and very high levels of metals including antimony, arsenic, copper, mercury, silver, zinc, and in particular lead, as well as total polycyclic aromatic hydrocarbons (PAHs), base neutral compounds and petroleum hydrocarbons, all of which exceed the New Jersey Department of Environmental Protection (NJDEP) guidelines for cleanup. In addition, a number of PAHs exceed NYSDEC cleanup criteria for the protection of ground water.

The waste material in the Tar Pit exceeds EP Toxicity limits for lead, and the Toxic Characteristics Leaching Procedure (TCLP) indicates lead-to-leach in substantial concentrations from the waste material, also in excess of limits. As a result, the material in the Tar Pit is characterized as a hazardous waste.

Based on the nature of the waste and historical information, the material in the Tar Pit comprises highly contaminated waste oils and lubrication grease, as well as possibly waste solvents, disposed during operation of the former railroad facility.

The waste material in the Tar Pit is a likely cause of ground water contamination, and contamination of the contiguous marsh and surface waters adjacent to the site. Based on the findings of the health risk and environment assessments, the exposed waste source is also threat to human health, and terrestrial and organic organisms through direct contact with and ingestion of the waste material.

The Tar Pit has an exposed surface area of about 9,000 square feet and is four to five feet in depth, constituting approximately 1,700 cubic yards of waste material. The waste material appears to be relatively homogeneous throughout the Tar Pit.

Based on the hazardous nature of the waste in the Tar Pit, the potential for contaminant migration and the threat to human health and the environment, the Tar Pit should be considered as part of a remedial action plan for the site (i.e., containment, removal or treatment).

- Drums - Fifty-five gallon drums were found in the Tar Pit, on top of the embankment on the east side of the Tar Pit and in the marsh area adjacent to the Tar Pit. The drums lying on the surface of the Tar Pit contained waste similar to that in the waste lagoon itself and were not sampled. All other accessible drums were found to be extremely deteriorated and empty, exclusive of two drums on the embankment.

Of these two drums, one was sampled. The sample obtained was observed to be a salt-like substance. The analysis of this sample indicated this waste to be hazardous due to its corrosivity.

Other salt-like wastes, similar in appearance to that found in the drum sampled, were found on the ground surface in a few areas on top of the embankment on the east side of and contiguous to the Tar Pit, as well as in

one of the test pits excavated in the area south and east of the Tar Pit which was also used for waste disposal, and referred to as the "Disposal Area."

It is unknown if this waste material was disposed as part of operations at the former railroad facility or after the facility was decommissioned. Because of the corrosive nature of this waste material, the primary threat is to human and environmental health due to direct contact, ingestion and inhalation. The quantity of this material is estimated to be a few cubic yards at most.

As a result of the hazardous nature of the waste material found in the drum and the likelihood that the similar appearing material in the waste disposal area contiguous to the Tar Pit (Disposal Area) is also of concern, this material should be considered as part of a remedial action plan for the site.

- o Surficial Soil - Surficial soil in the Disposal Area is for the most part stained with oil and generally contains elevated concentrations of PAHs, base neutral compounds, petroleum hydrocarbons and metals, including antimony, arsenic, cadmium, copper, zinc, and in particular lead, which are well in excess of background concentrations. In addition, a number of semi-volatile compounds exceed NYSDEC Soil Cleanup Criteria and lead levels typically exceed NYSDOH and USEPA soil clean up guidelines. Asbestos (between 2-10% chrysotile) was also found in a few surficial soil samples in the Disposal Area in excess of that considered to be a concern by USEPA.

EP Toxicity limits were exceeded for lead in one-half of the samples analyzed. Based on the high levels of total lead in other samples, it is possible that perhaps about one-half of the surficial soil in the Disposal Area could be characterized as a hazardous waste.

Since the chemical characteristics of the contaminated surficial soil in the Disposal Area is similar to that found in the Tar Pit, and the area, based upon historical information, was used for waste disposal during operation of the railroad facility, the apparent cause of this contamination is attributable to former railroad operations.

The surficial soil in the Disposal Area is a possible cause of ground water and surface water contamination, and based on the preliminary baseline health risk and environmental assessment, it is also a threat to human and ecological health as a result of direct contact, ingestion and inhalation.

The surface area of contaminated soil in the Disposal Area is approximately 145,000 square feet and can be considered, based on physical characteristics, to be 1 to 2 feet in depth resulting in a total of about 5,000 to 10,000 cubic yards.

Based on the hazardous nature of a large part of the surficial soil in the Disposal Area, potential contaminant migration to surface water and ground water, and the threat to public health and the environment, the surficial soil in the Disposal Area should be considered as part of a remedial action plan.

Samples of surficial soil obtained in the area of a former roundhouse on the Union Road Site, referred to as the Roundhouse Area, and the area south of the former roundhouse also exhibit contamination; however, except for PAHs, the degree of contamination is substantially less than that found in the Disposal Area. For the most part, surficial material encountered in the Roundhouse Area (and to the south) is largely comprised of cinder-like material, whereas the Disposal Area is overburden. The most contaminated soil sample in the Roundhouse Area, which exceeded NYSDOH/USEPA cleanup guidelines for lead and also contained asbestos (2-4% chrysotile), was located to the east of the former roundhouse, and closer to the Disposal Area than to the residential area of Losson Green Estates.

The cinder material found in the Roundhouse Area and to the south is widespread in the vicinity of the Union Road Site, especially west and southwest of the site, and is apparently coal cinders (bottom ash) used as roadbed material throughout the railroad yard. The source of this material may be ash generated as part of railroad operations, or perhaps from steel foundaries which were once numerous in the Buffalo area.

Based upon site observations and chemical data, it does not appear that the surficial soil in the Roundhouse Area is a source of either surface water or ground water contamination (except perhaps for low levels of antimony); however, it could possibly be a potential threat to human health as a result of ingestion or inhalation of this material.

The depth of this cinder material is about 3 to 4 feet in most areas, and as previously mentioned, exists over large portions on and contiguous to the Union Road Site.

Although the surficial soil in the Roundhouse Area and south of the former roundhouse is contaminated and may have a minor impact on ground water, the levels of contamination do not characterize the cinder material as hazardous; however, as previously mentioned, it may pose a health risk due to ingestion and inhalation. Determination of the need to consider this material as part of the remedial action plan for the site will be based on the findings of the final baseline risk assessment.

- o Subsurface Soil/Fill Material/Buried Waste - Significant amounts of waste material and highly contaminated soil are buried about 15 feet below ground surface within the Disposal Area. This buried material contains elevated levels of semi-volatile organic compounds, including PAHs, and very high concentrations of petroleum hydrocarbons and lead, as well as other metals such as antimony, arsenic, chromium, copper and zinc. Lead concentrations exceed cleanup guidelines recommended by NYSDOH and USEPA, and a number of semi-volatile compounds are above NYSDEC Soil Cleanup Criteria. Asbestos (2-4% chrysotile) was found in one subsurface sample.

EP Toxicity limits for lead were exceeded in about one-half of the samples analyzed, and based upon the high levels of total lead found in the buried waste and contaminated soil, nearly all of this material would most likely be characterized as a hazardous waste.

Based on the chemical and physical characteristics of the buried waste material and its location contiguous to the Tar Pit, as well as historical information, it is apparent that the waste underlying the Disposal Area is similar to that in the Tar Pit and resulted from waste disposal activities at the former railroad facility.

Although this buried waste material does not constitute a direct threat to human or ecological health, either through direct contact, ingestion or inhalation, it does cause contamination of ground water and most likely impacts the surface waters and sediments surrounding the site.

The area of buried waste and highly contaminated soil is about 145,000 square feet in aerial extent and ranges from less than 1 foot to approximately 12 to 13 feet in thickness. The volume of this material is estimated to be 25,000 cubic yards.

In addition to the buried waste material underlying the Disposal Area, samples obtained of the fill material overlying the buried waste, which in part is comprised of cinders and oil stained soil, exhibit elevated concentrations of PAHs, petroleum hydrocarbons and lead, as well as chromium, copper and nickel. In addition, a number of semi-volatile organic compounds exceeded the NYSDEC Soil Cleanup Criteria.

Pockets of waste material and highly contaminated soil were also found within the fill material in close proximity to the Tar Pit. For the most part, this shallow buried waste material (1 to about 8 feet below grade) exhibits elevated levels of semi-volatile compounds, and very high concentrations of petroleum hydrocarbons and lead, as well as antimony, arsenic, cadmium, copper and zinc. In addition, the concentrations of lead substantially exceeded NYSDOH and USEPA soil cleanup guidelines, and a number of PAH and base neutral organic compounds exceeded NYSDEC Soil Cleanup Criteria. Asbestos (2-4% chrysotile) was also found in one location that was sampled.

Although the EP Toxicity limits for lead are not exceeded in the cinder fill material, which are consistent with the findings in the Roundhouse Area, the high levels of total lead in the shallow buried waste material would likely exceed EP Toxicity limits and be characterized as a hazardous waste.

Based upon the chemical and physical characteristics of the fill material (i.e., for the most part cinders) and the shallow subsurface waste (i.e., grease-like material and oil-stained soil), this fill and waste material is the same as encountered at other locations in the Disposal Area, and based on the history of the operations at the site, is attributable to the former railroad facility.

Although the subsurface fill material and waste does not constitute a direct threat to human health, because it is less than a few feet below ground surface in many areas, it does pose a risk to terrestrial organisms that inhabit the site. In addition, the shallow buried material, at least in part, may cause ground water and, subsequently, surface water contamination.

The aerial extent of the fill material, which includes the areas of shallow buried waste and highly contaminated soil, is about the same as the more deeply buried waste, and approximately 145,000 square feet in area. The depth of the fill overlying the buried waste is approximately 15 feet, which results in a volume of 80,000 cubic yards, including the surficial soils.

Based on the hazardous nature of buried waste and highly contaminated soil underlying the Disposal Area, as well as the overlying contaminated fill material, shallow waste and surficial soil (a substantial portion of which is also characteristically hazardous); the potential for contaminant migration to ground water and surface water; and the threat to human and ecological health, the buried waste, fill material, and surficial soil and waste in the Disposal Area should be considered part of a remedial action plan for the site.

Subsurface soil in an area immediately southwest of the former roundhouse was found to be contaminated with fuel oil. Soil samples from this area exhibit levels of semi-volatile organic compounds, petroleum hydrocarbons and lead, as well as arsenic and copper. One sample contained concentrations of lead and semi-volatile compounds which exceed NYSDOH/USEPA soil cleanup guidelines and NYSDEC Soil Cleanup Criteria, respectively. EP Toxicity limits for lead were not exceeded for samples obtained in this area. Asbestos (2-4% chrysotile) was also found in one subsurface sample obtained in the Roundhouse Area.

Based on the chemical characteristics of the contaminated subsurface soil, the analytes and concentrations found are consistent with and in the range of contaminants found throughout the Union Road Site. As a result, it is likely that the spill of fuel oil (or waste oil) in the Roundhouse Area was caused by operations at the former railroad facility.

The contaminants and levels of contamination could cause possible ground water contamination but do not appear to pose a direct threat to human or environmental health.

The aerial extent of the fuel-oil contaminated material is about 10,000 to 12,000 square feet and the depth approximately 1 to 5 feet below grade, which results in an estimated volume of 1,800 cubic yards.

Based on the elevated levels of soil contamination in the Roundhouse Area resulting from an apparent spill of fuel or waste oil, and potential contaminant migration to ground water, this material should be considered as part of a remedial action plan for the site.

- o Ground Water – Ground water in the bedrock aquifer is contaminated essentially throughout the Union Road Site by benzene which exceeds NYS Ground Water Standards, and also by elevated levels of ethyl benzene, toluene and xylene. In addition, the bedrock aquifer underlying the Disposal Area is contaminated by lead and antimony in excess of the NYS Ground Water Standards.

The till aquifer immediately overlying bedrock and underlying the buried waste and fill material in the Disposal Area, also exhibits contamination by antimony and lead above NYS Ground Water Standards.

The perched aquifer in the fill and buried waste in the Disposal Area, is discolored, and has an oil sheen and fuel odor, and shows very high levels of lead, antimony and arsenic above NYS Ground Water Standards, and semi-volatile organic compounds, including PAHs, and petroleum hydrocarbons. The perched aquifer in the Roundhouse Area indicates antimony concentrations exist in excess of NYS Ground Water Guidance Values.

Based on the chemical characteristics of the ground water underlying the Disposal Area, as well as physical appearance of the perched water in the fill and buried waste material, it is apparent that ground water on the Union Road Site, exclusive of the aromatic hydrocarbons, is caused by waste disposal operations at the former railroad facility. Since aromatic hydrocarbons, in particular benzene, was not found in the waste material and soil on-site, nor in the perched aquifer in the Disposal Area, it appears that the source of this contamination is off-site, most likely southwest of the site, or in another area of the site which was not investigated, or is naturally occurring which is the most likely cause based upon other ground water investigation findings in the Buffalo/Niagara/Ontario area.

The source of perched ground water contamination in the vicinity of the former roundhouse, and to a lesser extent, the underlying till aquifer, appears to be the overlying cinder material which was the roadbed for the former railroad yard.

However, the contaminated ground water in the overburden does appear to impact the bedrock aquifer.

The semi-confining clay layer which underlies the Union Road Site, appears to be an effective barrier in mitigating the vertical migration of contaminants from the zone of fill, buried waste and highly contaminated soil to the underlying till and bedrock aquifers. However, although levels of contaminant concentrations are reduced by several orders of magnitude, contamination is not impeded entirely. Although the ground water beneath the Union Road Site in the till and bedrock is not highly contaminated, NYS Ground Water Standards and Guidelines are exceeded for lead and antimony (as well as by benzene in the bedrock aquifer).

Since, based upon available information, ground water in the vicinity of the Union Road Site is not used as a supply of potable water, contamination in the ground water does not pose a threat to human health; however, because it is likely that ground water, at least in part, discharges to marsh area on the site and the surface water contiguous to the site, (Deer Lik Creek and Slate Bottom Creek), it could impact surface water and sediment quality.

The volume of contaminated ground water underlying the Disposal Area in the perched/fill aquifer is estimated to be approximately 1.8 million gallons. Since the extent of ground water contamination in the till and bedrock aquifers has not been defined, the volume of ground water exceeding standards/guidelines cannot be determined.

Because ground water within the fill and buried waste underlying the Disposal Area is highly contaminated and exceeds ground water standards and guidelines, it should be considered as part of a remedial action plan for for the site.

Since ground water contaminated with aromatic hydrocarbons in the till and bedrock aquifers does not appear to be the result of on-site contamination, ground water outside of the Disposal Area should not be considered as part of the remedial action plan at this time; however, the source of this contamination should be determined/confirmed and separate remedial measures considered, if necessary.

- o Surface Water - Except for iron, which appears to be indigenous to the area of the Union Road Site, analytical results of samples obtained from Slate Bottom and Deer Lik Creeks did not contravene NYS Surface Water Standards and Guidelines for either Class C or D water bodies, and undisturbed samples obtained from the marsh contiguous to the Tar Pit, also did not exceed Surface Water Standards and Guidelines.

Although chemical contamination of the surface waters on and contiguous to the Union Road Site is low, releases of oil from the underlying sediment and banks in the marsh, as well as Slate Bottom and Deer Lik Creeks, have been observed on numerous occasions.

Based upon chemical and physical characteristics of the contaminants in the surface waters, and proximity to the waste source, it appears that the waste formerly disposed by the railroad facility in the Tar Pit, and contaminated sediment and possibly ground water, is the source of any surface water contamination at the site. Most of the releases of oil occur in the area of the northernmost discharge outlet from the marsh and continue in an attenuated manner, approximately 1,000 feet downstream of the marsh in Slate Bottom Creek.

Based on the findings of the health risk and environmental assessment, ingestion of contaminated surface water on and adjacent to the Union Road Site by aquatic organisms, could pose a threat to ecological health.

Because surface water on and contiguous to the site does not exceed standards or guidelines for the analytes of concern associated with on-site contamination, mitigation measures for surface waters should not be part of the remedial action plan for the site, except as it relates to contaminated surface water sediment.

- o Surface Water Sediment - Surficial sediment in Slate Bottom and Deer Lik Creeks, both upstream and contiguous to the site, generally exhibits elevated levels of petroleum hydrocarbons and base neutral compounds. However, the highest concentrations of these contaminants, as well as lead, are located downstream of the site.

Surficial surface water sediment in the marsh adjacent to the Tar Pit (being closer to the waste source) shows substantially higher contaminant levels as compared to the sediment in the creeks. Concentrations of base neutral compounds, and petroleum hydrocarbons and, in particular, lead are very high. Other metals found in the surficial marsh sediment include antimony, arsenic, copper and zinc.

In addition to substantial surficial sediment contamination in the marsh area, samples obtained from borings in the marsh show significant contamination of the subsurface sediment as well. Except for the underlying clay, and extreme northern portion of the marsh, essentially all of the marsh area exhibited substantially elevated levels for base neutral compounds, petroleum hydrocarbons and lead. Other metals, such as arsenic, copper, mercury and nickel also exhibited elevated levels.

Although the levels of total lead are very high in some of the marsh sediment, none of the samples analyzed exceed the EP Toxicity limits for lead. Apparently, because of the high organic content of the marsh sediment and/or the presence of chelating agents, such as sulfur compounds (hydrogen sulfide), metals are not readily released.

Based on the chemical characteristics of the marsh sediment and proximity to the Tar Pit, it is apparent that contamination of the marsh is the result of former waste disposal operations at the railroad facility.

The oils released from the sediment, as well as resuspended sediment, causes contamination of the marsh water and surface waters (Deer Lik and Slate Bottom Creeks) to which it discharges. Based on the findings of the health risk and environmental assessment, the contaminated marsh sediment is a threat to human and ecological health as a result of direct contact and ingestion.

The contaminated sediment also poses a threat to ground water underlying the marsh. However, because of the low permeability clay which underlies the marsh, and the high affinity of the contaminants, in particular metals, to the sediments as discussed above, it is unlikely that this matrix contributes significant contamination to ground water.

The aerial extent of the contaminated portion of the marsh comprises a surface area of approximately 41,000 square feet. The depth of contaminated marsh sediment varies from about one foot in the northern portions to greater than eight feet in the channelized area in the vicinity of the USEPA filter fence where the clay beneath the marsh is most likely eroded. Based on an average depth of contaminated sediment of about 5 feet, the estimated volume of contaminated marsh is 8,000 cubic yards.

In addition to contaminated subsurface marsh sediment, substantial amounts of highly contaminated sediment underlie the relatively clean surficial sediment in the banks of both Slate Bottom and Deer Lik Creeks. The analytical results and physical characteristics of this material and results of samples of surface waste deposits found along the upper reaches of the banks of the creeks indicate that it is similar to waste in the Tar Pit and highly contaminated sediment found in the marsh area (i.e., very high levels of lead and petroleum hydrocarbons).

This highly contaminated material in the banks of the creeks could be eroded/suspended during periods of high flow, and contaminants transported downstream and off-site. (Evidence of off-site contamination in Slate Bottom Creek has been observed west of the culvert which channels the creek under the former railroad yard.)

The exposed wastes and highly contaminated sediments along the creek banks pose a threat to human and environmental health as a result of direct contact and ingestion.

As a result of this threat, as mentioned above, approximately 1,700 cubic yards of waste deposits and contaminated sediment were removed from the banks of Slate Bottom Creek as an interim remedial measure. Although a substantial amount of contaminated material was removed, it is suspected that additional material remains in the banks of Slate Bottom Creek which could be exposed as a result of future erosion.

In addition to Slate Bottom Creek, based on site observation and test trenches, substantial quantities of waste material and contaminated sediments are also in the banks of Deer Lik Creek. This material ranges in thickness from 1 to 3 feet and extends up to 40 feet into the creek banks. It is estimated that the total volume of this material is 700 cubic yards.

Based on the high levels of contamination in the marsh sediment and the bed and banks of Deer Lik and Slate Bottom Creeks, the potential for contaminant migration to the surface waters, and the threat of human health and the environment, the marsh contiguous to the Tar Pit and the downstream contaminated sediment and waste in the banks of the creeks should be considered as part of a remedial action plan for the site.

Section 1



1.0 INTRODUCTION

1.1 Purpose of Study and Report

As part of the State of New York's program to clean up inactive hazardous waste sites, the New York State Department of Environmental Conservation (NYSDEC) entered into a contract with the firm of Dvirka and Bartilucci Consulting Engineers of Syosset, New York to undertake a Remedial Investigation and Feasibility Study (RI/FS) for the Union Road Site located in the Town of Cheektowaga, Erie County, New York. The registry number for this New York State Superfund Site is 9-15-128. The RI/FS for this site is being performed with funds allocated under the New York State Superfund Program.

The Union Road Site was the former location of a large railroad facility which comprised a classification yard, maintenance facilities and waste disposal area. This facility was operated for approximately 40 years from about 1915 to 1955.

The purpose of the overall RI/FS process is to perform a Remedial Investigation (RI) to determine the nature, extent and source(s) of contamination at the site, and the risk to public health and the environment, and to perform a Feasibility Study (FS) which will identify and evaluate mitigation alternatives, and recommend a cost-effective, environmentally sound and long-term remedial action, if necessary.

This document, entitled, "Phase I/Phase II Remedial Investigation Report for the Union Road Site," presents a detailed description of the activities and results of both the first and second phases of the field investigation program of the RI portion of the project as part of a multi-phased RI/FS prepared in accordance with the Federal Superfund Amendments and Reauthorization Act (SARA) and the NYSDEC Superfund Program.

The Phase I Remedial Investigation (Phase I RI) involved the analysis of existing information and environmental data in combination with the targeted field investigation/sampling program. The purpose of this phase was to provide an initial determination regarding the location and characterization of sources of contamination and to begin defining migration pathways, extent of contamination and exposed populations, as well as to assist in refining the type and location of additional sampling for subsequent investigation, if required. This Phase I RI also gathered data to evaluate the need to consider the waste lagoon (commonly referred to as the "Tar Pit") or other areas at the

site as an operable unit as defined under the National Contingency Plan, which involves temporary containment or permanent remediation as an interim action while the remainder/subsequent phases of the RI/FS continue.

The Phase I field program for the Union Road Site involved site mobilization; aerial photography; topographic mapping; geophysical surveys; excavation of test pits and trenches; sampling of surficial and subsurface soil and buried waste; sampling of the Tar Pit and drums; sampling of surface water and sediments; construction of soil/waste borings and installation of monitoring wells and piezometers; sampling of borehole soil and ground water; and air monitoring. In addition, eight off-site areas of concern, which were suspected as being additional sites for previous waste disposal as part of railroad operations or other independent activities, were investigated. Field work for a number of these "satellite sites" comprised geophysical surveys, test pit excavation, and soil/sediment and waste sample collection.

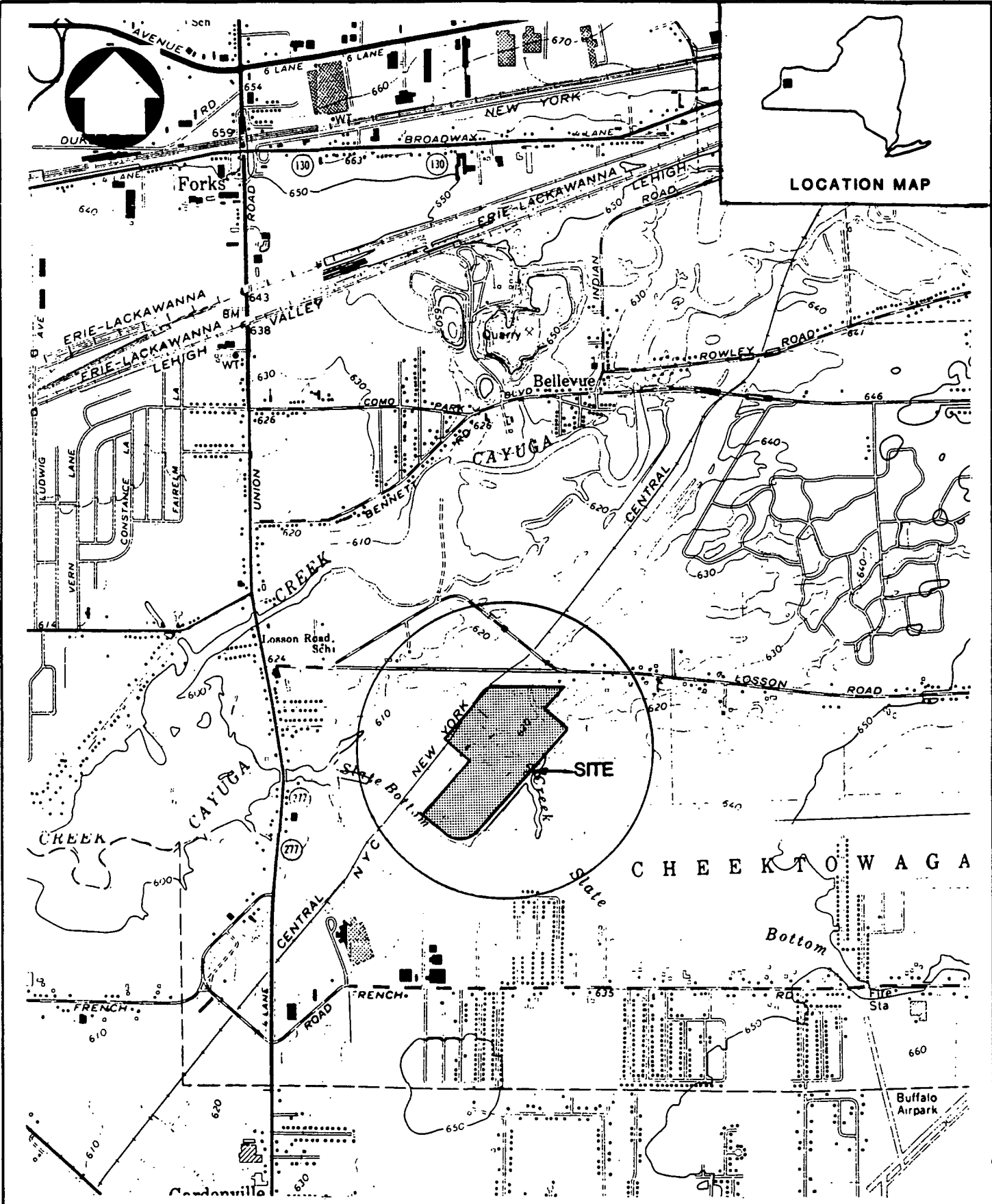
The Phase II Remedial Investigation was designed to provide additional field information necessary to refine and further characterize the site, and better determine the threat to public health and the environment, and the need for remediation. Data gaps identified by the Phase I Investigation were addressed and interim remedial action alternatives were identified and implemented.

The Phase II field program for the Union Road Site involved site remobilization; additional sampling of the Tar Pit; sampling of surficial soil, subsurface soil and buried waste; sampling of surface water and sediments; construction of soil/waste borings and marsh borings, and installation of monitoring wells and piezometers; sampling of borehole soil and ground water; and air monitoring. The Phase II RI also included the construction of a security fence around the Disposal Area, waste lagoon and area of contaminated marsh sediment, and placement of a berm and sorbent booms at drainage outlets from the marsh.

1.2 Site Background

1.2.1 Site Location, Ownership and Access

The Union Road Site is located approximately 8 miles east of the City of Buffalo in the Town of Cheektowaga, Erie County, New York, on property about 1 mile east of Union Road, between Losson and French Roads (see Figure No. 1-1). The site is presently owned



SCALE: 1" = 2000'

UNION ROAD SITE
LOCATION MAP



FIGURE 1-1

by the Witben Realty Corporation located in the Town of North Boston, New York. The parent company of Witben Realty is a Florida based land development company by the name of Universal Marion Corporation. The site was formerly owned (and operated) by the New York Central Railroad and the Penn Central Railroad.

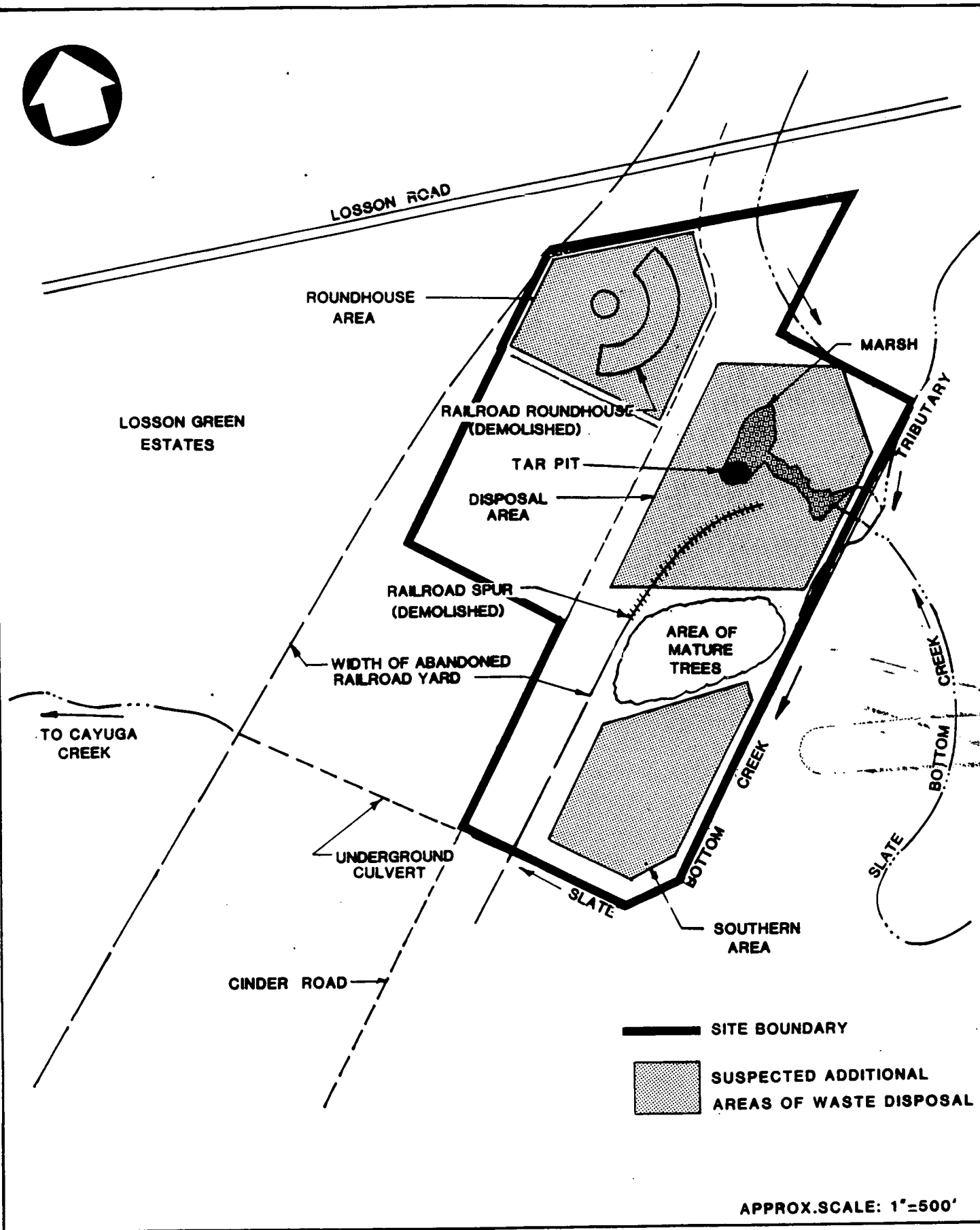
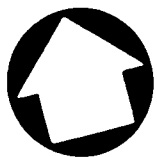
Access to the Union Road Site is via State Route 277 (Union Road), French Road and Losson Road. Primary site access is from Losson Road. Delineation of the site boundary is illustrated in Figure No. 1-2. A number of access roads or vehicle trails cross the northern end of the site and an unimproved/cinder roadway exists along the western perimeter. Access is also possible through residential areas located south and west of the site.

Access to the site by the public is discouraged by the posting of signs warning of the presence of hazardous waste at the primary access locations to the site and along the banks of Slate Bottom Creek immediately adjacent to the site. In addition, a 6 foot high, 3,300 foot long chain link fence, also posted with hazardous waste warning signs, encompasses the Tar Pit and contiguous area.

1.2.1.1 Environmental Setting

The area immediately surrounding the Disposal Area at the Union Road Site consists of fields and woods with some low lying marsh areas. Residential areas exist essentially adjacent to the site to the north and west, and within 1/8 mile to the east and south. Construction of new housing less than 1/4 mile north and west of the Union Road Site is currently underway and additional residential construction is planned about 1/4 mile east of the site. Commercial buildings are located within one mile of the site on Losson, Union and French Roads. A Town of Cheektowaga Park is situated about 1/2 mile northeast of the site.

Historical aerial photographs indicate that as early as 1928, a portion of the site and the area immediately west of the site was a large railroad yard. The site itself contained railroad maintenance facilities and at least one area for waste disposal. Old rail beds and assorted railroad structure foundations are still evident in this area. According to a date found on a structure at the site (culvert for Slate Bottom Creek at the southern boundary of the site), the railroad yard was probably constructed about 1913.



UNION ROAD SITE
**DEFINITION OF SITE /
STUDY AREA BOUNDARY**

1.2.1.2 Demography and Land Use

Figure No. 1-3 illustrates land use in the vicinity of the Union Road Site. This figure was prepared using aerial photography obtained in March 1983 and updated, where applicable, with aerial photography obtained in May 1987. Demographic data developed from the 1980 Census of Population and Housing was obtained from the Erie-Niagara Counties Regional Planning Board for an area located within approximately a 1 mile radius from the site (see Figure No. 1-4).

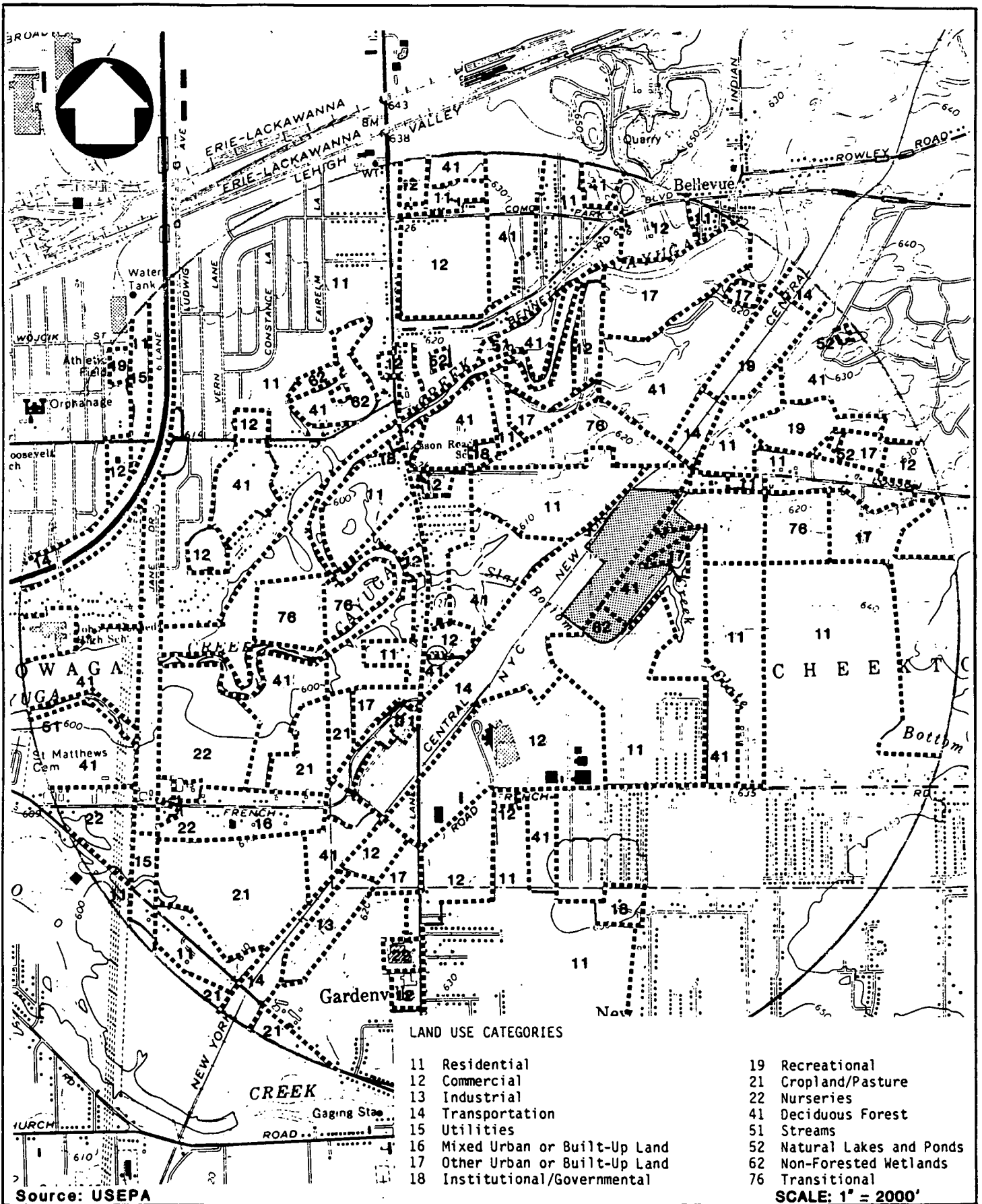
Areas to the west and south of the Union Road Site essentially comprise single family residential homes. There is also some multiple family residential and commercial/industrial development to the south. The area to the north consists of Town of Cheektowaga parkland and is partially developed with primarily single family residential homes. East of the site is developed with multiple family residences and is planned for construction of single family houses.

Most development in the area of the Union Road Site occurred from the 1960's to the mid 1970's. A substantial amount of development has also occurred within the last 5 years and is continuing. Based on the 1980 Census, there are a total of 2,478 single family and 1,686 two family residences in the study area. In addition, there are 192 mobile home/trailers. The average number of persons per household is approximately three. The total population within approximately a 1 mile radius of the Union Road Site is 12,956 according to the 1980 Census, but is most probably greater today as a result of recent development. Data from the 1990 Census will not be available by census tract for further analysis of the area within 1 mile of the site until 1992. A breakdown of population by ages is provided in Table No. 1-1.

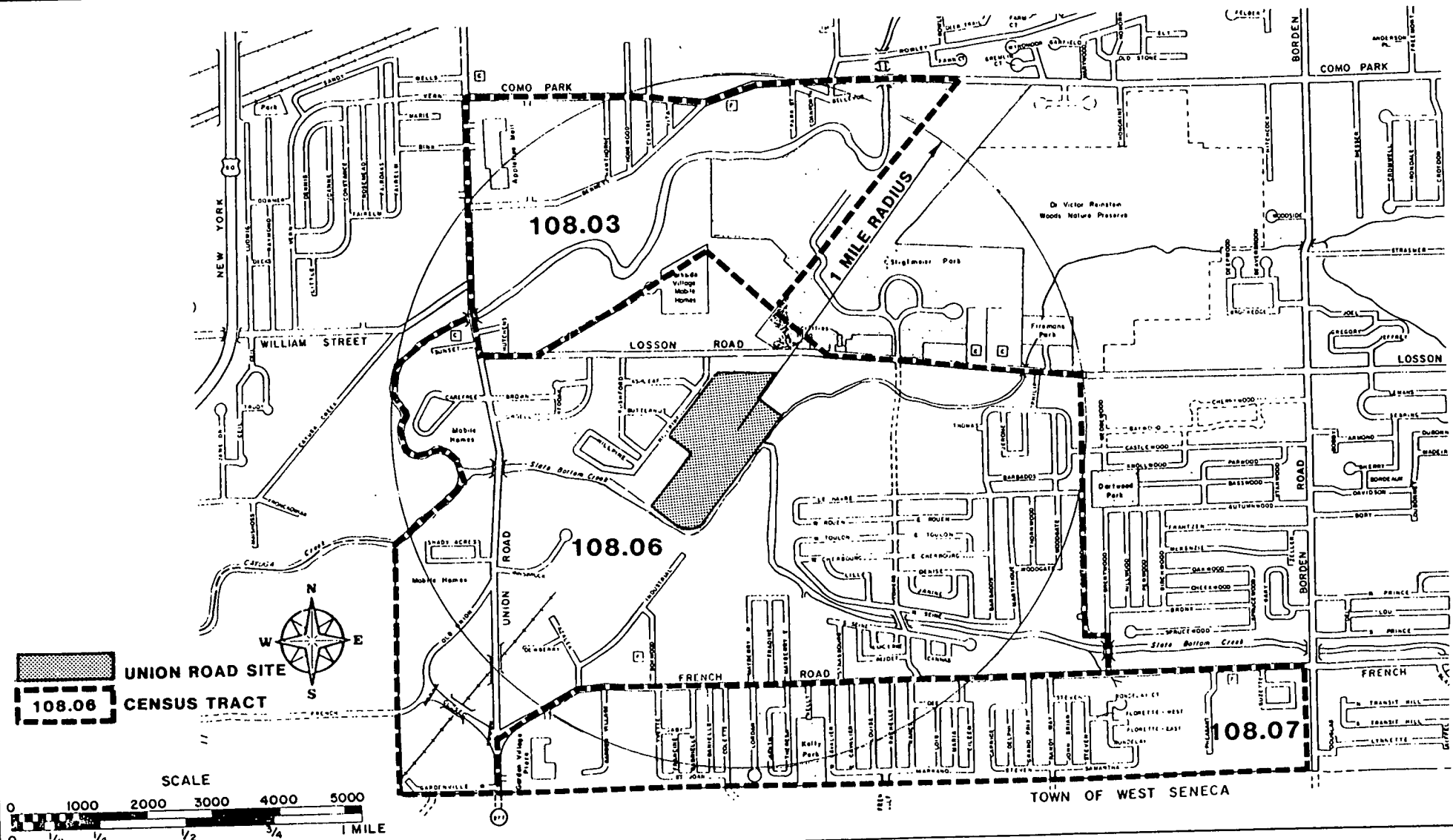
1.2.1.3 Climate/Meteorological Conditions

The average annual precipitation for the site area is approximately 35.5 inches. The monthly average varies between a low of 2.6 inches in April to a high of 3.2 inches in December. The maximum 24-hour rainfall recorded at the Buffalo Weather Bureau station was 5 inches in June 1987. The average annual snowfall is approximately 78 inches. The highest monthly mean is approximately 20 inches, occurring in January.

The average annual temperature is approximately 47 degrees Fahrenheit. July is the warmest month and February is the coldest month, with average temperatures of 70.1 and 27.5 degrees Fahrenheit, respectively.



**UNION ROAD SITE
LAND USE IN THE VICINITY
OF THE UNION ROAD SITE**



UNION ROAD SITE
**LOCATION OF 1980 CENSUS INFORMATION AREAS
 SURROUNDING THE UNION ROAD SITE**

FIGURE NO. 1-4

Table No. 1-1

SUMMARY OF POPULATION BY AGE WITHIN A ONE
MILE RADIUS OF THE UNION ROAD SITE
(1980)*

<u>Age (Years)</u>	<u>Total Number</u>	<u>Percentage (%)</u>
0-4	914	7
5-14	2,711	21
15-24	2,319	18
25-34	2,493	19
35-44	2,011	16
45-54	1,039	8
55-64	774	6
65 and over	<u>695</u>	<u>5</u>
	12,956	100

The median population ages by sex are:

<u>Sex</u>	<u>Median Age (Years)</u>
Male	29.1
Female	27.0
Male and Female	28.2

*1990 Census data by census tract will not be available until sometime in 1992.

Source: 1980 Census on Population and Housing

Figure No. 1-5 contains a wind diagram for Buffalo, New York, based on records from the United States Coast Guard Station in Buffalo, for the period January, 1936 to December, 1943, and January, 1947 to December, 1971. The Coast Guard Station is located approximately 20 miles southwest of the Union Road Site. Table No. 1-2 presents the average directional winds recorded in the Buffalo area. As can be seen from this table, the prevailing wind direction is from the southwest.

1.2.1.4 Topography

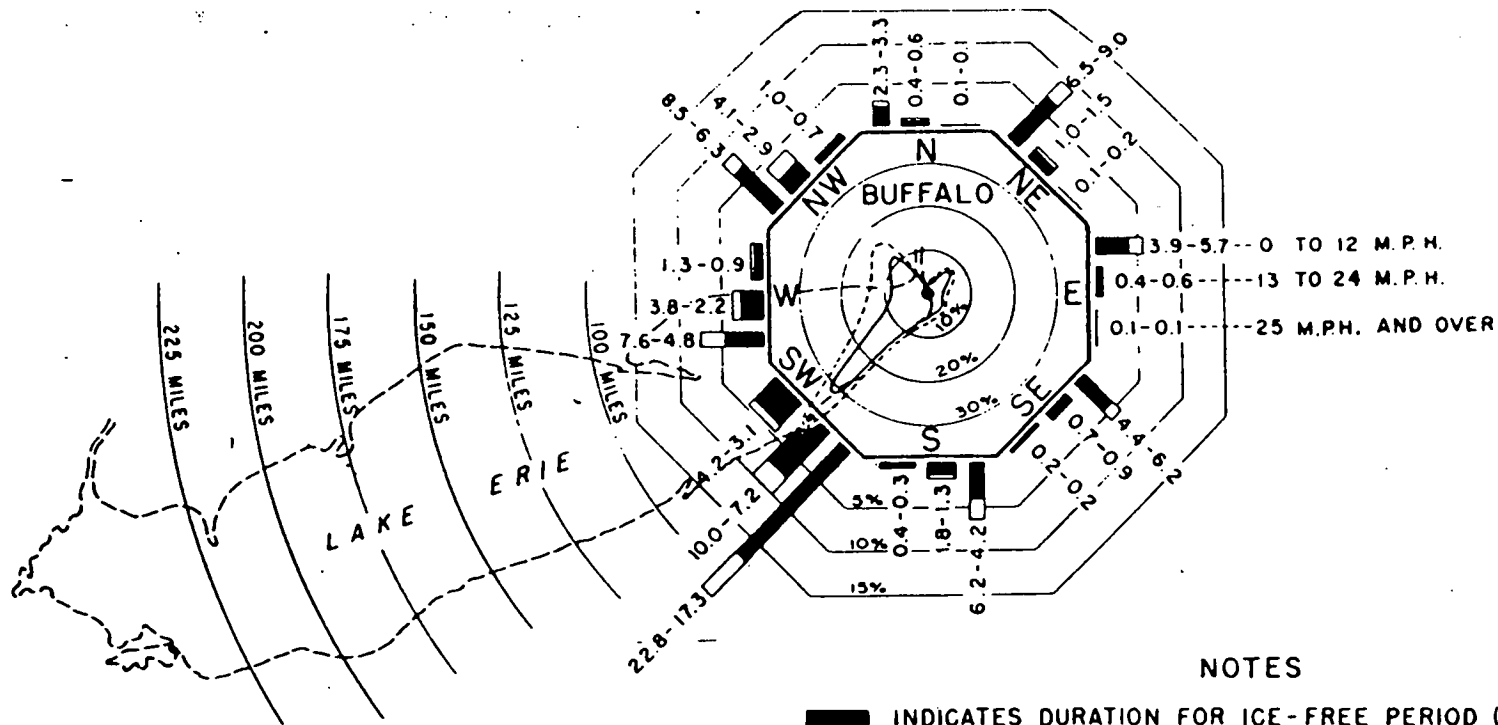
The area in the vicinity of the Union Road Site is characterized by generally flat topography with a gentle slope ranging from 1 to 3 percent. Elevations within 1 mile of the site range from approximately 650 feet above mean sea level to the north, east and south, to approximately 600 feet to the west. Construction activities have altered the terrain in the immediate vicinity of the site, resulting in the creation of bluffs, depressions and low lying marsh areas (a topographic map developed for the site and the immediately surrounding area is provided in Appendix I.)

1.2.1.5 Soil

The Soil Conservation Service (SCS) has classified soils found in the area of the Union Road Site area as Niagara, nearly level. Niagara soils are composed of silty, gravelly and stone-free, lake-laid sediments. These soils are somewhat poorly drained and have a seasonal high water table in the upper portion of the subsoil during the spring and other excessively wet periods. The rate of water movement through the soil is moderately slow. In some areas the silty sediments are underlain by gravelly glacial till deposits. Logs for three borings performed immediately west of the site (in Losson Green Estates) in October 1984 indicated that the silt layer is underlain by a layer of clay ranging between 20 to 25 feet thick.

Borings on the site in the vicinity of the Disposal Area, and constructed as part of this investigation in 1989, indicate a surface layer of cinders, roadbed gravel and fill from 5 to 23 feet in depth, underlain by varying thicknesses of waste material from 1 to 13 feet which in turn is underlain by 10 to 20 feet of clay over about 1 to 15 feet of glacial till deposits.

Borings in the vicinity of the area of the former roundhouse revealed no evidence of buried waste material as was found in the Disposal Area. The stratigraphy in the Roundhouse Area is consistent with that in the Disposal Area with the exception of the



NOTES

- INDICATES DURATION FOR ICE-FREE PERIOD (MAR. TO DEC. INCL.) IN PERCENT OF TOTAL DURATION.
- INDICATES DURATION FOR ICE PERIOD (JAN. TO FEB. INCL.) IN PERCENT OF TOTAL DURATION.
- INDICATES PERCENT OF TOTAL WIND MOVEMENT OCCURRING DURING ICE-FREE PERIOD.
- - - INDICATES PERCENT OF TOTAL WIND MOVEMENT OCCURRING DURING COMBINED ICE AND ICE-FREE PERIODS.

FIGURES AT ENDS OF BARS INDICATE PERCENT OF TOTAL WIND DURATION FOR ICE-FREE PERIOD AND COMBINED ICE-FREE AND ICE PERIODS, RESPECTIVELY.

WIND DATA BASED ON RECORDS OF THE U. S. COAST GUARD AT BUFFALO, N. Y. FOR PERIOD 1 JAN. 1936 TO 31 DEC. 1943 AND 1 JAN. 1947 TO 31 DEC. 1971

UNION ROAD SITE

WIND DIAGRAM FOR BUFFALO, NEW YORK

Table No. 1-2

AVERAGE YEARLY WINDS AT BUFFALO, NEW YORK

<u>Direction</u>	<u>Duration of Total (%)</u>	<u>Direction</u>	<u>Duration of total (%)</u>
North (N)	4.0	South (S)	8.4
Northeast (NE)	10.7	Southwest (SW)	37.0
East (E)	6.4	West (W)	12.7
Southeast (SE)	7.3	Northwest (NW)	13.6

upper 20 feet which shows laterally discontinuous zones of cinderfill material that appear to be concentrated in areas immediately surrounding pre-existing roundhouse structures. Elsewhere in the Roundhouse Area, clays and silts predominate in the upper 20 feet.

Borings in both the Northern and Southern Areas of the site did not encounter buried waste material or the cinderfill. In these areas, clays and silts extend from the ground surface to the glacial till deposits immediately overlying bedrock. Locally, an organic rich soil layer is present at the surface. The marsh area is characterized by organic rich sediments from the surface to a depth of 2 to 6 feet which are generally contaminated with the tar/waste material. This sediment is underlain by clay deposits which presumably extend down to the glacial till deposits.

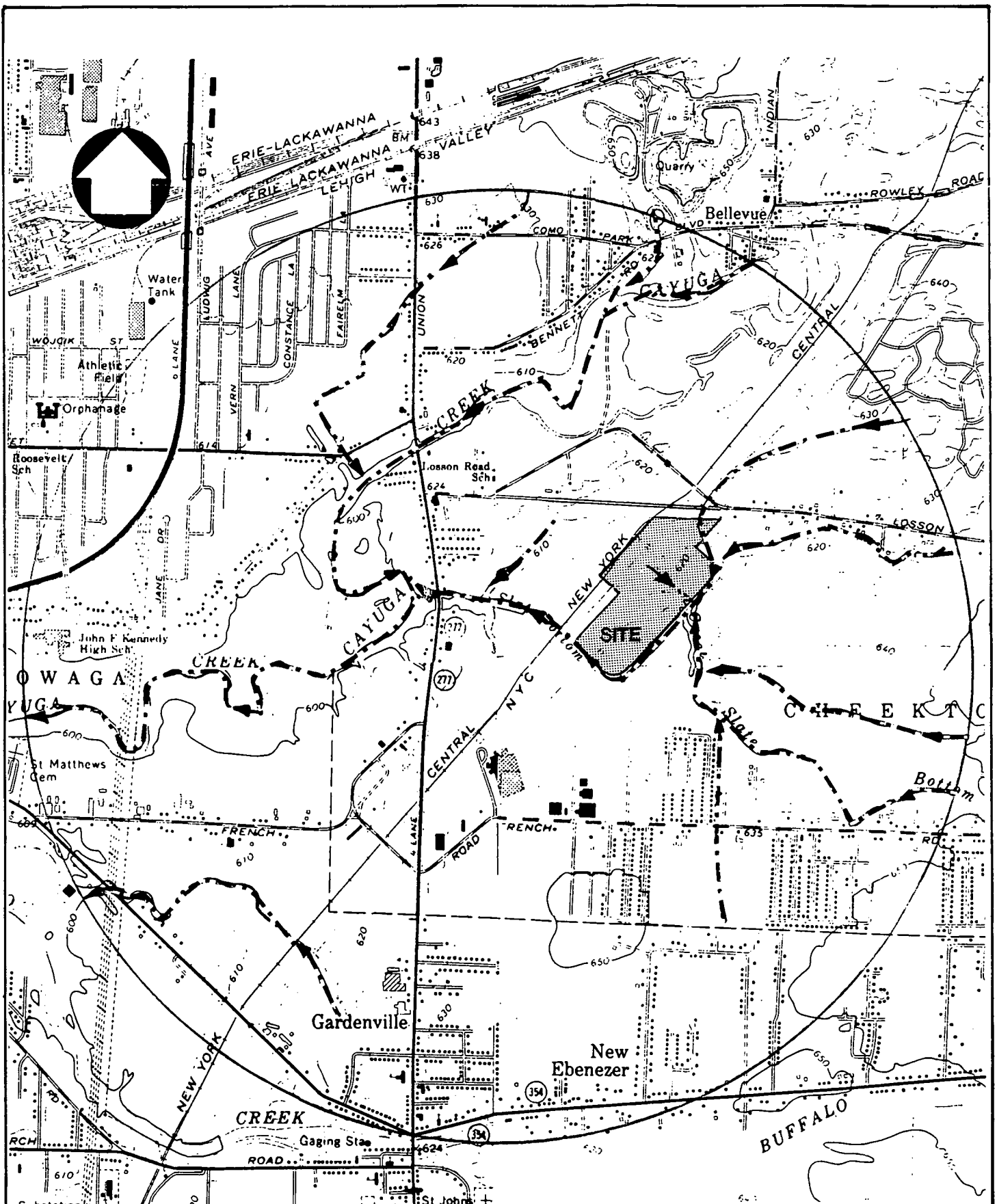
1.2.1.6 Surface Drainage

Runoff from the site drains generally southeastward through a marsh area to Deer Lik Creek which in turn flows into Slate Bottom Creek which is a tributary of Cayuga Creek located approximately 1 mile west of the site. Figure No. 1-6 shows the drainage patterns within approximately 1 mile of the site.

The known Disposal Area, which contains tar-like material, drums and other waste debris, lies within a northeast-southwest trending depression measuring approximately 100 yards in length and 40 yards in width. The depth of this depression is approximately 20 feet below the elevation of the surrounding grade. The majority of the depression is marshy, especially in the eastern and northern portions. Drainage occurs along the eastern side of the depression and an outlet to Deer Lik Creek opens to the southeast. An area of waste disposal/tar pit, measuring approximately 80 feet by 140 feet, is located along the southern part of the depression. The northern and eastern portions of the Disposal Area extend into the marshy area and seasonally contain standing water. During periods of heavy precipitation, the ponded surface water in the area of the Tar Pit overflows and drains through the downstream marsh area and to the outlets to Deer Lik Creek. The distance between the depression and the creek is about 200 yards.

1.2.1.7 Floodplains

Based on a review of a Federal Emergency Management Agency (FEMA) flood map, a portion of the perimeter of the site and the marsh area adjacent to the Tar Pit appears to lie within the 100-year floodplain of Slate Bottom Creek (see Figure No. 1-7).



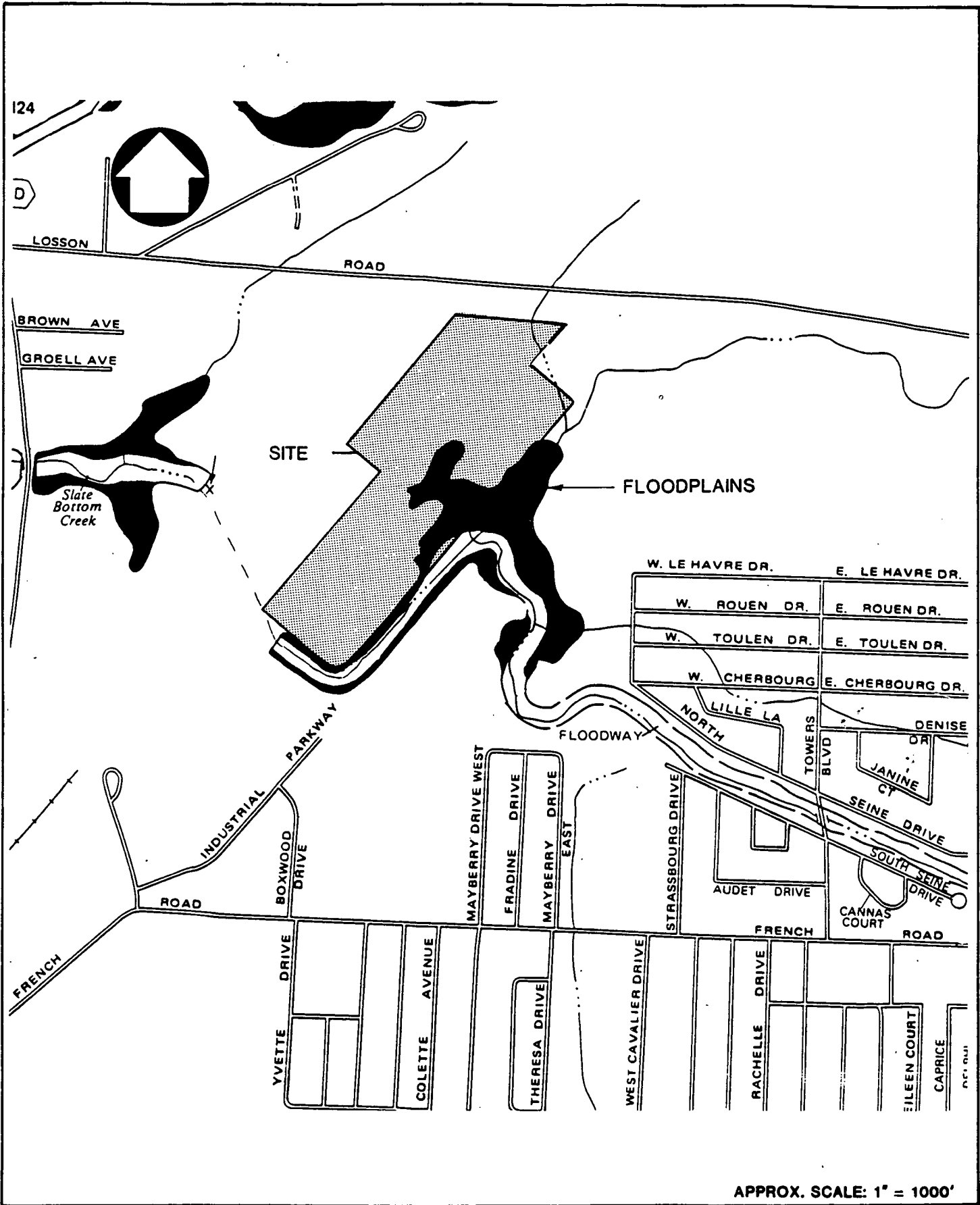
Source: USEPA

SCALE: 1" = 2000'

UNION ROAD SITE
DRAINAGE PATTERNS IN THE
VICINITY OF THE UNION ROAD SITE



FIGURE NO. 1-6



UNION ROAD SITE
**FLOODPLAINS IN THE VICINITY
 OF THE UNION ROAD SITE**

1.2.1.8 Wetlands

A review of the NYSDEC and Erie County Department of Environment and Planning freshwater wetlands maps indicates that there are no protected wetlands located directly within the boundary or immediately contiguous to the Union Road Site. The nearest regulated New York State Wetland (LA-6) is located approximately 1 mile northeast of the site (see Figure No. 1-8). The marsh within the site is composed primarily of *Phragmites australis* (reed) and/or cattail vegetation north and east of the Tar Pit. Other vegetation on the site exists in areas of standing water, in particular along either side of the cinder road that borders the southwestern boundary of the site, and in the southern portion of the site.

1.2.1.9 Endangered Species

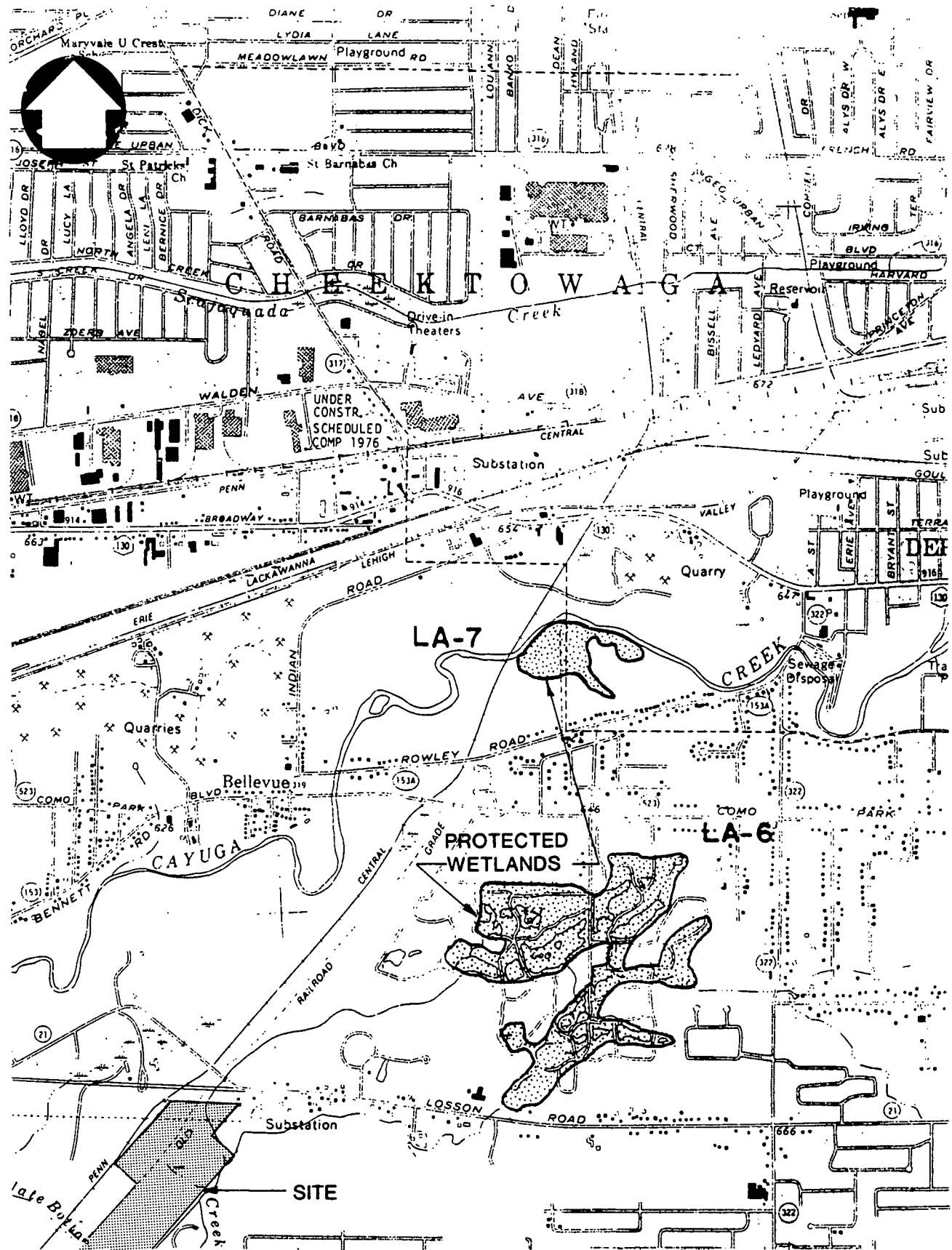
There are no known critical habitats, or endangered or threatened species within 1 mile of the Union Road Site. However, because the site and a portion of the surrounding area is undeveloped, wildlife, including beaver, woodchuck, rabbit and deer, inhabit the site. In addition, fish up to about 12 inches in length and crayfish have been observed in Slate Bottom Creek adjacent to the site, and small fish approximately 3 inches in length have been observed in Deer Lik Creek.

1.2.1.10 Surface Water

Cayuga Creek, a New York State Class B and C waterway used for fishing and limited boating, flows approximately 1 mile north and west of the site (see Figure No. 1-6). Slate Bottom Creek, a Class D waterway suitable for secondary contact recreation (recently proposed to be upgraded to Class C), lies adjacent to the site on the east and south and flows into Cayuga Creek approximately 1 mile west of the site. Slate Bottom Creek enters the Class C portion of Cayuga Creek. The Class B portion of Cayuga Creek lies approximately 1 mile upstream of the site. The site is also bordered in the east by a tributary to Slate Bottom Creek which is known locally as Deer Lik Creek and is a Class D water body.

1.2.1.11 Geology

Based on the Geologic Map of Erie County (Buehler and Tesmer, 1963) in the general area of the Union Road Site, it was anticipated that bedrock first encountered underlying the site would have been that of the Marcellus Formation. However, during the



SCALE: 1" = 2000'

UNION ROAD SITE
**PROTECTED WETLANDS IN THE
 VICINITY OF THE UNION ROAD SITE**



monitoring well construction program conducted as part of this investigation, bedrock first encountered at the Union Road Site was the Moorehouse Member of the Onondaga Limestone. The Moorehouse Member is the uppermost member of the Onondaga Limestone that is recognizable in Erie County. The texture varies from coarse to very finely crystalline and the color from dark grey to tan. Chert, some light buff in color, and disseminated bituminous matter are also present. There are no published estimates on the thickness of the Onondaga Limestone in Erie County.

As discussed in Section 1.2.1.5, three test borings were conducted in 1984, west and adjacent to the Union Road Site in the area of what is now Losson Green Estates. These borings were undertaken to evaluate the potential for ground water movement from beneath the site to a proposed storm and sanitary sewer system for a housing development (Losson Green Estates). Depth to bedrock was interpreted/found to exist 32 to 40 feet beneath ground surface. A thin layer of fill consisting of slag and sand, and cinders and roadbed gravel was found between 1 and 2 feet from the surface. Beneath this layer, approximately 5 to 7 feet of stiff silt and fine sand occurred to a depth of about 10 feet below ground surface, and beneath this silt and sand layer, a 20 to 25 feet thick layer of clay, with an estimated permeability of less than 10^{-6} centimeters per second, was found.

A thin layer of glacial till estimated between 2 and 5 feet thick was interpreted to overlie bedrock throughout the housing development and site limits. The report from the Buffalo Drilling Company, which performed the borings in the Losson Green Estates Area, concluded that ground water migration from the Union Road Site would be highly unlikely due to the highly impermeable clay soils. This would also apply to vertical migration on the site.

Borings constructed throughout the site as part of this investigation provided subsurface data basically consistent with that found during the previous boring program off-site with the exception of descriptions of the thicknesses of the cinderfill material and glacial till deposits which were both found to vary substantially in thickness from 5 to 23 feet throughout the site as is discussed in greater detail in Section 3.1.3 of this report. In addition, in the Disposal Area on the site, the silt and sand/fill layer was underlain by waste/contaminated soil from 1 to 13 feet in thickness and about 10 to 15 feet of clay.

1.2.1.12 Ground Water

In the three test borings conducted in Losson Green Estates in 1984, water was not encountered in two of the borings, but a water level of 13.5 feet was measured in the third. Based on this information, a continuous water bearing zone within the area of the borings did not appear to exist within the unconsolidated material. The marshy area adjacent to the site to the north and east, as well as Deer Lik Creek to the east and Slate Bottom Creek to the east and south, is believed to be in a ground water discharge area.

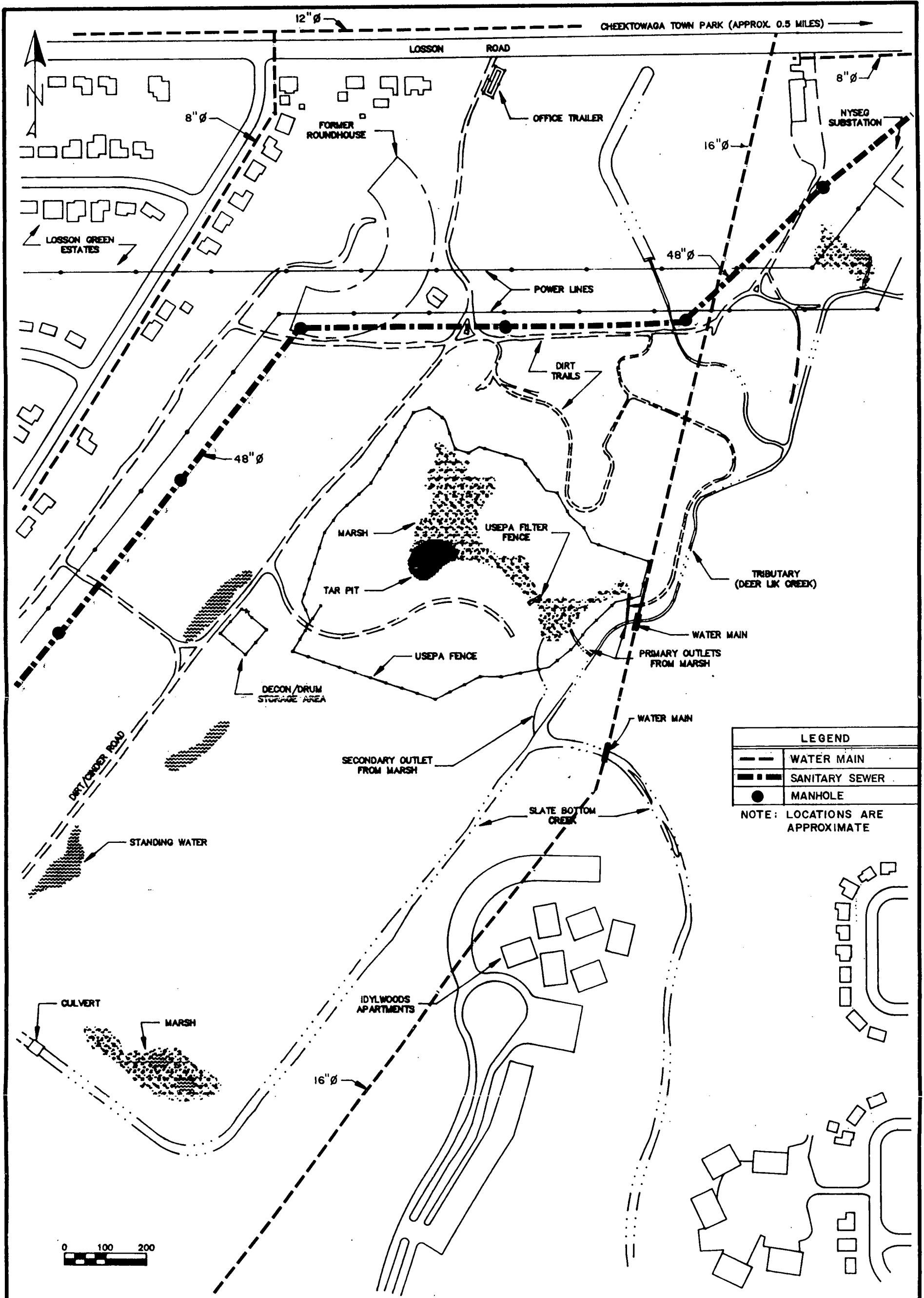
As a result of the ground water monitoring program conducted as part of this investigation, it was determined that there are three aquifers present at the Union Road Site. A perched/shallow water table aquifer is present in the cinderfill material overlying clay in both the Disposal and Roundhouse Areas. A till zone aquifer is found to overlie bedrock throughout the site and ground water was encountered at a depth approximately 7 to 10 feet below the bedrock surface. Bedrock ground water was found to move through the site in a generally north to northeast direction. Ground water in the till zone aquifer moves in a generally east to southeast direction with local variations and ground water in the perched/shallow water table aquifer is found to move generally in an east to east-southeast direction towards Slate Bottom Creek. Vertical potential gradients were found to vary from location to location throughout the site as well as seasonally. A detailed description of hydrogeologic condition is provided in Section 3.1.4.

1.2.1.13 Water Supply

There are no known uses of ground water within 3 miles of the Union Road Site and no known surface water intakes within 3 miles downstream of the site. According to 1980 Census information, all residents within a 1 mile radius of the site are connected to public water supply (Erie County Water Authority) which is obtained from Lake Erie. A water main serving areas to the southeast of the site runs through a portion of the site (see Figure No. 1-9).

1.2.1.14 Stormwater

Runoff in the vicinity of the Union Road Site is collected in roadway catch basins and stormwater collection systems, and diverted to Slate Bottom Creek or its tributaries and other creeks in the area, or drains directly to these same creeks. Stormwater in the Losson Green Estates, approximately 1/4 mile west of the site, is collected in a storm-



UNION ROAD SITE
 LOCATIONS OF SANITARY SEWER AND WATER MAIN

Section 2



water drainage system and discharged to a creek west of the development. Runoff along Losson Road in the vicinity of the site is discharged to a ponded area and ravine which drains to Deer Lik Creek. Runoff at the site itself drains to the Tar Pit depression and marsh area to Deer Lik Creek, or directly to Deer Lik and Slate Bottom Creeks.

1.2.1.15 Wastewater

The area surrounding the Union Road Site is located within the Erie County Sewer District and serviced by wastewater collection and treatment provided by Erie County Sewer District No. 3. A gravity main serving areas north of the site runs through a portion of the site as illustrated in Figure No. 1-9.

1.2.2 Site History and Previous Investigations

Review of historical aerial photographs indicates that by 1928, the area adjacent to, and including the Union Road Site, was already established as a large railroad classification yard, apparently initially operated by the New York Central Railroad and later taken over by the Penn Central Railroad. It is reported that the facility commenced operation about 1900 and a date of 1913 is inscribed on one of the structures which still exists at the site (concrete culvert at the southern boundary). One roundhouse, several maintenance and storage buildings, tanks and numerous sheds were constructed in the vicinity of the site. The railroad yard operated until the mid-1950's and was dismantled sometime between 1951 and 1958 as indicated by historical photographs.

The marsh and depression, constituting the known, exposed Disposal Area, were not in evidence in 1928. However, the 1928 aerial does indicate large areas of disturbed land approximately 1,500 feet south of the known Disposal Area, lying in an area bounded on the immediate south and east by Slate Bottom Creek, on the west by the former railroad yard and on the north by an area of mature trees (see Figure No. 1-10). The 1928 photograph also indicates a possible area of waste disposal south of the existing Tar Pit which was subsequently filled as shown in later photographs. A 1951 aerial photograph shows the creation of what appears to be a depression containing standing water in this Southern Area. This Southern Area of the site was reported to be a storage area for fill used at the site.



LOSSON ROAD

LOSSON GREEN ESTATES

RAILROAD ROUNDHOUSE (DEMOLISHED)

STUDY AREA DELINEATED IN THE REQUEST FOR PROPOSALS

RAILROAD SPUR (DEMOLISHED)

WIDTH OF ABANDONED RAILROAD YARD

TO CAYUGA CREEK

UNDERGROUND CULVERT

AREA OF MATURE TREES

MARSH

TRIBUTARY

CREEK

SLATE

BOTTOM CREEK

SLATE

LEGEND



1928 AERIAL PHOTO DISTURBED AREA



1953 AERIAL PHOTO DISTURBED AREA



1960 AERIAL PHOTO DISTURBED AREA



1979 AERIAL PHOTO DISTURBED AREA



EXISTING CONFIGURATION OF TAR PIT



EXISTING CONFIGURATION OF MARSH AREA

APPROXIMATE SCALE: 1"=500'

UNION ROAD SITE

**AERIAL PHOTOGRAPHIC INTERPRETATION
OF HISTORICAL DISTURBED/
WASTE DISPOSAL AREAS**



FIGURE NO. 1-10

A 1938 photograph shows a railroad spur that extends from the main tracks and terminates at the depression. According to discussions with a former railroad employee who worked at the site, this spur was used to facilitate waste disposal in the depression. An aerial photograph obtained in 1951 shows another area of possible waste disposal in the northern portion of the depression/marsh area. A 1960 aerial photograph indicates that half of the original depression remained, and a considerable amount of additional fill material had been disposed of at the location since a 1951 aerial and the time the railroad yard was abandoned. In addition, the railroad spur leading to the Disposal Area had been removed as part of decommissioning the facility. In a 1972 photograph, residential development south and east of the site is clearly evident and no apparent disposal activity was noted; however, in a 1979 photograph the area north of the depression appears to be reworked and possibly used for waste disposal.

In 1982, the Erie County Department of Environment and Planning (DEP), responding to a complaint, inspected the site and found an area at the southern end of the depression measuring approximately 80 feet by 140 feet that contained a tar-like waste material and approximately 56 drums. The area was littered with household trash and a flow of water was observed passing over the tar-like area, through a marshy area and draining to Slate Bottom Creek to the southeast. Samples of the tar-like material and water flowing from the site were taken during the inspection and again in April, 1983.

An Infra-Red (IR) scan of two samples of the tar-like material collected in 1982 by DEP, indicated one sample had characteristics of asphalt while the other that of lubrication oil. Analysis of a surface water sample for metals indicated low levels for those parameters tested. The tar-like material, sampled again in 1983 by DEP, was analyzed for PCBs and phenolic compounds. PCBs in the four samples collected ranged from less than 0.14 to 37 parts per million (ppm). Minor amounts of phenol and phenolic compounds were detected and many alkane peaks were recorded.

Following the 1983 investigation, the County concluded that the depression was man-made and that the railroad siding bordering the northern edge was constructed solely for the purpose of transporting waste to the Disposal Area. DEP also concluded that the depression was filled in from south to north resulting in approximately half of the original depression remaining. In addition to the drums and tar-like material in the depression, railroad car parts and tar-like material were observed in the embankment of the Tar Pit and on the surface of the apparent fill area surrounding the depression, respectively, during site reconnaissance in October, 1988.

In August, 1983, Universal Marion Corporation contracted with RECRA Research, Inc. to evaluate the site. RECRA personnel observed that the disposal site and surrounding area were being used as a local dump as evidenced by discarded household garbage, construction debris, household appliances, broken furniture and old tires. Probing of the tar-like material revealed a crusty surface overlying a soft material with the consistency, appearance and smell of thick lubricating grease. Samples were obtained for analysis from the tar-like material, surface water in the depression, randomly chosen drums and Slate Bottom Creek. RECRA personnel noted that a tar-like material was also found along the banks of Slate Bottom Creek just downstream of where the outlet from the Disposal Area enters the creek. This tar-like waste was interpreted to represent an outflow of material from the Disposal Area.

The samples collected by RECRA Research, Inc. in August, 1983 showed that the tar-like material contained long-chain aliphatic hydrocarbons and high metals content including lead (up to 121,000 ppm), copper (9,780 ppm), mercury (10.4 ppm), antimony (150 ppm) and chromium (24 ppm). PCBs were reported (37 ppm) and a small volatile fraction was detected. The pH of the tar samples ranged up to 12.75. Drum contents were found to contain lead concentrations of up to 47,600 ppm. (It should be noted that samples were obtained from drums which were open and lying on the surface of the Tar Pit and, therefore, most likely to contain tar-like material [which may have been originally in the drums or possibly seeped into the drums while in the lagoon].) During this investigation, there was some evidence of movement of the tar-like material from the Disposal Area to an outlet discharging to Slate Bottom Creek. While there were no ground water monitoring wells at the site prior to this investigation, a subsequent study conducted by RECRA (discussed in more detail below) indicated that the leachate from the tar waste deposits could potentially be entering the ground water. Other analyses showed that the waste in the area of the Tar Pit exhibited an EP Toxicity concentration of 130 ppm for lead, thereby classifying the material hazardous by definition of the Resource Conservation and Recovery Act (RCRA).

Surface water analyses for metals indicated low levels for all parameters detected except lead in a tar-like sample (3.4 ppm). Aliphatic compounds and volatile halogenated organics were detected in two creek samples (one upstream and one downstream of the discharge point from the site). Aliphatic compounds and volatile halogenated organics were also detected in surface water samples from the Disposal Area.

As part of a Phase I Investigation undertaken for NYSDEC, RECRA inspected the site in March, 1986. The waste lagoon was found to be partially situated in a marshy area containing standing water. The tar-like material, rusted drums and household trash were still evident at the site. An oil film and iron leachate were observed in the surface water drainage leading from the lagoon to Deer Lik Creek. Organic odors were not detected in the Disposal Area. During a previous site inspection by RECRA in August, 1983, a "grease or tar" smell was noted when the tar-like material was disturbed.

The NYSDEC Phase I Investigation also indicated the area around the site to contain extensive fields and woods used by neighborhood youth for recreation. Since a network of trail-bike paths exists in many parts of the site, New York State Department of Health (NYSDOH) personnel expressed concern about children playing in the area being exposed to the wastes. A snow fence and signs warning of potential hazardous wastes had been erected around the site by the Town of Cheektowaga.

In April, 1986, NYSDEC Region 9 personnel inspected the site to evaluate the condition of the drums. A total of 81 drums, rusted and unlabeled, many almost totally deteriorated, were counted on-site. None of the drums appeared to contain any liquid and about 10 contained solid material (stone with binder). The southern bank of the Tar Pit depression was observed to be composed of crushed cinders. The possibility of additional drums being located beneath the existing rubble was noted.

In September, 1986, tar-like waste was found on the adjacent creek banks by NYSDEC Region 9 personnel and in February, 1987, the United States Environmental Protection Agency (USEPA) collected samples of the tar-like material, the marsh sediment and Slate Bottom Creek. The results indicated the presence of chromium, lead, copper, oil and grease, aliphatic compounds and halogenated organics. PCBs were not detected.

1.2.3 Other Background Information

Railroad roundhouses served as primary maintenance areas for railroad operations during the time when steam engines were at their peak utilization. As the primary areas for maintaining railroad equipment, the roundhouses served as locations where locomotive furnaces were cleaned of coal ash, engine crank case oil and steam piston oil were removed and changed, and steam engine components were rebuilt as part of a periodic maintenance program. In addition, other general maintenance on locomotives and railroad

cars was conducted including painting and repacking wheel bearings with heavy weight lubrication and grease. Degreasing agents, such as benzene and carbon tetrachloride were probably also used. Some roundhouses were also used to decommission steam engines as they were approaching the end of their useful life and were being replaced by diesel locomotives. During the decommissioning process, the steam boilers, which were often covered in an asbestos insulation material, were removed and disposed.

One of the strikingly evident properties of the tar-like substance analyzed by RECRA Research, Inc. was the discovery that it contains considerable concentrations of lead (121,000 ppm), copper (9,780 ppm), antimony (150 ppm) and chromium (24 ppm). Most steam engine bearing assemblies of the type utilized by railroads consisted of a babbitt metal comprised of a lead-based alloy including tin, copper and antimony nearly in the same ratios as found in the tar samples. At some railroad roundhouse operations, babbitt alloys were mixed on-site and poured into the bearing cases of steam engine blocks. As the bearings wore under typical use, significant amounts of the alloy would wear and become mixed with the lubricating crankcase oil. When the oil was changed it is likely that it was discarded at nearby on-site disposal pits together with cutting oils and solvents used to clean engine and other locomotive/railroad car parts.

Also, wheel bearing grease had metal additions, such as lead, copper, antimony and zinc to enhance its lubricating properties. Similarly, when the wheel bearings were repacked, the spent packing material and grease, as well as spent bearing material, were disposed of nearby. Evidence of burlap-like material found in waste samples obtained during the RI field program appears to verify this supposition.

In addition to the waste crank case oil, it is also likely that coal ash from steam locomotive furnaces was removed from engines as part of normal operation and scheduled maintenance. It is assumed that the areas identified as "disturbed" from aerial photographic historical interpretation are likely to have received such ash. Depending on the quality of the coal from which the coal ash was derived, it is possible that the residue could contain high levels of metals found in coal, and concentrations of various polycyclic aromatic hydrocarbons (PAHs) resulting from incomplete combustion. It is also possible that these railroad yard facilities used coal tar and creosote on-site as wood preservatives to coat railroad ties.

As previously mentioned, three borings were undertaken by the Buffalo Drilling Company, Inc. in November of 1984 in a then planned area of development (Losson Green Estates) west of the Union Road Site. The boring program indicated that a layer of fill consisting of slag and foundry sand was discovered between 1 and 2 feet beneath ground surface. This was also evidenced in excavations for building foundations north of the Union Road Site during a site visit in October, 1988 and west of the site in May, 1989. This slag and sand is most likely road bed material for the railroad yard. The source of this material could have been from steel mills and foundrys which formerly operated in the area, and/or from on-site operations, such as disposal of coal ash and foundry sands used in the manufacturer of crank shaft and wheel bearings.

1.2.4 Response Actions to Date

In 1982, the Town of Cheektowaga erected a standard height snow-fence and posted signs warning of potential hazardous wastes in the area in an attempt to secure the waste lagoon and Disposal Area, and deny access to the public.

In April, 1988, USEPA, under the authority of the Comprehensive Environmental Response, Cleanup and Liability Act (CERCLA), erected a high visibility fence and hazardous waste site warning signs surrounding the Disposal Area and marsh. In addition, EPA-Region II funded construction of a filter screen to prevent the migration of contamination from the Tar Pit and marsh area to Deer Lik and Slate Bottom Creeks (see Figure No. 1-11).

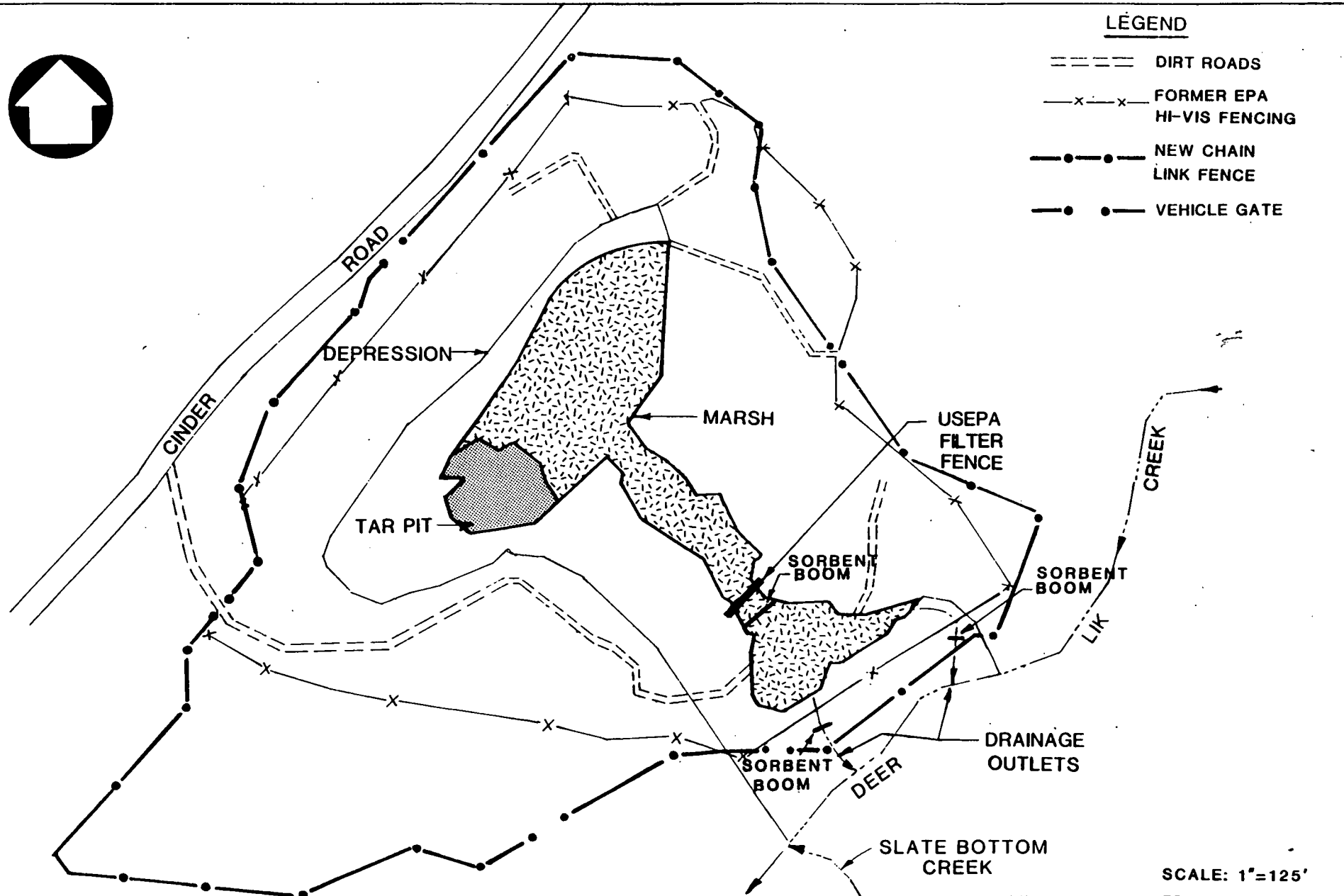
During the periods January through April, 1989 and September through December, 1989, Dvirka and Bartilucci Consulting Engineers, under contract to the New York State Department of Environmental Conservation, conducted comprehensive field investigations (Phase I and II of the RI) at the Union Road Site. The results of these investigations are the subject of this report.

In October, 1989, Dvirka and Bartilucci Consulting Engineers contracted with Allied Fence, Inc. to dismantle and remove the existing high visibility fence and construct a 3,300 foot long, 6 foot high chain link fence encompassing the Tar Pit, marsh and Disposal Area. The total area incorporated by the chain link fence is greater than that of the previously existing high visibility fence as it extends approximately 250 feet further to the south of the Disposal Area where significant contamination of surficial soil was found. Thirty hazardous waste warning signs were posted along the length of the fence.



LEGEND

- DIRT ROADS
- x-x- FORMER EPA HI-VIS FENCING
- NEW CHAIN LINK FENCE
- VEHICLE GATE



SCALE: 1"=125'

**UNION ROAD SITE
LOCATION OF SECURITY FENCE SURROUNDING
THE TAR PIT AND WASTE DISPOSAL AREA
AND CONTAMINATION FILTER SCREEN/SORBENT BOOMS**



In November 1989, Dvirka and Bartilucci Consulting Engineers installed sorbent booms at three locations within the marsh area. One boom was placed across the marsh approximately 20 feet downstream of the EPA filter fence. Booms were also installed at the central and northern marsh outlets to Deer Lik Creek. In addition, a berm constructed of bentonite was placed across the southern (intermittent) marsh outlet in order to divert flow towards the central marsh area.

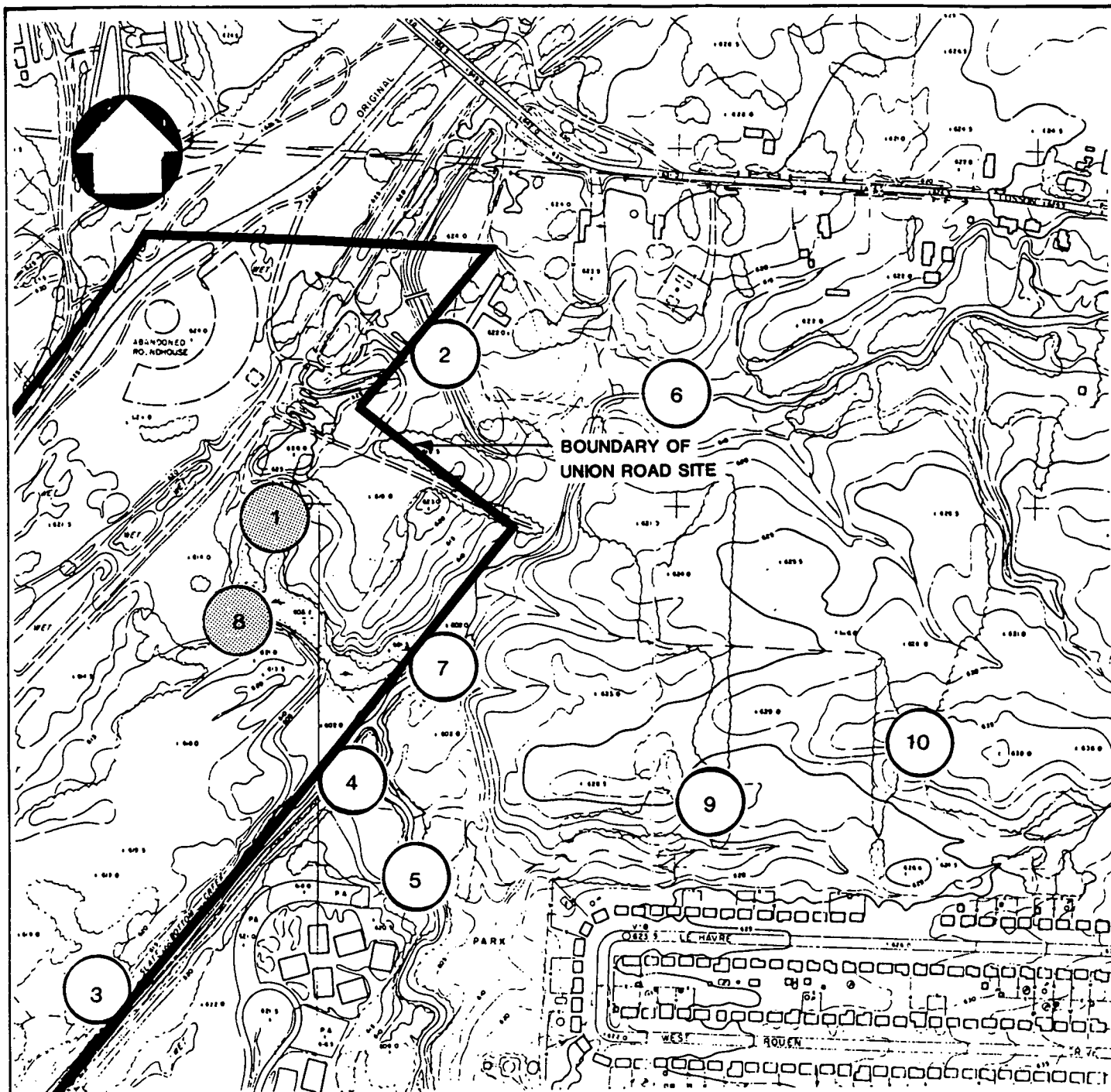
In December 1989, Dvirka and Bartilucci Consulting Engineers erected 12 hazardous waste warning signs along Deer Lik and Slate Bottom Creeks in order to inform the public of the presence of waste material deposited in and along the banks of both Slate Bottom and Deer Lik Creeks.

1.2.5 Additional Areas of Concern


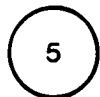
An environmental group comprised of local citizens had identified a number of additional suspected waste disposal sites located both north and south of Losson Road that may have been attributed to former railroad operations or other disposal activities (see Figure No. 1-12 for the sites south of Losson Road). Site Nos. 1 and 8, which are the northern portion of the Disposal Area and Tar Pit, respectively, were investigated as part of the Union Road Site and involved a full-scale investigation under this Remedial Investigation and Feasibility Study. Site Nos. 2, 3, 4, 5, 6, 7, 9 and 10 required limited exploratory investigation as part of the study. The objective of this exploratory work was to provide a determination of the existence (and preliminary characterization, if required) of hazardous substances which might be present at each of these eight "satellite sites," and to define pathways by which pollutants might be migrating from the sites, if found. The results of this ancillary study are contained in a separate document entitled "Phase I Remedial Investigation - Satellite Site Report," and are also discussed in part in this report.

1.3 Overview of the Remedial Investigation and Report Organization

The Remedial Investigation is designed as a sequential progression of multiple phased sampling and data analysis programs. The objective of this strategy is to apply data generated from previous phases to the design of future phases. In this way, a cost-effective, targeted program is implemented which generates meaningful specific data.



LEGEND

-  - N.Y.S. REGISTRY SITES (MAIN SITE)
-  - SATILLITE SITES

Note: Site Location is approximate.

APPROXIMATE SCALE: 1" = 400'

UNION ROAD SITE
**LOCATION OF ADDITIONAL SITES
 OF SUSPECTED WASTE DISPOSAL**

As an introduction to the report and as presented above, Section 1.0 provides a general discussion of the purpose of the Remedial Investigation/Feasibility Study and the RI Report, as well as a description of the regional and physical features of the Union Road Site Study Area and a description into the site background that led up to conducting this Remedial Investigation. Also included in this section is an overview of the site history, and nature and extent of the chemical contamination as documented primarily by previous investigations, as well as a discussion of waste types and characteristics as they pertain to the contaminants of concern in the study area. Other sections which make up this report include the following.

Section 2.0 describes the various activities associated with the field work conducted during the Phase I and II Remedial Investigations which were performed in order to characterize the site. In addition, the individual programs incorporated into the particular work activities, including health and safety, quality assurance and control, and data validation are reviewed.

Section 3.0 provides the results of the field activities to determine the physical environmental/ecological characteristics of the site. Included in this section are the results of the aerial photography and topographic mapping, geophysical surveys, well drilling and soil borings, test pit excavation, sampling and monitoring, flow measurement and wildlife habitat inventory conducted as part of the field investigation.

Section 4.0 discusses the results of the field activities and sampling, and the nature, extent and source(s) of contamination. It presents the results of the site characterization, both natural chemical components and contaminants in each of the media sampled as reported by a NYSDEC certified laboratory. Included in this section is a discussion of Applicable or Relevant and Appropriate Requirements (ARARs) established for the site for data evaluation and other guidelines and standards that pertain to each media, and a comparison of these criteria to the contaminant levels found at the site.

Section 5.0 discusses contaminant fate and transport. It includes physical, chemical, and/or biological factors of importance for each media and potential routes of contaminant migration, and factors affecting migration for each analyte/matrix of importance.

Section 6.0 provides conclusions resulting from the investigation of the site, as well as recommendations for future work and recommended interim and long-term remedial action objectives.

2.0 STUDY AREA INVESTIGATION

2.1 Site Facilities

The initial field operations undertaken during the Remedial Investigation involved the establishment of a field office at the site and a secure area for equipment, supplies and drum storage, as well as a decontamination pad.

The field office comprised a trailer located along Losson Road at the entrance to the main access roadway to the site (see Figure No. 2-1). Electricity and telephone service were provided to the trailer. The trailer was enclosed by an 8 foot high chain-link fence and truck gate topped with barbed wire.

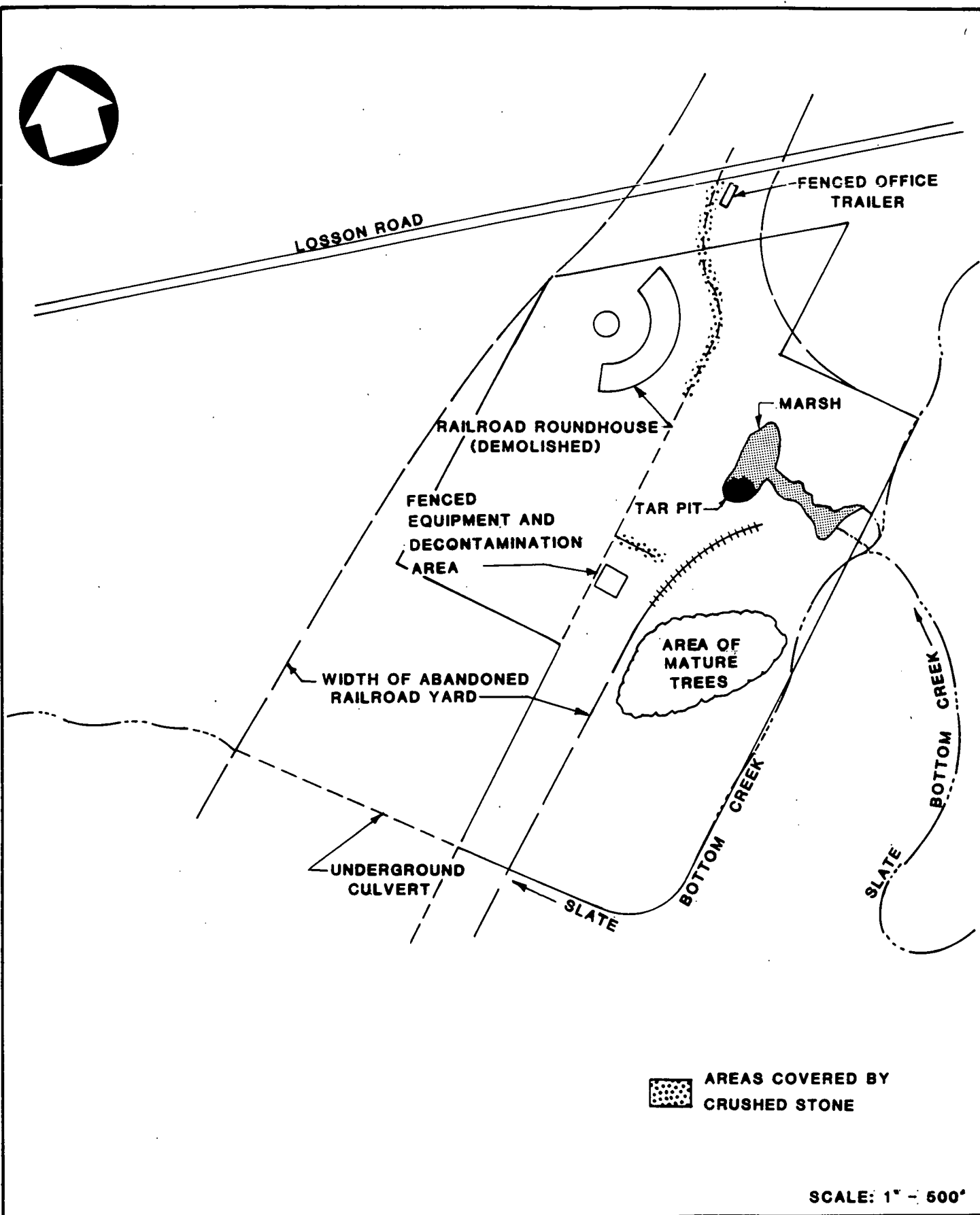
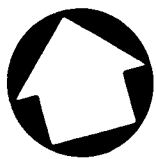
The decontamination/storage area was located closer to the center of field activities and away from residences surrounding the site (see Figure No. 2-1). This area, which measures 80 feet by 80 feet, was also enclosed by an 8 foot high chain-link fence and truck gate with barbed wire as is illustrated in Figure No. 2-2. The decontamination pad was constructed of sand covered by a plastic liner and a platform to support vehicles. Wastewater generated as a result of steam cleaning/chemical washing equipment and supplies was diverted to a sump and pumped into drums. A detailed description of the decontamination pad is provided in the project Work Plan.

In addition, due to the extremely muddy conditions which existed in a number of areas along the site access roadway which made travel difficult, approximately 400 tons of stone (Crusher Run No. 3) were spread along the roadway leading from Losson Road to just south of the Roundhouse Area and from the cinder road to the dirt access roadway to the Tar Pit in order to provide a more competent roadway. The areas covered by the stone are shown in Figure No. 2-1.

2.2 Field Activities/Site Characterization

The Phase I (Baseline) component of the Remedial Investigation for the Union Road Site comprised the following (a more detailed breakdown, which includes the dates the activities were conducted, is provided in Table No. 2-1):

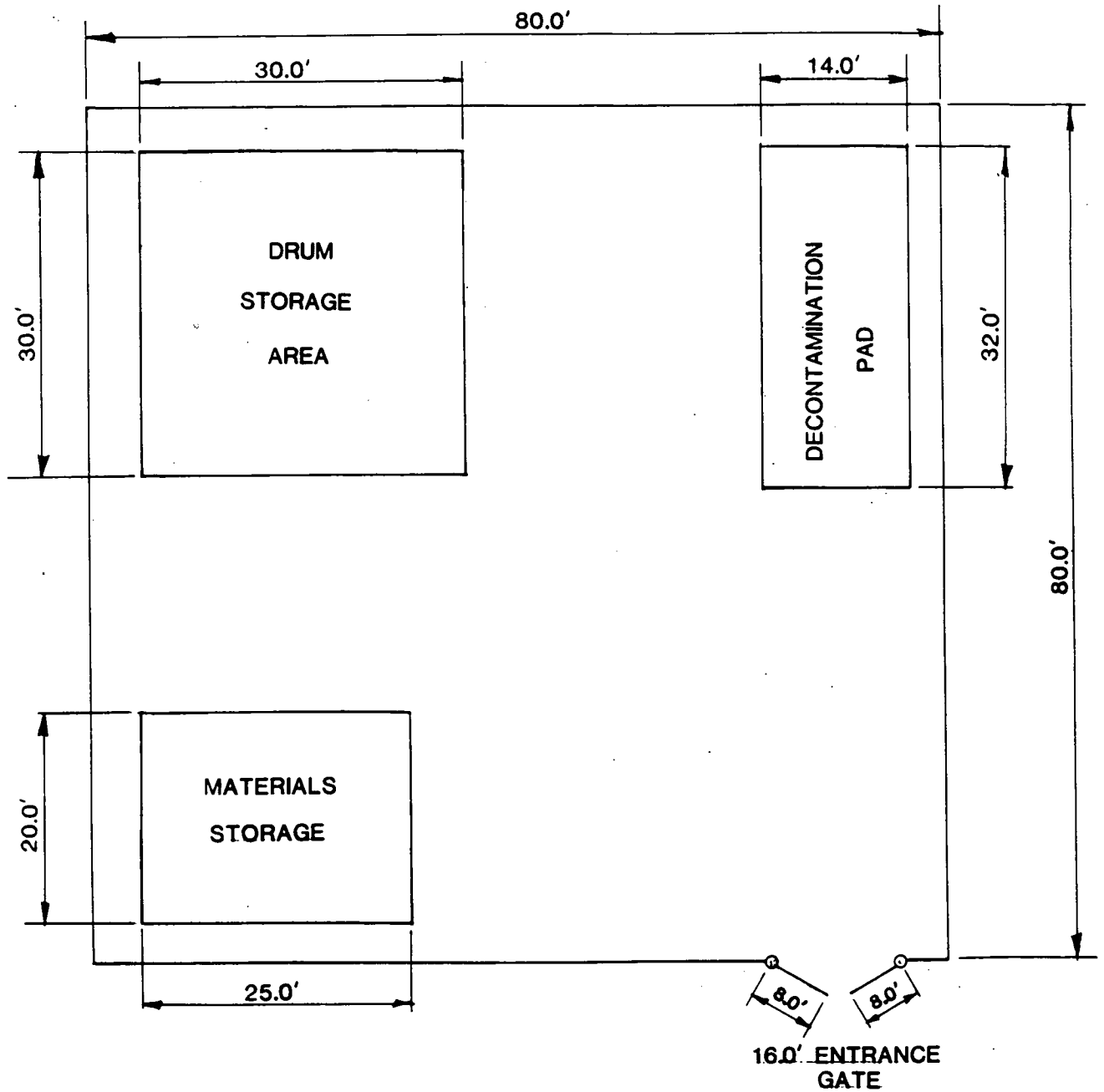
- o Aerial photography and topographic mapping,
- o Geophysical survey,



UNION ROAD SITE
**LOCATION OF FIELD OFFICE TRAILER
AND EQUIPMENT/DECONTAMINATION AREA**



FIGURE NO. 2-1.



UNION ROAD SITE
**FENCED EQUIPMENT STAGING, DECONTAMINATION PAD
 AND DRUM STORAGE AREA**

Table No. 2-1

SUMMARY OF PHASE I INVESTIGATION FIELD ACTIVITY DATES

	<u>Field Activity</u>	<u>Date(s)</u>
1.	Site Mobilization, and Office Trailer Delivery and Setup	12/28/88-12/30/88
2.	Fence Construction for Trailer and Decontamination/Drum Storage Area	12/27/88-12/30/88
3.	Survey of Geophysical Grid Network	01/07/89-01/24/89
4.	Clearing for Geophysical Survey	01/09/89-01/24/89
5.	Geophysical Survey	
	a. Main Site	01/17/89-01/24/89
	b. Satellite Site Nos. 9 and 10	01/21/89-01/22/89
6.	Delivery and Spreading of Stone for Access Roadway	01/23/89
7.	Monitoring Well Installation	02/06/89-03/17/89
8.	Waste Boring	03/20/89-03/31/89
9.	Tar Pit Sampling	03/29/89-03/30/89
10.	Test Pit/Trench Construction	
	a. Main Site	04/03/89-04/11/89
	b. Satellite Site No. 9	04/03/89
	c. Satellite Site No. 10	04/10/89
11.	Surveying of Aerial Topographic Control Points, Wells, Piezometers and Waste Borings	04/03/89-04/19/89
12.	Sampling of Satellite Site Nos. 2, 3, 6 and 7	04/11/89
13.	Surficial Soil Sampling	04/11/89-04/12/89
14.	Creek and Marsh Sampling	04/11/89-04/14/89
15.	Ground Water Sampling	04/13/89-04/19/89
16.	Hydraulic Conductivity Testing	04/17/89-04/19/89
17.	Site Demobilization	04/20/89-04/21/89

- o Waste lagoon/Tar Pit sampling,
- o Drum sampling,
- o Test pit and test trench excavation and sampling,
- o Surface water and sediment sampling,
- o Soil boring and sampling in areas of buried waste,
- o Surficial soil sampling,
- o Monitoring well soil boring and sampling,
- o Monitoring well installation and ground water sampling,
- o Hydraulic conductivity/slug testing, and
- o Air monitoring.

A summary description of the field/sampling program performed during the Phase I Remedial Investigation (Phase I RI) is presented in Table No. 2-2, and is discussed in the remainder of Section 2.0.

The Phase II component of the Remedial Investigation for the Union Road Site comprised the following (a more detailed breakdown, which includes the dates the activities were conducted, is provided in Table No. 2-3):

- o Waste lagoon/Tar Pit sampling,
- o Surface water and sediment sampling,
- o Soil boring and sampling in marsh and areas of buried waste,
- o Soil boring and sampling in areas of potential clean borrow material,
- o Surficial soil sampling,
- o Monitoring well soil boring and sampling,
- o Monitoring well installation and ground water sampling,
- o On-site radiation survey,
- o Hydraulic conductivity/slug testing,
- o Packer testing/sampling of bedrock monitoring wells,
- o Construction of security fence,
- o Placement of booms and berm in marsh area,
- o Placement of warning signs along creek banks, and
- o Air Monitoring.

A summary of the field/sampling program performed during the Phase II Remedial Investigation (Phase II RI) is presented in Table No. 2-4, and is discussed in detail below. The results of these field activities are presented in Sections 3.0 and 4.0, and the findings are discussed in Section 5.0.

Table No. 2-2

SUMMARY OF PHASE I REMEDIAL INVESTIGATION

<u>Phase I Program Element</u>	<u>Waste Disposal Area, Tar Pit and Area of Former Roundhouse</u>	<u>Southern Area of the Site</u>	<u>Satellite Sites</u>
Geophysical Survey	Tar Pit and Disposal Area (electrical resistivity w/50' grid, terrain and magnetic conductivity w/25' grid) (where accessible); Roundhouse Area (limited screen electromagnetic terrain conductivity w/50' lines and 25' stations)	Electrical resistivity 1/100' lines and 50' stations, and magnetic w/25' grid (where accessible)	Magnetic and terrain conductivity w/10' grid at Site Nos. 9 and 10
Surface Water Samples	Five from marsh area (five for TCL and petroleum hydrocarbons and three for hardness) and five from Creek in areas upstream and downstream of Disposal Area and Tar Pit (five for TCL and petroleum hydrocarbons and hardness)	N/A	N/A
Sediment Samples	Three from Tar Pit and marsh area (five for TCL and petroleum hydrocarbons, one waste characterization and one EP toxicity) five from Creek in areas upstream and downstream of Disposal Area and Tar Pit (five for TCL and petroleum hydrocarbons)	N/A	N/A
Soil Boring Samples	Three from monitoring well borings (split spoon) (TCL and petroleum hydrocarbons) and five from waste borings (split spoon) (eight TCL and petroleum hydrocarbons, two waste characterization and two EP toxicity)	N/A	N/A
Surficial Soil Samples	Three from Disposal Area (TCL and petroleum hydrocarbon), one from Roundhouse Area (TCL and petroleum hydrocarbons) and one off-site (Town Park) (TCL and petroleum hydrocarbons)	N/A	N/A
Air Monitoring	Total Organic Vapors (OVA/TIP)	Total Organic Vapors (OVA/TIP)	Total Organic Vapors (OVA/TIP)
Monitoring Wells	Ten wells (three shallow, three mid-depth and four bedrock)	N/A	N/A
Ground Water Samples	Ten from monitoring wells (ten TCL and petroleum hydrocarbons)	N/A	N/A
Tar Pit Samples	Four core locations comprising one sample per core (four TCL [and one VOC only], four petroleum hydrocarbons, three waste characterization [two for asbestos], one treatability screen [one composite sample] and three EP toxicity)	N/A	N/A

Note: General well depths are the following: Shallow (Water Table) - 15-25 feet; Mid-depth (Overburden/Bedrock Interface) - 30-40 feet; and Bedrock (Shallow) - 45-70 feet.

Table No. 2-2 (continued)

SUMMARY OF PHASE I REMEDIAL INVESTIGATION

<u>Phase I Program Element</u>	<u>Waste Disposal Area, Tar Pit and Area of Former Roundhouse</u>	<u>Southern Area of the Site</u>	<u>Satellite Sites</u>
Test Pits and Test Trenches	Two test pits and one trench in Roundhouse Area and eighteen test pits in Disposal Area	Two test pits	One test pit each at Site Nos. 9 and 10 (total of two)
Soil Samples (Test Pits and Test Trenches)	One from the test pits in Roundhouse Area and six from the test pits in the Disposal Area (total of seven TCL, seven asbestos and seven petroleum hydrocarbons)	Two from the test pits (TCL, Asbestos and Petroleum Hydrocarbons)	One per both test pits (total of two TCL and two Petroleum Hydrocarbons)
Drum Samples	One drum (TCL, petroleum hydrocarbons, and waste characterization)	N/A	N/A
Waste/Sediment Samples	N/A	N/A	One each from Site Nos. 2, 3, 6 and 7 (four TCL and four Petroleum Hydrocarbons)

Note: General well depths are the following: Shallow (Water Table) - 15-25 feet; Mid-depth (Overburden/Bedrock Interface) - 30-40 feet; and Bedrock (Shallow) - 45-70 feet.

Table No. 2-3

SUMMARY OF PHASE II INVESTIGATION FIELD ACTIVITY DATES

	<u>Field Activity</u>	<u>Date(s)</u>
1.	Site Remobilization	09/18/89-09/19/89
2.	Resurvey of Grid Network	09/19/89-09/22/89
3.	Waste Boring	09/20/89-11/29/89
4.	Marsh Boring	10/05/89-11/30/89
5.	Monitoring Well Installation	10/09/89-11/21/89
6.	Surficial Soil Sampling	10/17/89-10/18/89
7.	Construction of Fence Around Disposal/Tar Pit Area	10/31/89-12/06/89
8.	Placement of Booms and Berm	11/20/89-11/30/89
9.	Packer Sampling	12/01/89-12/05/89
10.	Ground Water Sampling	12/05/89-12/08/89
11.	Sampling in Area of Satellite Site No. 2	12/07/89
12.	Placement of Signs along Creek Banks	12/12/89
13.	Radiation Survey	12/13/89
14.	Surveying of Wells, Piezometers and Waste Borings	12/19/89-12/20/89
15.	Site Demobilization	12/21/89-12/22/89
16.	Hydraulic Conductivity Testing	02/05/90-02/07/90
17.	Creek Bank Sampling	04/09/90
18.	Biological Study Program	08/14/90-08/16/90
19.	Bank Waste Removal	08/13/90-11/05/90

Table No. 2-4

SUMMARY OF PHASE II REMEDIAL INVESTIGATION

<u>Phase II Program Element</u>	<u>Waste Disposal Area, Tar Pit and Area of Former Roundhouse</u>	<u>Northern/Southern Area of the Site</u>	<u>Satellite Sites</u>
Surface Water Samples	One from tributary to Deer Lik Creek (area of Satellite Site No. 2) downstream from Losson Road (polynuclear aromatic hydrocarbons)	N/A	N/A
Sediment Samples	Fifteen from marsh area (5 for TCL, 15 for petroleum hydrocarbons, 10 for lead and 11 for lead EP toxicity), four from Slate Bottom Creek (1 for TCL [minus VOC], and 3 for lead and petroleum hydrocarbons) and two from Deer Lik Creek downstream from Losson Road (1 for TCL [minus VOC] and 1 for polynuclear aromatic hydrocarbons)	N/A	One from Site No. 2 location (polycyclic aromatic hydrocarbons)
Soil Boring Samples	One from monitoring well borings (split spoon) (TCL, petroleum hydrocarbons and lead EP toxicity) and 21 from waste borings (split spoon) (6 for TCL, 21 for petroleum hydrocarbons, 15 for lead, 7 for lead EP toxicity and 9 for asbestos)	Two from soil borings (split spoon) (TCL and petroleum hydrocarbons)	N/A
Surficial Soil Samples	Six from Disposal Area (two for TCL, six for petroleum hydrocarbons, four for lead, four for lead EP toxicity and six for asbestos), eight from Roundhouse Area (four for TCL, eight for petroleum hydrocarbons, four for lead, six for lead EP toxicity and eight for asbestos) and five off-site (three for TCL, five for petroleum hydrocarbons, two for lead and five for asbestos)	N/A	N/A
Air Monitoring	Total organic vapors (OVA/TIP) and particulates (Miniram)	Total organic vapors (OVA/TIP) and particulates (Miniram)	Total organic vapors (OVA/TIP) and particulates (Miniram)
Monitoring Wells	Eight wells (one shallow, four mid-depth and three bedrock)	N/A	N/A
Radiation Survey	On-site radiation survey for alpha, beta and high energy gamma	Continuous reading around perimeter and across site	N/A
Ground Water Samples	Eight from Phase II monitoring wells (TCL and petroleum hydrocarbons), six from Phase I monitoring wells (TCL and petroleum hydrocarbons) and four utilizing packers in Phase I bedrock monitoring wells (TCL and petroleum hydrocarbons)	N/A	N/A

Note: General well depths are the following: Shallow (Water Table) - 10-25 feet; Mid-depth (Overburden/Bedrock Interface) - 20-40 feet; and Bedrock (Shallow) - 45-70 feet.

Table No. 2-4 (continued)

SUMMARY OF PHASE II REMEDIAL INVESTIGATION

<u>Phase II Program Element</u>	<u>Waste Disposal Area, Tar Pit and Area of Former Roundhouse</u>	<u>Northern/Southern Area of the Site</u>	<u>Satellite Sites</u>
Tar Pit Sample	One sample for matrix cleanup analysis (TCL)	N/A	N/A
Roundhouse Water Sample	One from beneath former roundhouse (TCL and petroleum hydrocarbons)	N/A	N/A

Note: General well depths are the following: Shallow (Water Table) - 10-25 feet; Mid-depth (Overburden/Bedrock Interface) - 20-40 feet; and Bedrock (Shallow) - 45-70 feet.

2.2.1 Surface Features

2.2.1.1 Aerial Photography and Topographic Mapping

As part of the Phase I RI, a flyover of the Union Road Site was conducted in order to obtain an aerial photograph (see Appendix H) and produce a 1 inch to 100 foot scale topographic map of the site and immediately surrounding area. The topographic map was constructed with 2 foot elevation contours (see Appendix I). The aerial photograph and topographic map was obtained to illustrate natural and manmade features of the site, as well as to assist in locating areas of possible waste disposal, defining surface and subsurface drainage patterns and evaluating data. The map is also used to present survey results, sample and test locations, sample/survey results and remedial action alternatives.

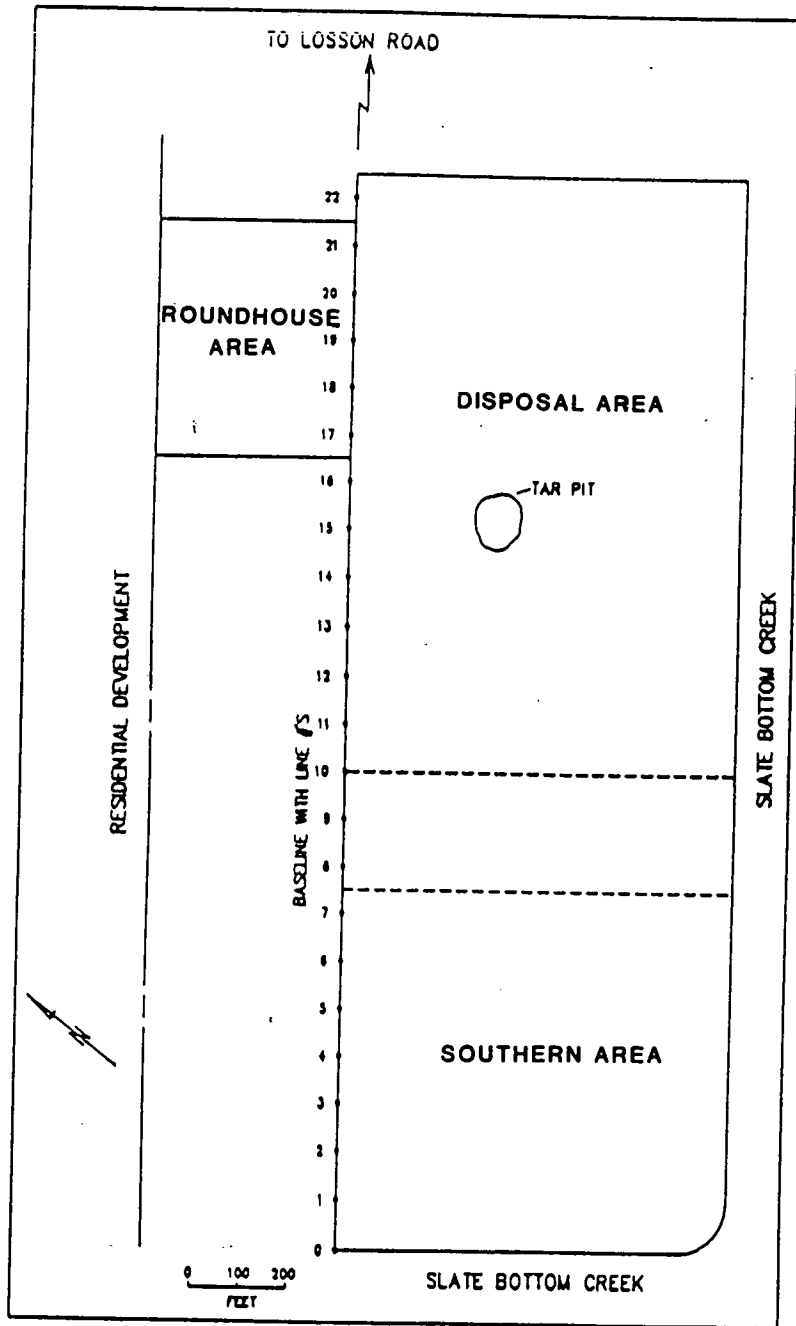
2.2.1.2 Surveying Program

In order to develop the topographic contours, horizontal and vertical controls to within 0.1 feet were established at 17 locations surrounding the site. These elevations were referenced to United States Geological Survey Datum, and the contour elevations on the topographic map are referenced to Mean Sea Level (MSL).

The surveying program also provided the elevations of all monitoring well and piezometer casings, and ground level elevations at the monitoring wells and waste borings. These elevations were used to accurately measure ground water levels referenced to Mean Sea Level (MSL) to determine flow direction, and to prepare geologic and buried waste cross sections through the site.

2.2.2 Geophysical Survey

A series of geophysical investigations were conducted by Hager-Richter Geoscience, Inc. as part of the Phase I Investigation, to assist in better understanding the vertical and horizontal components of fill material within the confines of the Tar Pit and Disposal Area, Roundhouse Area and Southern Area of the Union Road Site (see Figure No. 2-3 for locations of geophysical survey areas). The surveys were performed to identify anomalous subsurface conditions indicative of buried drums and other large items, and identify anomalous conditions representing contaminant plumes, contaminated soil, buried coal tars and other wastes.



Source: HAGER-RICHTER GEOSCIENCE, INC.

UNION ROAD SITE
LOCATIONS OF GEOPHYSICAL SURVEY AREAS

The geophysical program, as well as other facets of the field investigation, involved the review of existing geologic information including local soils maps, evaluation of regional geology and a technical evaluation of boring logs at areas adjacent to the site. A survey team established a baseline along the cinder road that runs through the site (see Figure No. 2-3). Staked and brush-cut lines, where possible, were run orthogonal from the baseline to Slate Bottom Creek approximately 800 feet to the east, and in the Roundhouse Area to Losson Green Estates about 500 feet to the west. Thick brush and forested areas covering large portions of the site were a major impediment to the geophysical survey which required clearing of many of the planned geophysical lines with a small bulldozer. Not all of the possible planned stations were accessible and surveyed for geophysical study. Where there were interferences, the closest point to the planned station location was surveyed.

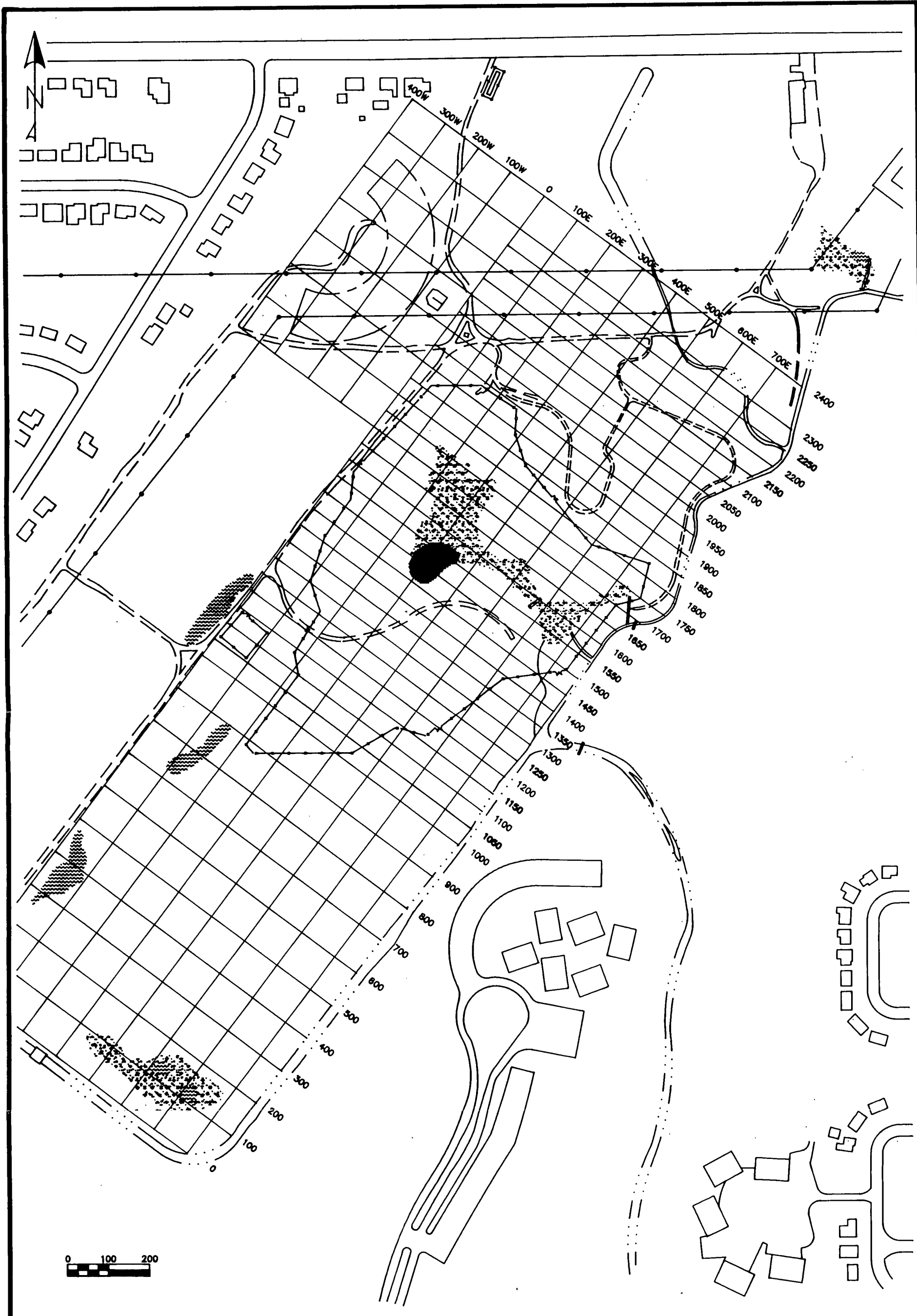
Because of the severity of the contamination at the Tar Pit and Disposal Area, the orthogonal lines were located at 50 foot intervals with stakes every 100 feet along the lines in these areas. For the Roundhouse and Southern Areas, the lines were cut at 100 foot intervals, with stakes every 100 feet along the lines (see Figure No. 2-4).

The techniques used during the geophysical program at the site were magnetics, terrain conductivity and resistivity. Magnetic and resistivity surveys were conducted at the Tar Pit and Disposal Area and the Southern Area. Terrain conductivity profiling was performed at the Tar Pit and Disposal Area, the Roundhouse Area and the Southern Area.

- o Magnetic Surveys - The magnetic surveys were performed using an EG&G Model G856 Proton Precession Portable Magnetometer. The G856 is a microprocessor controlled instrument with a resolution of 0.1 gamma, an accuracy of 1 gamma, and a memory capable of storing the data for approximately 1000 stations.

Magnetic data were collected at 4992 stations at the site. A 10 by 25 foot station spacing (25 foot grid) was used for the Tar Pit and Disposal Area and the Southern Area. The station grid on the site was oriented by the coordinates staked by the survey team subsequent to the survey. Areas of open water and thick underbrush were not surveyed.

A base magnetic station was occupied every few hours during the field work in order to obtain data necessary for the removal of the temporal variation in the earth's magnetic field. The magnetic survey data were processed by correcting



UNION ROAD SITE
GEOPHYSICAL GRID NETWORK

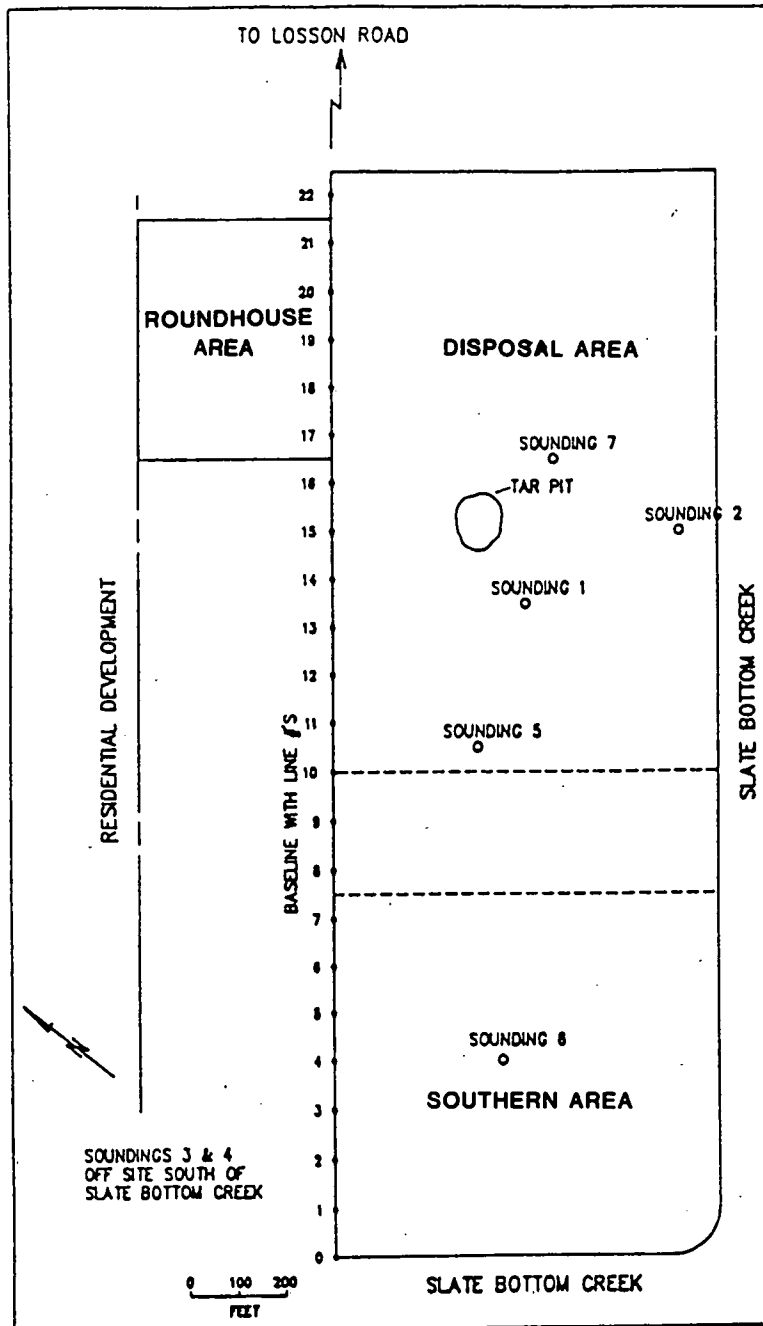
each reading for the temporal "drift" of the magnetic field based on the base station data. The corrected data were then plotted and contoured by a contouring program developed for use with spatial geophysical data.

- o Resistivity Surveys – The resistivity surveys were performed with an EDA Model R-PLUS resistivity/IP system. This microprocessor-based unit consists of a 360 volt DC power supply, transmitter, and receiver. The unit provides a direct LCD reading of apparent resistivity in ohm-meters. Any of the usual electrode configurations, including the Schlumberger and Wenner arrays, can be used with the instrument.

At the site, a Wenner array electrode configuration was used with the instrument. Four electrodes were driven into the ground in a linear array. The distance between electrodes is called the A-spacing. The two outer electrodes were used to inject electric current into the earth and the two inner electrodes were used to measure the voltage in the ground. The depth of survey is generally taken to be 1/2 to 1/3 the A-spacing. As the electrode spacing is increased, the apparent resistivity values are dominated by deeper and larger volumes of material. The measured value is an apparent resistivity because it includes contributions from all layers present in the subsurface as well as lateral variations in resistivity.

Two modes of operation were used at the site, sounding and traversing. The goal of resistivity sounding is to determine the apparent resistivity as a function of depth by systematically increasing the electrode spacing. All measured values in a sounding are plotted as a curve of apparent resistivity versus electrode spacing. Changes in direction and slope of the curve are a result of subsurface variations in material with depth.

The objective of the soundings was to determine at what electrode spacing is the apparent resistivity affected by the electrical characteristics of the tar-like waste material. Seven soundings were conducted on the site. As shown in Figure No. 2-5, four soundings were located in the Tar Pit and Disposal Area (two of these near the Tar Pit), one in the Southern Area, and two off-site south of the Slate Bottom Creek. The data from the soundings were then used to select the best electrode spacing for traversing.



Source: HAGER-RICHTER GEOSCIENCE, INC.

UNION ROAD SITE
LOCATIONS OF RESISTIVITY SOUNDINGS

The goal of electrical resistivity traversing is to determine the apparent resistivity over some particular depth as a function of horizontal position. The actual field measurements are current and voltage, made as a function of horizontal distance, while maintaining a constant A-spacing. At the site, 296 resistivity traversing stations were occupied.

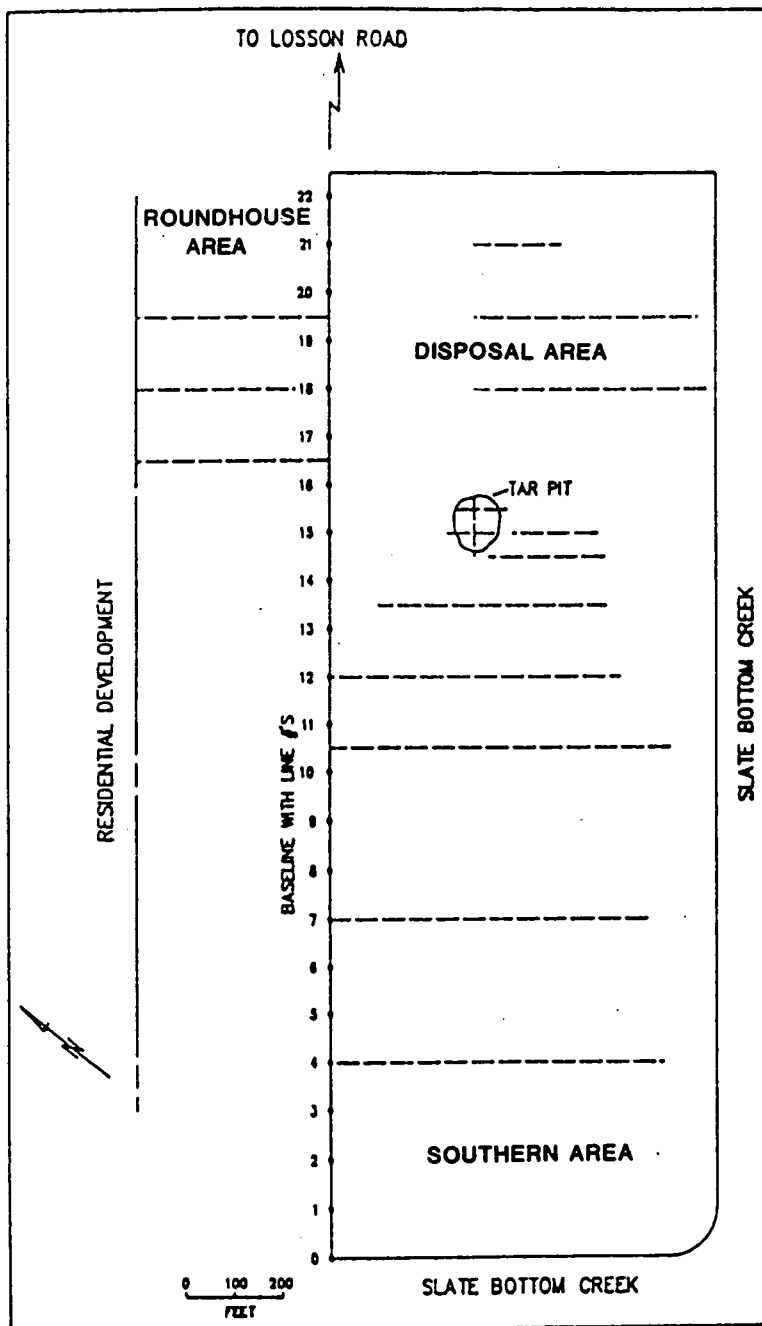
- o Terrain Conductivity Profiling - Terrain conductivity profiling was conducted using a Geonics EM31-DL terrain conductivity meter. The EM31-DL is an induction type unit and provides measurement of both the quadrature-phase and in-phase components of terrain conductivity without ground electrodes or contact. The data for both phases are recorded on a digital data logger. The EM31-DL is calibrated to read ground conductivity directly in millimhos per meter with a resolution of 2% of full scale and an accuracy of 1 mmho/meter. The in-phase component of terrain conductivity is particularly sensitive to the presence of metal objects in the subsurface. The nominal depth of earth sampled by the EM31-DL is about 18 feet. Terrain conductivity profiling was conducted at the site with continuous operation of the instrument and with data recorded at 10 foot intervals. Figure No. 2-6 shows the locations of the terrain conductivity profiles throughout the site at the Tar Pit and Disposal Area, and the Roundhouse and Southern Areas.

2.2.3 Soil Investigations

2.2.3.1 Phase I Surficial Soil Sampling

A total of five surficial soil samples were obtained during the Phase I Remedial Investigation, four on-site and one off-site to represent background conditions. As shown in Figure No. 2-7, the locations of three of these surface soil samples were in the Disposal Area (SUSL-1, 2 and 3), one in the Roundhouse Area (SUSL-5), and one off-site (SUSL-4), approximately 1/2 mile northeast of the site at a Town of Cheektowaga Park (Steiglmeir Park).

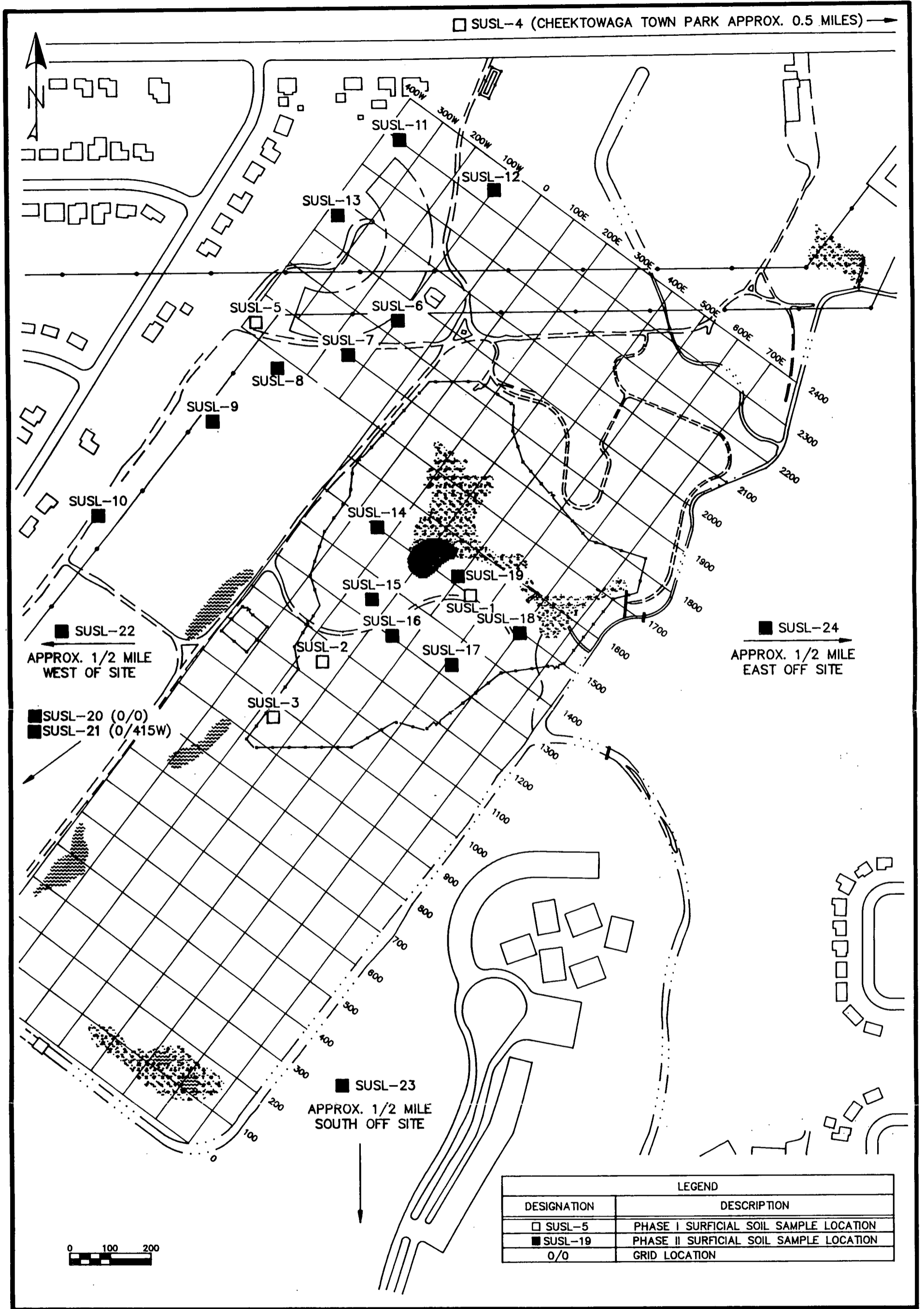
The Phase I surficial soil samples were obtained at depths between 2 to 5 inches below the ground surface using a wooden tongue depressor and transferred directly to glass sample containers in accordance with the sampling procedures outlined in the project Work Plan (see Work Plan contained in a separate document for a detailed description of sampling procedures). Each of the Phase I soil samples was analyzed for both Target Compound List +30 (TCL +30) substances and petroleum hydrocarbons.



Source: HAGER-RICHTER GEOSCIENCE, INC.

UNION ROAD SITE
LOCATIONS OF TERRAIN CONDUCTIVITY PROFILES

☐ SUSL-4 (CHEEKTOWAGA TOWN PARK APPROX. 0.5 MILES) →



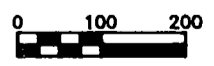
■ SUSL-22
APPROX. 1/2 MILE
WEST OF SITE

■ SUSL-20 (0/0)
■ SUSL-21 (0/415W)

■ SUSL-24
APPROX. 1/2 MILE
EAST OFF SITE

■ SUSL-23
APPROX. 1/2 MILE
SOUTH OFF SITE

LEGEND	
DESIGNATION	DESCRIPTION
☐ SUSL-5	PHASE I SURFICIAL SOIL SAMPLE LOCATION
■ SUSL-19	PHASE II SURFICIAL SOIL SAMPLE LOCATION
0/0	GRID LOCATION



UNION ROAD SITE
LOCATIONS OF SURFICIAL SOIL
SAMPLING POINTS

FIGURE NO. 2-7

All samples collected for chemical analysis as part of the Phase I RI field investigation (as well as Phase II) were analyzed by York Laboratories, Inc., which is a NYSDEC approved laboratory. The surficial soil sample designations, depths of each sample and the types of analyses performed on each sample for Phase I are shown in Table No. 2-5.

2.2.3.2 Phase II Surficial Soil Sampling

A total of 19 surficial soil samples were obtained during the Phase II Remedial Investigation. As shown in Figure No. 2-7, the locations of six of these surface soil samples (SUSL-14 to 19) were in the Disposal Area, eight in the Roundhouse Area (SUSL-6 to 13) and five off-site (SUSL-20 to 24). However, it should be noted that "off-site" samples SUSL-20 and 21 were collected immediately to the west of the site in areas which were part of the former railroad classification yard and did not represent true "background" samples.

Phase II surficial soil samples were collected in a similar manner as the Phase I samples, except the depth of sample collection was between 1 to 3 inches below ground surface. All Phase II surficial soil samples were analyzed for petroleum hydrocarbons with selected samples analyzed for TCL +30, lead, lead EP Toxicity and/or asbestos. A summary of the Phase II samples, including depth and analyses, is provided in Table No. 2-5.

2.2.3.3 Phase I Investigation Subsurface/Borehole Soil Sampling

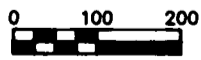
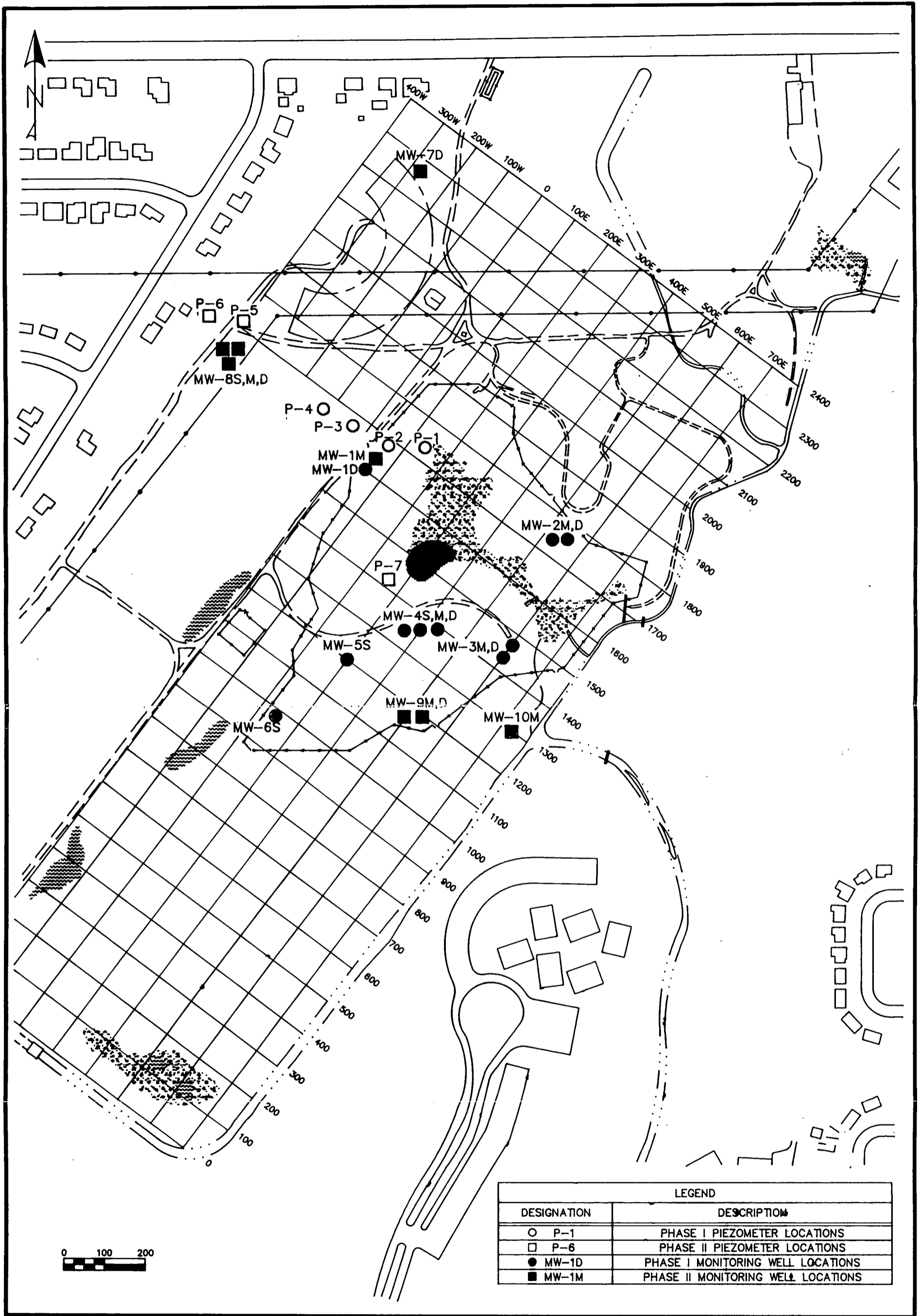
Provision was made in the field program for the collection and chemical analysis of split spoon soil samples obtained during the construction of monitoring wells and from soil/waste borings. A total of eight subsurface/borehole soil samples were obtained during the Phase I RI. Three of the subsurface soil samples (SLBH-1, 2 and 3) were taken from two monitoring well borings (MW-3M and MW-4D) and five samples (SLBH-4, 5, 6 and 7, and B7) were obtained from three soil/waste borings (WB-2, 3 and 7). The locations of these monitoring well borings is shown in Figure No. 2-8. The locations of soil/waste borings are shown in Figure Nos. 2-9 and 2-10. Samples SLBH-1, 2, 4 and 6 were suspected of being waste or highly contaminated soil based upon visual appearance, and SLBH-3, 5 and 7 were samples of apparently "clean" underlying clay.

Table No. 2-5

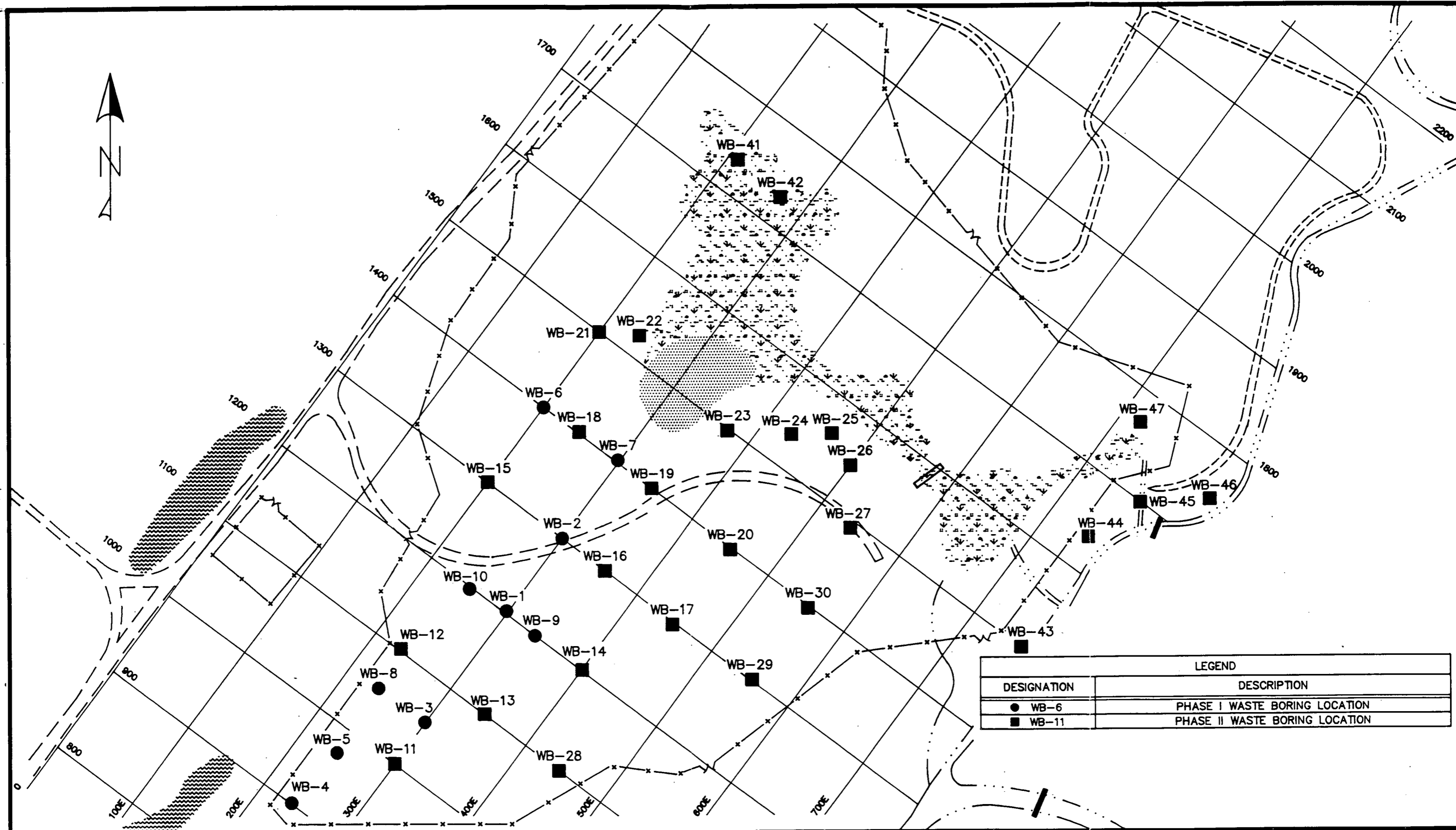
**SUMMARY OF PHASE I AND PHASE II RI
SURFICIAL SOIL SAMPLE COLLECTION AND ANALYSES**

Sample Designation	Depth of Sample*	Analyses Performed						Asbestos
		TCL +30	Petroleum Hydrocarbons	Hazardous Waste Characteristics	EP Toxicity	Lead	Lead EP Toxicity	
<u>Phase I</u>								
SUSL-1	2-4 inches	X	X					
SUSL-2	2-4 inches	X	X					
SUSL-3	2-4 inches	X	X					
SUSL-4	3-5 inches	X	X					
SUSL-5	2-4 inches	X	X					
<u>Phase II</u>								
SUSL-6	1-3 inches	X	X				X	X
SUSL-7	1-3 inches		X			X		
SUSL-8	1-3 inches		X			X		X
SUSL-9	1-3 inches	X	X				X	X
SUSL-10	1-3 inches	X	X				X	X
SUSL-11	1-3 inches	X	X				X	X
SUSL-12	1-3 inches		X			X	X	X
SUSL-13	1-3 inches		X			X	X	X
SUSL-14	1-3 inches	X	X				X	X
SUSL-15	1-3 inches		X			X		X
SUSL-16	1-3 inches		X			X	X	X
SUSL-17	1-3 inches	X	X					X
SUSL-18	1-3 inches		X			X	X	X
SUSL-19	1-3 inches		X			X	X	X
SUSL-20	1-3 inches		X			X		X
SUSL-21	1-3 inches		X			X		X
SUSL-22	1-3 inches	X	X					X
SUSL-23	1-3 inches	X	X					X
SUSL-24	1-3 inches	X	X					X

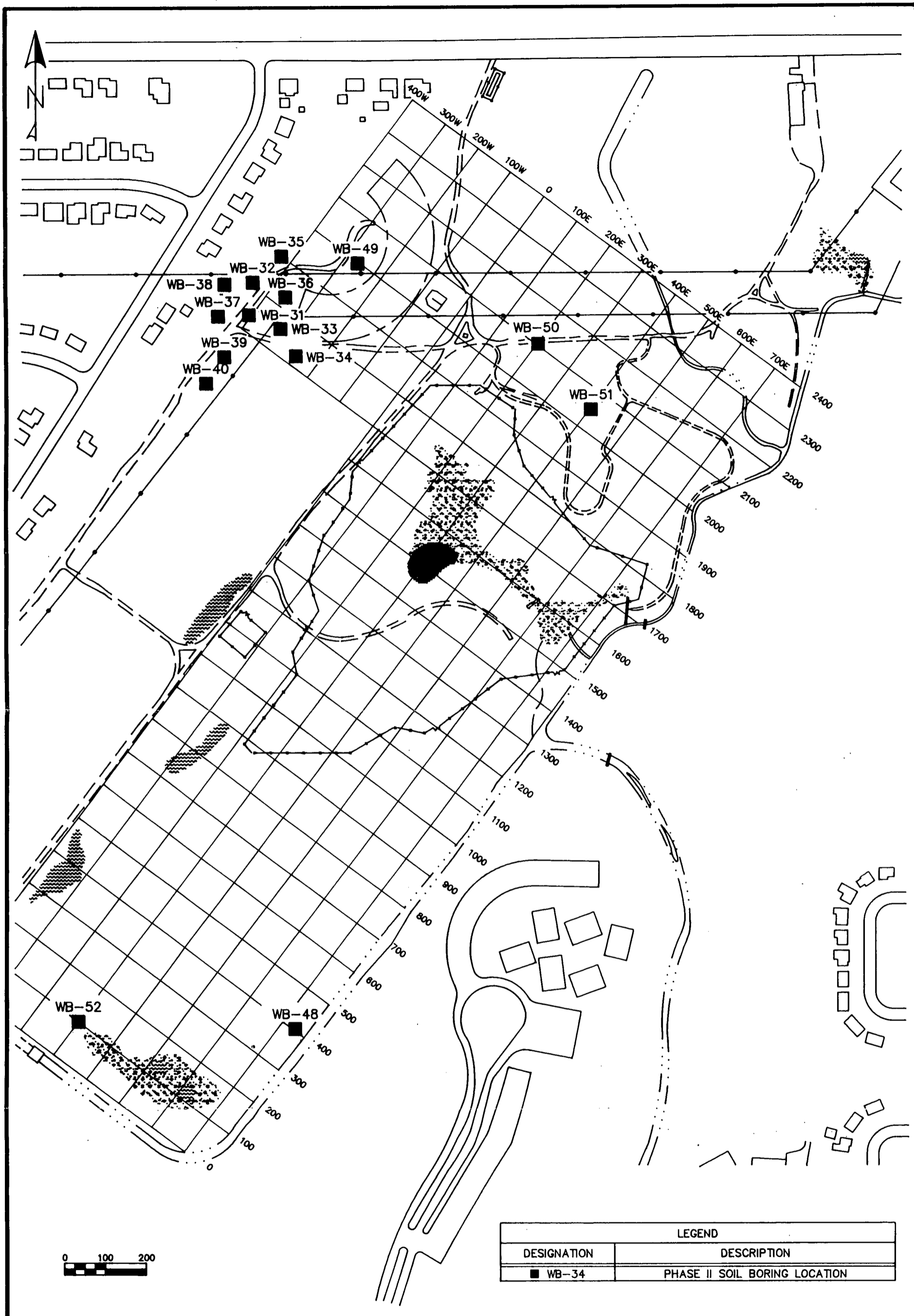
*Below ground surface.



UNION ROAD SITE
**LOCATIONS OF MONITORING WELLS
 AND PIEZOMETERS**



UNION ROAD SITE
 LOCATIONS OF WASTE BORINGS
 IN DISPOSAL AREA



UNION ROAD SITE

LOCATIONS OF BORINGS IN ROUNDHOUSE AREA,
NORTHERN AREA AND SOUTHERN AREA

All of the borehole samples were obtained using a 2-inch diameter split spoon sampler and samples were transferred from the split spoon to the sample containers using a wooden tongue depressor. Sampling was performed in accordance with the sampling procedures outlined in the Work Plan. All eight of the monitoring well borehole and waste boring soil samples were analyzed for both TCL +30 substances and petroleum hydrocarbons. In addition, two of the waste boring samples (SLBH-4 and 6) were also tested for EP Toxicity and Hazardous Waste Characteristics (Ignitability, Corrosivity and Reactivity). The subsurface/borehole soil sample designations, depths of each sample and the types of analyses performed on each sample as part of the Phase I RI are shown in Table No. 2-6.

2.2.3.4 Phase II Investigation Subsurface/Borehole Soil Sampling

A total of 24 subsurface/borehole soil samples were obtained during the Phase II RI. One of the subsurface soil samples (MW-7D [38-40 feet]) was taken from a monitoring well boring and the remainder were obtained from 23 soil/waste borings. The location of MW-7D is shown in Figure No. 2-8. Borings in the Disposal Area are shown in Figure No. 2-9 and those in the Roundhouse Area, Northern Area and Southern Area in Figure No. 2-10. Samples WB-16 (10-12 feet) and WB-24 (6-8 feet) were samples of apparently "clean" fill material. Sample MW-7D (38-40 feet) exhibited elevated levels of volatile organics during in-field screening with an organic vapor analyzer (OVA). Samples WB-51 (25-27 feet) and WB-52 (20-22 feet) were of potentially clean borrow material (clay) and the remainder were suspected of being buried waste material or highly contaminated soil based upon visual appearance. Borings in the area of the former roundhouse (WB-35 to 40 and WB-49) were constructed to define the extent of subsurface oil and contaminated soil discovered during excavation of a test pit in this area during Phase I.

All of the borehole samples collected during the Phase II field program were also obtained using a 2-inch diameter split spoon sampler and samples were transferred from the split spoon to the sample containers using a wooden tongue depressor. Sampling was performed in accordance with the sampling procedures outlined in the Work Plan. Decontamination of split spoons was accomplished using a hexane rinse for boreholes WB-13, 14, 15, 16 and 17. At this point in the waste boring program, it was found that the final rinse of distilled water was not removing all of the hexane, which was being detected by the OVA. As a result, it was decided to change to the steamcleaning method of decontamination with the approval of the NYSDEC.

Table No. 2-6

**SUMMARY OF PHASE I AND PHASE II RI
SUBSURFACE/BOREHOLE SOIL SAMPLE COLLECTION AND ANALYSES**

<u>Sample Designation</u>	<u>Depth of Sample*</u>	<u>Analyses Performed</u>						
		<u>TCL +30</u>	<u>Petroleum Hydrocarbons</u>	<u>Hazardous Waste Characteristics</u>	<u>EP Toxicity</u>	<u>Lead</u>	<u>Lead EP Toxicity</u>	<u>Asbestos</u>
<u>Phase I</u>								
SLBH-1 (at MW-3M)	20-22 feet	X	X					
SLBH-2 (at MW-4D)	22-24 feet	X	X					
SLBH-3 (at MW-4D)	34-36 feet	X	X					
SLBH-4 (at WB-2)	14-22 feet	X	X	X		X		
SLBH-5 (at WB-2)	28-30 feet	X	X					
SLBH-6 (at WB-3)	18-22 feet	X	X	X		X		
SLBH-7 (at WB-3)	26-28 feet	X	X					
B-7 (at WB-7)	16-18 feet	X	X					

*Below ground surface.

Table No. 2-6 (continued)

**SUMMARY OF PHASE I AND PHASE II RI
SUBSURFACE/BOREHOLE SOIL SAMPLE COLLECTION AND ANALYSES**

Sample Designation	Depth of Sample*	Analyses Performed						Asbestos
		TCL +30	Petroleum Hydrocarbons	Hazardous Waste Characteristics	EP Toxicity	Lead	Lead EP Toxicity	
Phase II								
WB-13	20-22 feet		X			X		
WB-14	16-18 feet		X			X		
WB-16	10-12 feet	X	X					X
WB-16	18-20 feet		X			X		
WB-17	16-18 feet		X			X		
WB-18	14-16 feet	X	X				X	X
WB-19	16-18 feet		X			X		
WB-20	20-22 feet		X			X		
WB-22	6-8 feet		X			X	X	
WB-23	18-20 feet		X			X		
WB-24	24-26 feet	X	X				X	X
WB-24	6-8 feet	X	X					X
WB-25	20-22 feet		X			X		
WB-26	18-20 feet		X			X	X	
WB-27	20-22 feet		X			X		
WB-31	6-8 feet		X			X		
WB-32	6-8 feet		X			X	X	X
WB-34	8-10 feet		X			X		
WB-40	14-16 feet	X	X				X	X
WB-41	2-4 feet		X			X	X	X
WB-45	0-2 feet	X	X				X	X
WB-51	25-27 feet	X	X					
WB-52	20-22 feet	X	X					
MW-7D	38-40 feet	X	X				X	

*Below ground surface.

Similar to the Phase II surficial soil sampling program, all Phase II subsurface/borehole samples were analyzed for petroleum hydrocarbons, and selected samples were analyzed for TCL +30 parameters, lead, lead EP Toxicity and/or asbestos. The subsurface/borehole soil sample designations, depths of each sample and the types of analyses performed on each sample are shown in Table No. 2-6.

2.2.3.5 Radiation Survey

An on-site survey of radiation levels was conducted on December 13, 1989. The survey was conducted by a geologist with a geiger counter (Ludlum Measurements, Inc. Model #14C) set at its most sensitive setting. The unit measures alpha, beta and high energy gamma radiation. No radiation was detected during any point in the survey which encompassed the entire on-site area of the Union Road Site.

2.2.4 Geological Investigation

2.2.4.1 Borehole Logging

All boreholes and monitoring wells were logged by a geologist. The locations of each borehole and monitoring well are shown in Figure Nos. 2-8, 2-9 and 2-10. Notes were kept in both bound field log books and on Boring Logs and Well Construction Logs in accordance with the Field Operations and Quality Assurance/Quality Control (QA/QC) Plan outlined in the Work Plan. (See Appendices M, N, O and P in Volume III of this document for the Boring Logs and Well Construction Logs.) The Modified Burmeister Classification System was used to describe soil samples recovered from the borings. A Daily Field Activity Report was completed whenever drilling activities (or any other field activities) were undertaken during the field program. (These Daily Field Activity Reports are also contained in the Field Record Reports.) Geologic data from borehole construction was used to prepare geologic cross sections of the site showing stratigraphy. In addition, observations documented during borehole construction were also used to develop cross sections of the buried waste.

2.2.5 Ground Water Monitoring

While ground water, according to all available information, is not used as a source of potable water by the communities surrounding the site, a hydrogeological investigation is important to determine the nature, rate and extent of migration of subsurface

contamination from the site. In order to achieve this objective, an investigation was undertaken to define the hydrogeological characteristics and ground water quality at the site. Considerations such as soil permeability, stratigraphy, depth to the saturated zone, hydraulic gradients, proximity to closest drinking water supply aquifer, and proximity to surface water, floodplains and wetlands were addressed.

2.2.5.1 Phase I Investigation Monitoring Well/Piezometer Installation

As part of the hydrogeological investigation, a ground water monitoring well installation program was implemented consisting of either single wells or well clusters comprised of a varying combination of shallow, mid-depth and deep wells depending on location. For the Phase I investigation, 10 wells were installed in the vicinity of the Tar Pit and Disposal Area (see Figure No. 2-8). Four of these wells (MW-1D, 2D, 3D and 4D) were installed in bedrock, three (MW-2M, 3M and 4M) were installed at the overburden/bedrock interface and three (MW-4S, 5S and 6S) are shallow/water table overburden wells. Table No. 2-7 lists each monitoring well by its designation and includes the material of construction, formation (overburden or bedrock) in which the well was installed, interval at which the well was screened for overburden wells or interval of open hole for bedrock wells, and the total depth of each well.

As shown in Table No. 2-7, all of the overburden monitoring wells were constructed of 2-inch diameter stainless steel riser pipe and screens in order to ensure well integrity if placed in the types of waste and tar-like material suspected to be at the site. (PVC in this environment could be subject to deterioration.) Bedrock wells were constructed using 4-inch diameter stainless steel riser pipe. Boreholes in the overburden were constructed using hollow-stem augers. Bedrock was cored by means of an NX core barrel with the exception of MW-8D and MW-9D, where portions of the bedrock were cored utilizing an HQ core barrel. The substitution was necessitated by the failure of several NX core barrel bits. In addition, the final 2.5 feet of MW-9D was drilled using a roller bit due to the presence of metal fragments in the borehole from a lost tape measure weight. Drilling with a roller bit prevented damage of a costly diamond core barrel bit. All deviations from the Work Plan were approved by the on-site NYSDEC representative.

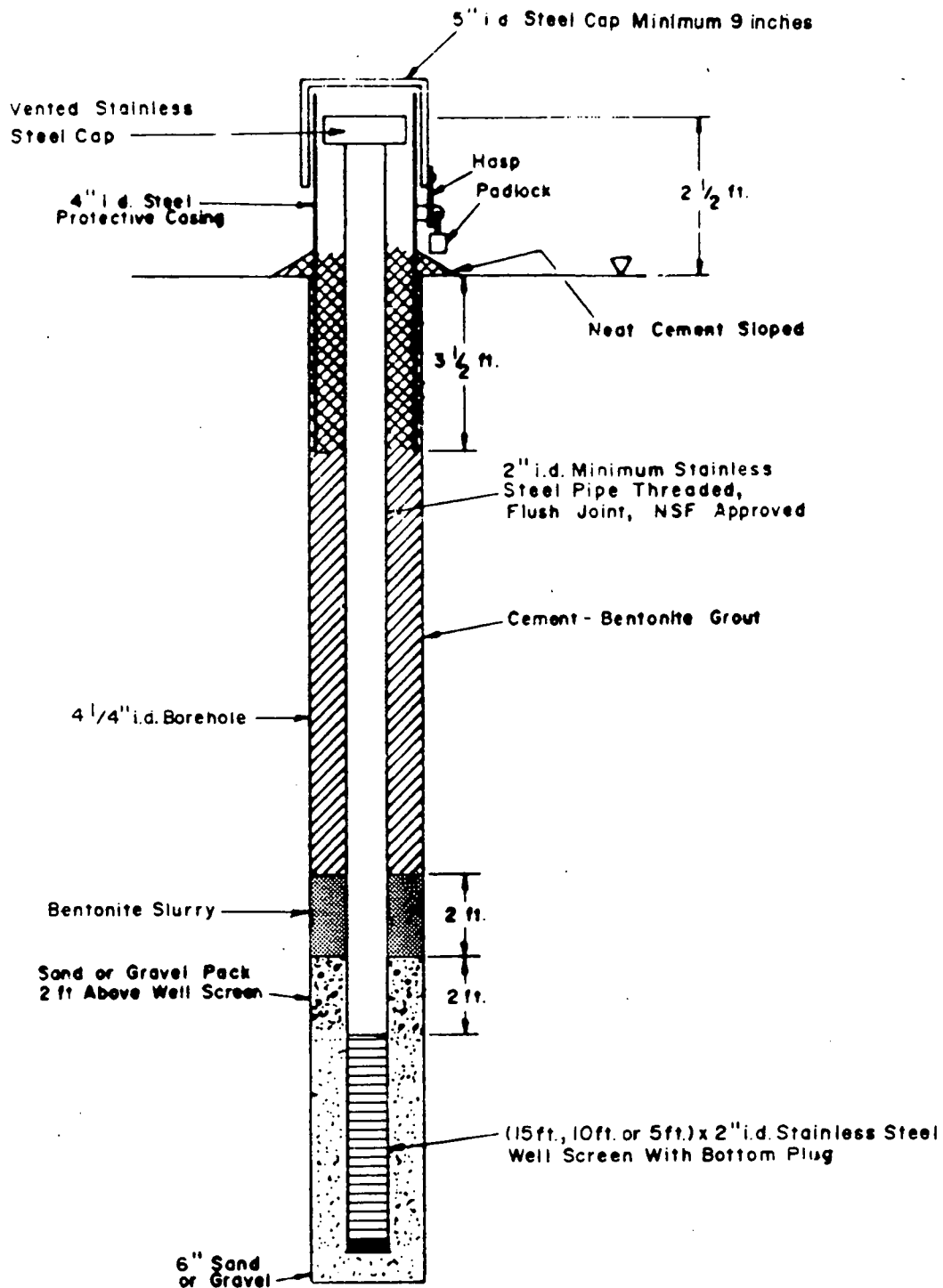
Monitoring wells were installed in accordance with the procedures outlined in the Work Plan and illustrated in Figure Nos. 2-11 and 2-12. These wells provide initial information on the subsurface soil conditions (soil type and quality), depth to bedrock, ground water elevations and flow direction, hydraulic conductivity and ground water quality at the site.

Table No. 2-7

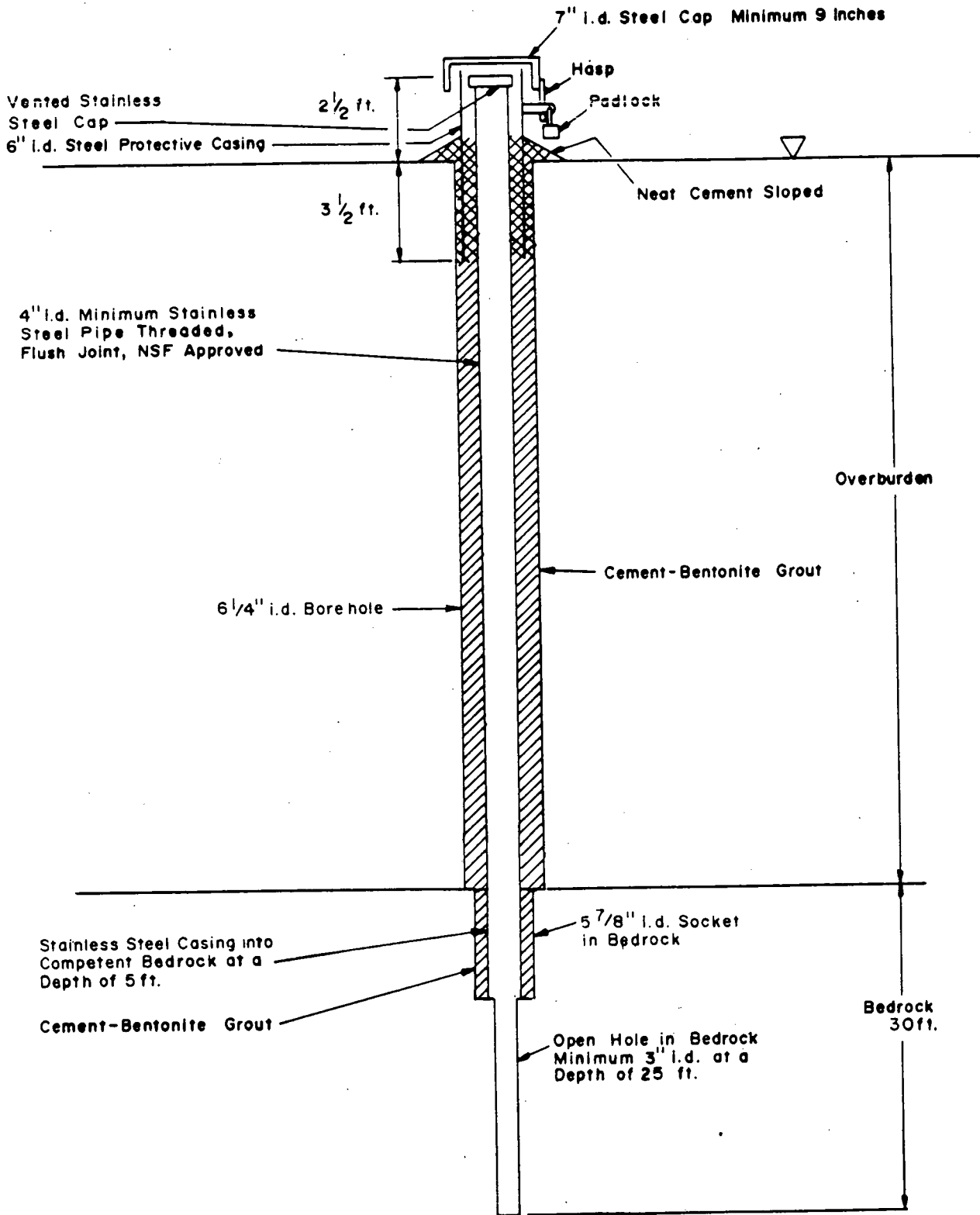
SUMMARY OF PHASE I RI
MONITORING WELL INFORMATION

<u>Well Designation</u>	<u>Material of Construction</u>	<u>Formation Installed/Screened</u>	<u>Open Hole/ Screened Interval (ft)*</u>	<u>Total Depth (ft)*</u>
MW-1D	Stainless Steel	Bedrock	45.5-64.75	64.75
MW-2M	Stainless Steel	Overburden/Bedrock Interface	29.0-39.0	39.0
MW-2D	Stainless Steel	Bedrock	44.0-68.5	68.5
MW-3M	Stainless Steel	Overburden/Bedrock Interface	23.25-38.25	39.0
MW-3D	Stainless Steel	Bedrock	46.5-71.17	71.17
MW-4S	Stainless Steel	Water Table/Overburden	13.0-23.0	23.5
MW-4M	Stainless Steel	Overburden/Bedrock Interface	31.0-41.0	41.25
MW-4D	Stainless Steel	Bedrock	47.0-72.0	72.0
MW-5S	Stainless Steel	Water Table/Overburden	14.0-24.0	24.5
MW-6S	Stainless Steel	Water Table/Overburden	17.0-22.0	22.0

*Below ground surface



UNION ROAD SITE
**CONSTRUCTION OF
 OVERBURDEN MONITORING WELLS**



UNION ROAD SITE
**CONSTRUCTION OF
 BEDROCK MONITORING WELLS**

All monitoring wells were developed by bailing. Temperature, conductivity, pH and turbidity were periodically monitored during the course of development. Wells were considered developed when turbidity levels reached <50 NTUs and/or the remaining parameters stabilized.

In addition to the monitoring wells, four piezometers were installed to the west of the marsh area (see Figure No. 2-8) in order to better define shallow ground water flow in that area. The piezometers were constructed of a one foot in length stainless steel screen (well point) and steel casing which was advanced into the subsurface/water table with a hammer.

2.2.5.2 Phase II Investigation Monitoring Well/Piezometer Installation

As in the Phase I investigation, a ground water monitoring well installation program was implemented during the Phase II field program consisting of either single wells or well clusters comprised of a varying combination of shallow, mid-depth and deep wells depending on location. For the Phase II investigation, four wells were installed in the vicinity of the Tar Pit and Disposal Area and four wells in the Roundhouse Area. Three of these wells (MW-7D, 8D and 9D) were installed in bedrock, four (MW-1M, 8M, 9M and 10M) were installed at the overburden/bedrock interface and one (MW-8S) is a shallow/water table overburden well. Table No. 2-8 lists each monitoring well by its designation and includes the material of construction, formation (overburden or bedrock) in which the well was installed, interval at which the well was screened for overburden wells or interval of open hole for bedrock wells, and the total depth of each well.

Similar to the Phase I program, monitoring wells were constructed in accordance with the procedures outlined in the Work Plan with the exception of MW-9D. It was not possible at this location, to advance the 4-inch stainless steel riser to the bottom of the 5 foot rock socket due to coarse sands under a high hydrostatic head running into the socket. This resulted in 1 foot of cement/bentonite grout in the bottom of the rock socket as the casing was set at a point 1 foot off the bottom in the 5 foot rock socket. It was decided (with the approval of the NYSDEC) to telescope a 2-inch diameter stainless steel riser and screen to the bottom of the open hole in the bedrock through the 4-inch riser pipe. A sand pack was installed to a point just below the area of grout and a bentonite seal was placed above to effectively isolate the grout.

Table No. 2-8

SUMMARY OF PHASE II RI
MONITORING WELL INFORMATION

<u>Well Designation</u>	<u>Material of Construction</u>	<u>Formation Installed/Screened</u>	<u>Open Hole/ Screened Interval (ft)*</u>	<u>Total Depth (ft)*</u>
MW-1M	Stainless Steel	Overburden/Bedrock Interface	29.1-39.1	39.6
MW-7D	Stainless Steel	Bedrock	58.0-63.3	63.3
MW-8S	Stainless Steel	Water Table/Overburden	5.2-10.2	10.5
MW-8M	Stainless Steel	Overburden/Bedrock Interface	42.0-52.0	52.5
MW-8D	Stainless Steel	Bedrock	58.1-65.8	65.8
MW-9M	Stainless Steel	Overburden/Bedrock Interface	29.0-39.0	39.5
MW-9D	Stainless Steel	Bedrock	47.0-52.0	52.8
MW-10M	Stainless Steel	Overburden/Bedrock Interface	13.2-18.2	18.3

*Below ground surface

These Phase II wells provide information needed to more precisely define subsurface soil conditions (soil type and quality), depth to bedrock, ground water elevations and flow direction, hydraulic conductivity and ground water quality, as well as the source of contamination, at the site. As in the Phase I program, monitoring wells were developed by bailing with the exception of MW-7D, 8M, 8D, 9D and 10M, where sufficient recharge permitted the use of a PVC hand pump. The pump facilitated the removal of a greater volume of water at a higher rate. Wells were developed according to the same criteria as in Phase I.

In addition to the monitoring wells, three piezometers were also installed. Two were installed in the Roundhouse Area in close proximity to what appears to have been an isolated fuel spill to better define shallow ground water flow in relation to nearby homes in that area. The third piezometer was installed near the Tar Pit in the Disposal Area to aid in the definition of shallow ground water flow direction within the fill material. The piezometers were constructed of a stainless steel screen (well point) 1 foot in length and 1.25 inch diameter steel casing which was advanced into the subsurface/water table using the drill rig pull-down.

2.2.5.3 Ground Water Level Measurement

Water levels were obtained at each of the monitoring wells and piezometers in order to determine ground water elevations and the ground water flow direction at the site. Ground water level measurement was performed electronically using a Sinco Water Level Indicator Model No. 51453. Measurements were made to within 0.01 of a foot. The Phase I monitoring wells were measured five times (three times during the first phase field program and twice during the second phase) and the Phase II wells were measured twice.

2.2.5.4 Phase I Investigation Aquifer Permeability/Slug Testing

In order to determine the hydrogeologic characteristics at the Union Road Site, slug tests (rising and falling head) were performed on all of the overburden wells constructed as part of the Phase I RI (monitoring well Nos. MW-2M, 3M, 4M, 4S, 5S and 6S). The location of these wells are shown in Figure No. 2-8. Two slugs were utilized during the testing. The slugs were manufactured of stainless steel in the shape of a 5 foot long by 1-1/2 inch diameter solid cylinder. The slugs were decontaminated prior to each test in accordance with the project Work Plan. Nylon cord was dedicated to each monitoring well tested.

Procedures followed for each slug test consisted of the following:

1. Obtain initial static water level reading.
2. Introduce pressure transducer into well.
3. Achieve water table equilibration.
4. Start Electro-Piezo Recorder.
5. Introduce slug into well and perform falling head test.
6. End test after achieving a water level that is within 90 percent of the initial static water level.
7. Remove slug from well and repeat above procedures for rising head test.

The Bouwer and Rice method (Bouwer and Rice, 1976) was utilized to analyze the slug test data due to the applicability of this method for determining hydraulic conductivities utilizing fully or partially penetrating wells in both confined and unconfined aquifers. The Bouwer and Rice model assumes that the aquifer is homogenous and isotropic with no aquifer storage and finite wellbore storage. The results of implementing the Bouwer and Rice model is an estimation of the hydraulic conductivity within the immediate vicinity of the well.

Slug tests were attempted in shallow/water table monitoring wells MW-4S and MW-6S, however, these tests were unsuccessful due to an insufficient water column in the well. Appendix A contains the graphs and calculations used to derive hydraulic conductivities for each slug test performed.

In addition, grain size analyses were performed on three soil samples obtained during borehole construction and were used to develop/confirm estimates of permeability and rate of ground water flow. These samples were obtained from depths corresponding to those at which the well screens are situated at locations MW-2M, MW-3D and MW-5S (see Figure No. 2-8 for locations). Other physical soil properties, such as natural water content and Atterberg limits, were analyzed for more cohesive soils obtained from MW-4D and MW-6S. Geologic data from borehole construction and water level data was used to prepare geologic cross sections and potentiometric surface maps of the site showing water level elevations, stratigraphy and ground water flow direction.

2.2.5.5 Phase II Investigation Aquifer Permeability/Slug Testing

Slug tests were performed on all of the overburden wells constructed as part of the Phase II RI (monitoring well Nos. MW-1M, 8M, 9M and 8S) with the exception of MW-10M. Upon arrival at the site for the Phase II RI slug tests it was observed that the stainless steel casing at MW-10M had buckled, possibly due to the freezing and thawing of ice inside the protective steel casing thereby rendering the well inaccessible for slug testing. It should also be noted that a rising head slug test was not performed at MW-1M due to extremely slow aquifer response and recovery. In addition, a falling head test could not be performed at MW-8S as the screened interval was not fully saturated. The locations of the wells are shown in Figure No. 2-8.

A single slug consisting of 2 foot long, threaded sections was utilized during the testing. The slug was manufactured of a schedule 40 PVC 1.66 inches in diameter and filled with sand. A slug 4 feet in length was used for slug tests in the overburden/bedrock interface wells and a 2 foot long slug was used in the shallow overburden/water table well. The slugs were decontaminated prior to each test in accordance with the project Work Plan. Nylon cord was dedicated to each monitoring well tested.

The slug test procedures followed were the same as those utilized in the Phase I investigation. Data was recorded with the In-Situ Hermit 1000B Data Logger. Slug test data was analyzed utilizing the Aqtesolv computer program. The Bouwer and Rice method was selected as in the Phase I investigation. The Aqtesolv program estimates aquifer parameters (hydraulic conductivity) using the Marquardt non-linear least-squares technique, and matching the data with type curves. Graphs derived from the time/drawdown plots are contained in Appendix B.

2.2.5.6 Phase I Investigation Ground Water Sampling

As a part of the Phase I RI, ground water samples were obtained from each monitoring well for a total of ten samples. Figure No. 2-8 depicts the locations of each of the monitoring wells (and ground water samples). Samples were collected a minimum of seven days after completion of well construction. Each well was purged at least three times the well volume prior to sample collection. (The shallow wells [MW-4S, MW-5S and MW-6S] were purged six to eight times at the request of the NYSDEC field supervisor.) Temperature, pH, conductivity and turbidity readings were periodically monitored during purging and allowed to stabilize prior to sampling. Samples were obtained using Teflon bailers (and nylon rope) dedicated to each well and transferred directly from the bailer to

the sample bottles. Ground water sampling was performed in accordance with the sampling procedures contained in the Work Plan. Each ground water sample was analyzed for both TCL +30 substances and petroleum hydrocarbons.

2.2.5.7 Phase II Investigation Ground Water Sampling

As a part of the Phase II RI, ground water samples were obtained from the eight newly constructed monitoring wells in addition to five monitoring wells (MW-2D, 3M, 4S, 4M and 6S) constructed during the Phase I RI. (These five wells were found to be the most contaminated during the first phase field program.) In addition, monitoring wells MW-1D and MW-3D were each sampled utilizing a packer assembly in order to isolate both the upper and lower portions of the open bedrock hole. Figure No. 2-8 depicts the locations of each of the monitoring wells (and ground water samples). Each well was purged a minimum of three times the well volume prior to sample collection except in the case of MW-1M and MW-9M where, due to extremely slow recovery, the wells were purged dry at the end of the day, allowed to recover overnight, and sampled the following morning at the request of the NYSDEC on-site representative. For samples obtained utilizing the packer assembly, 10 times the volume of the isolated open hole was purged using a bladder pump. Similar to Phase I, all ground water samples were analyzed for TCL +30 substances and petroleum hydrocarbons.

2.2.5.8 Roundhouse Water Sampling

One sample of standing/subsurface water was obtained from what is believed to be a portion of the substructure/basement of the former roundhouse (see Figure No. 2-15). The sample was obtained with a long handled, decontaminated polyethylene scoop. Sampling was performed in accordance with procedures contained in the Work Plan. The sample was analyzed for TCL +30 substances and petroleum hydrocarbons.

2.2.6 Phase I Investigation Waste Lagoon Sampling

The waste lagoon/Tar Pit was sampled at three locations. Each sampling location is shown in Figure No. 2-13. Core samples were obtained from the waste lagoon using a 3-inch diameter drive casing and a 2-inch split spoon sampler mounted on a portable tripod. After the casing was driven to the selected depth for sampling, a split spoon sampler was inserted into the casing and driven into the tar-like material to obtain the sample at the designated depth. The split spoon was removed and the waste material transferred to sample containers using a wooden tongue depressor.

The waste lagoon sampling was performed in accordance with the sampling procedures outlined in the project Work Plan except that disposable wooden tongue depressors were used instead of stainless steel spatulas to transfer the samples from the split spoon to the sample containers. In addition, a split spoon was driven and removed manually through a driven outer casing to obtain samples at core location No. 3. Since sufficient sample material was not obtained in the split spoon, additional material was obtained from the exterior of the drive casing after it was removed. Table No. 2-9 lists the number of samples taken and depths of samples at each Tar Pit core location, as well as the types of chemical analyses performed. As shown in Table No. 2-9, a total of four samples were tested for TCL +30 substances and one sample for TCL volatile compounds only, four analyzed for petroleum hydrocarbons, three tested for EP Toxicity and Hazardous Waste Characteristics, two tested for asbestos and one for a Treatability Screen.

In addition, provision was made for a paint filter test to determine if the tar-like material contained free liquid, and thus what disposal limitations, if any, to consider in the evaluation of remedial action evaluations as part of the Feasibility Study. The Treatability Screen included viscosity testing, melting point, Btu content, organic material content, texture, oil and grease, pH, ash content, sulfur content, specific gravity, solvent extractable material content, moisture content and combustible material content.

2.2.7 Phase II Investigation Waste Lagoon Sampling

As a part of the Phase II investigation, an additional representative sample of "tar-like" material was obtained from the Tar Pit. The sampling location (C-4) is shown in Figure No. 2-13. The sample was obtained for the purpose of evaluating an alternate method for reducing matrix interference in the analysis of "tar-like" samples for semi-volatile organics and pesticides/PCBs.

2.2.8 Test Pit and Test Trench Excavation and Sampling

From the interpretation of historical aerial photographs, it appeared that there were considerable areas of disturbed soil in the Disposal and Southern Areas of the site, which could have been used for waste disposal. In addition, the geophysical surveys indicated the possible existence of buried material/waste in the waste disposal area. To determine if waste was disposed in these areas, test pits and test trenches were excavated as part of

Table No. 2-9

**SUMMARY OF PHASE I AND PHASE II RI
TAR PIT SAMPLING**

<u>Sample Designation/No.</u>	<u>Sample Location</u>	<u>Depth of Sample (ft)/ Description</u>	<u>Analyses Performed</u>					<u>Treat-ability Screen</u>
			<u>TCL +30</u>	<u>Petroleum Hydro-carbons</u>	<u>Hazardous Waste Character-istics</u>	<u>EP Toxicity</u>	<u>Asbestos</u>	
<u>Phase I</u>								
TP-TA-C1 (1-3)	Core-1	1-3/waste	X	X	X	X		
TP-TA-C1 (5-6)	Core-1	5-6/clay	X	X				
TP-TA-C1 (3-4 1/2)	Core-1	3-4 1/2/waste	(VOC only)					
TP-TA-C1-A	Core-1	(composite off drive casing)/ waste					X	
TP-TA-C2 (1-3)	Core-2	1-3/waste	X	X	X	X		
TP-TA-C3 (1-3)	Core-3	1-3/waste	X	X	X			
C3 EP TOX	Core-3	1-3/waste				X		
C3A	Core-3	1-3/waste					X	
CIT	Core-1	(composite off drive casing)/ waste						X
<u>Phase II</u>								
Tar Pit	Core-4	0-1/waste	(semi-volatiles and pesticides/ PCBs)					

the Phase I field program. The use of test pits/trenches, rather than soil borings, was provided because test pits and trenches generally provide a better method of initial waste determination and visual characterization.

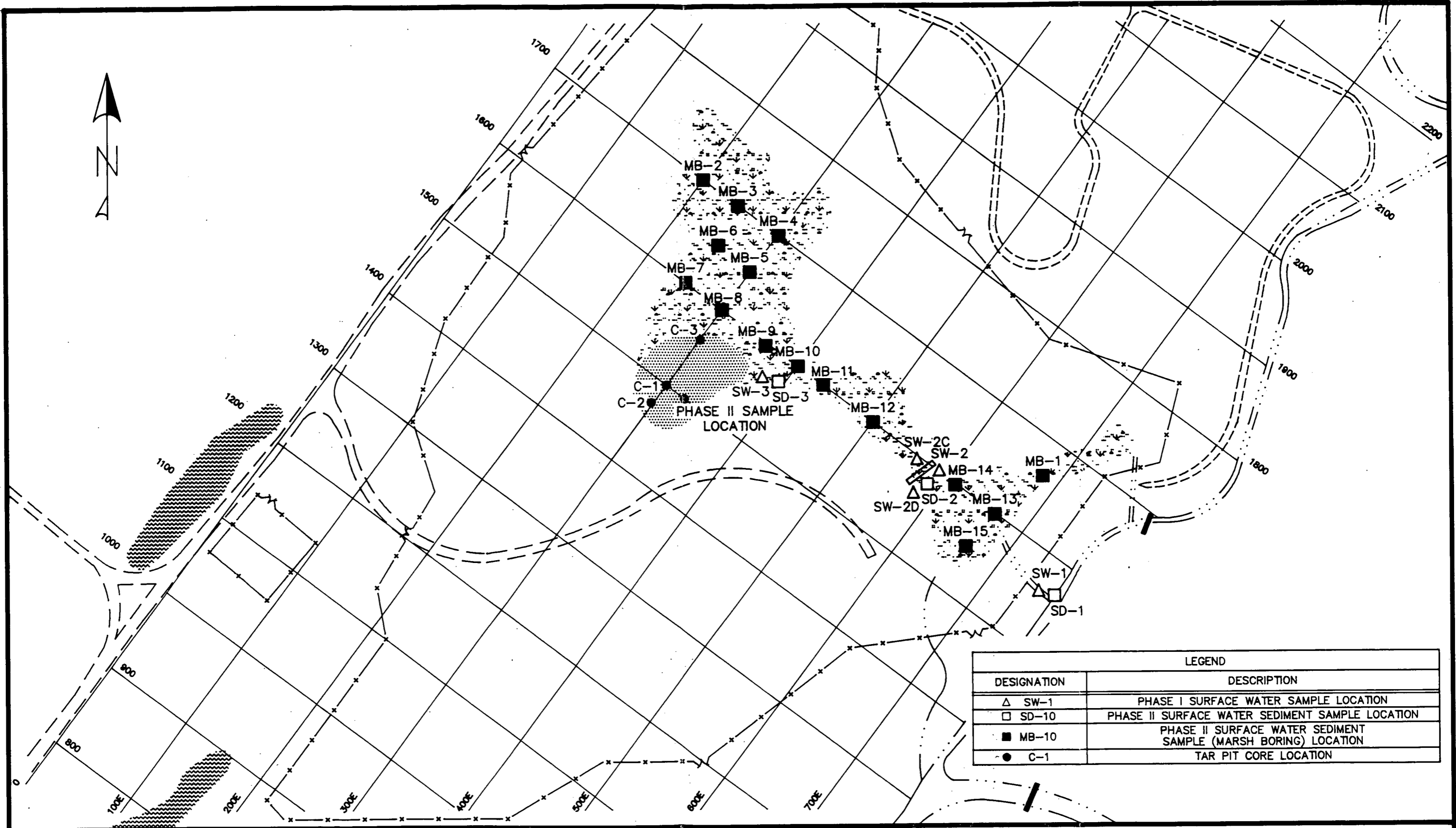
A total of 18 test pits (8 feet x 8 feet x 8 feet) were excavated using a backhoe at and adjacent to the Disposal Area, two test pits were excavated in the Roundhouse Area and two test pits were excavated in the Southern Area. In addition, one test trench (3 feet x 8 feet x 20 feet) was constructed in the Roundhouse Area. The locations of the test pits and test trench are shown in Figure No. 2-14.

Based upon a visual determination of possible waste material or contaminated soil, seven test pits were sampled. One sample was taken from a test pit in the Roundhouse Area (TP-21) and six were obtained from test pits in the Disposal Area (TP-2, 3, 10, 11, 13 and 17). Samples were collected directly from the backhoe bucket and transferred to the sample containers using a wooden tongue depressor. (The backhoe bucket was decontaminated between each test pit/trench.) As shown in Table No. 2-10, all seven of the soil samples were analyzed for TCL +30 substances and petroleum hydrocarbons. In addition, all seven samples were analyzed for asbestos.

2.2.9 Phase I Investigation Surface Water Sampling

2.2.9.1 Slate Bottom and Deer Lik Creek Sampling

A total of five surface water samples were obtained from Slate Bottom and Deer Lik Creeks. Each of the sampling locations are shown in Figure No. 2-15. One sample was taken at a downstream location in the creek before the entrance to an underground culvert ([SBC]SW-1) and two samples were collected at upstream locations. One upstream sample was obtained in Slate Bottom Creek, east of the junction with Deer Lik Creek ([SBC]SW-4). Another upstream sample was taken from Deer Lik Creek at a location north of the site Disposal Area and the confluence of Deer Lik Creek and Slate Bottom Creek ([SBC]SW-5). The other two surface water/creek samples were obtained from segments of Slate Bottom Creek contiguous to the site, one of which was taken at the junction with Deer Lik Creek immediately downstream of the marsh discharge outlets ([SBC]SW-3) and the other downstream of the confluence of Deer Lik Creek and Slate Bottom Creek ([SBC]SW-2).



LEGEND	
DESIGNATION	DESCRIPTION
△ SW-1	PHASE I SURFACE WATER SAMPLE LOCATION
□ SD-10	PHASE II SURFACE WATER SEDIMENT SAMPLE LOCATION
■ MB-10	PHASE II SURFACE WATER SEDIMENT SAMPLE (MARSH BORING) LOCATION
● C-1	TAR PIT CORE LOCATION

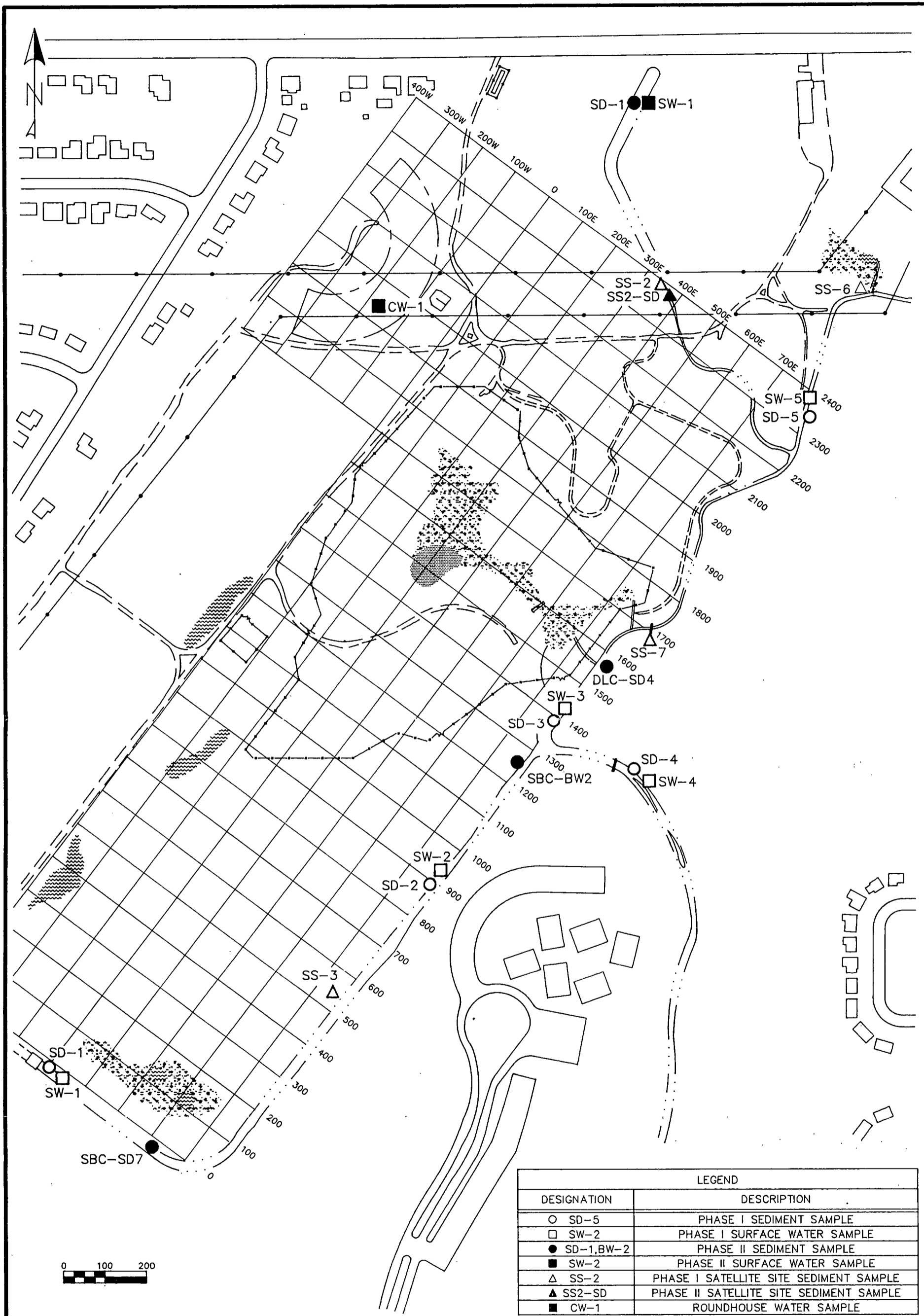
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LOCATIONS OF SURFACE WATER AND SURFACE WATER SEDIMENT SAMPLES
IN MARSH AREA AND TAR PIT SAMPLES

Table No. 2-10

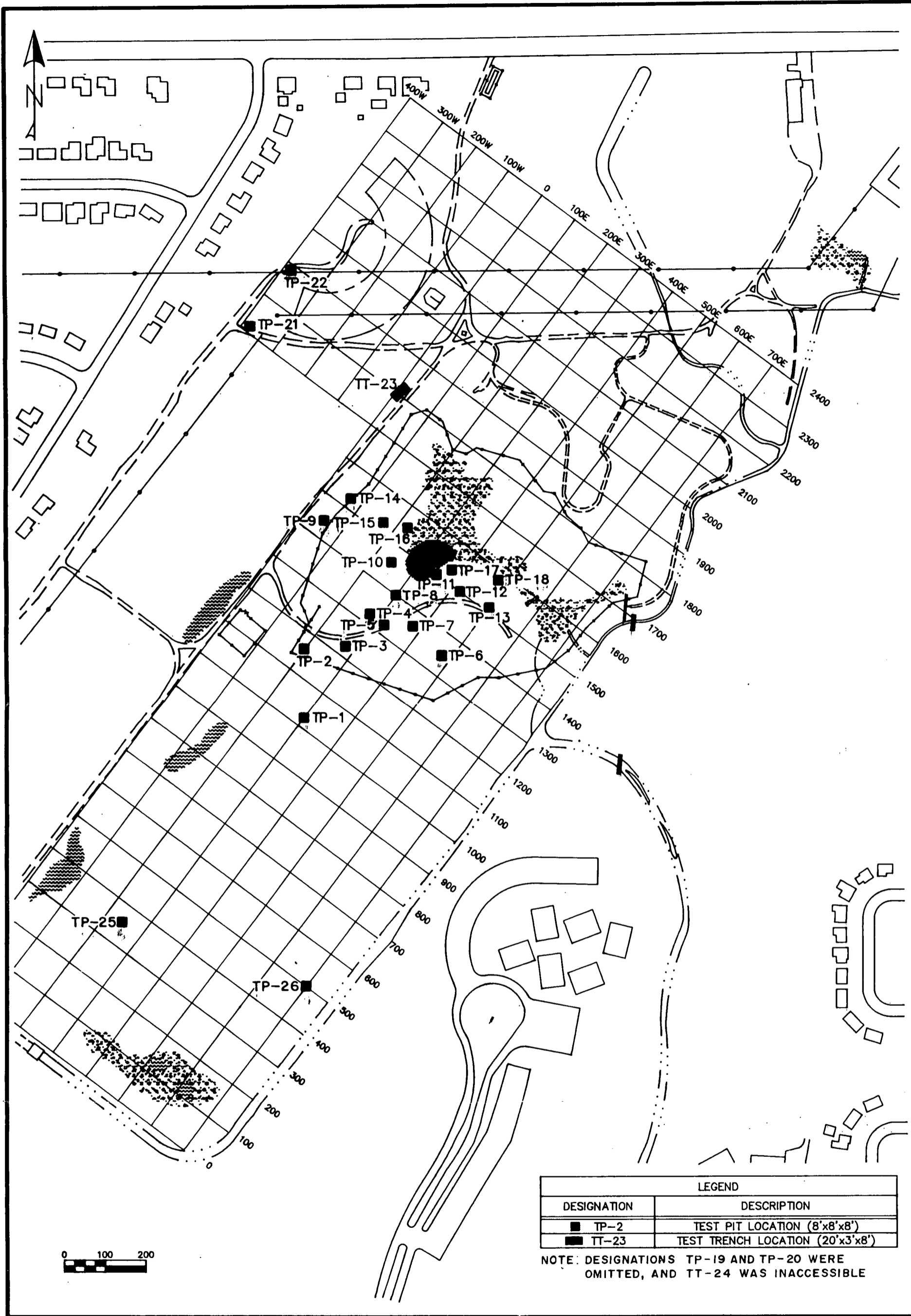
**SUMMARY OF PHASE I RI
TEST PIT AND TEST TRENCH SAMPLING**

<u>Sample Designation</u>	<u>Sample Location</u>	<u>Sample Depth</u>	<u>Analyses Performed</u>		
			<u>TCL +30</u>	<u>Petroleum Hydrocarbons</u>	<u>Asbestos</u>
SLTP-2	Test Pit - 2	1 feet	X	X	X
SLTP-3	Test Pit - 3	1-3 feet	X	X	X
SLTP-10	Test Pit - 10	0-1 feet	X	X	X
SLTP-11	Test Pit - 11	1-3 feet	X	X	X
SLTP-13	Test Pit - 13	5-6 feet	X	X	X
SLTP-17	Test Pit - 17	5-6 feet	X	X	X
SLTP-21	Test Pit - 21	1-2 feet	X	X	X



LEGEND	
DESIGNATION	DESCRIPTION
○ SD-5	PHASE I SEDIMENT SAMPLE
□ SW-2	PHASE I SURFACE WATER SAMPLE
● SD-1, BW-2	PHASE II SEDIMENT SAMPLE
■ SW-2	PHASE II SURFACE WATER SAMPLE
△ SS-2	PHASE I SATELLITE SITE SEDIMENT SAMPLE
▲ SS2-SD	PHASE II SATELLITE SITE SEDIMENT SAMPLE
■ CW-1	ROUNDHOUSE WATER SAMPLE

UNION ROAD SITE
LOCATIONS OF SURFACE WATER,
ROUNDHOUSE WATER, SURFACE WATER SEDIMENT,
BANK WASTE AND SATELLITE SITE SAMPLES



**UNION ROAD SITE
LOCATIONS OF TEST PITS
AND TEST TRENCH**

All of the surface water samples from the creeks were obtained by directly submerging the sample bottles a few inches below the water surface and allowing the bottles to fill while facing the bottles upstream into the direction of flow. Sampling was performed in accordance with the procedures contained in the Work Plan. Each of the five samples was analyzed for TCL +30 substances, petroleum hydrocarbons and hardness. (Hardness was analyzed because many of the surface water standards/guidance values are defined as a function of this parameter.) A summary of the surface water samples, including their sample designations and types of analyses performed, is shown in Table No. 2-11.

2.2.9.2 Marsh Sampling

A total of five surface water samples were obtained from three locations in the marsh area contiguous to the Tar Pit. As shown in Figure No. 2-13, one sample was obtained at a location in the marsh in a pond/wetland area immediately downstream of the Tar Pit ([MA]SW-3), three samples adjacent to the USEPA filter fence ([MA]SW-2), and one sample at the southern outlet of the marsh area to a tributary to Deer Lik Creek ([MA]SW-1). Of the three samples taken near the USEPA filter fence, one of these samples, (MA-SW-2), was taken downstream of the filter fence, of what appeared to be "clean" flowing surface water; the second, taken upstream of the filter fence (MA-SW-2C), was a sample of water that contained a film which appeared to be present naturally; and the third sample (taken downstream of the filter fence) was contaminated surface water that was obtained after the marsh sediment was purposely disturbed and contamination was released from the sediment into the water column as a worst case scenario.

Each of the surface water samples from the marsh was obtained using a stainless steel scoop and directly transferred to the sample bottles. Sampling was performed in accordance with the procedures outlined in the Work Plan.

All five water samples were analyzed for TCL +30 substances and petroleum hydrocarbons. Three of these samples (MA-SW-1, 2 and 3) were also tested for hardness. Table No. 2-11 lists each sample by sample designation and location, and identifies the types of analyses performed for each sample.

Table No. 2-11

**SUMMARY OF PHASE I AND PHASE II RI
SURFACE WATER SAMPLING**

<u>Sample Designation</u>	<u>Sample Location</u>	<u>Analyses Performed</u>			
		<u>TCL +30</u>	<u>Petroleum Hydrocarbons</u>	<u>Hardness</u>	<u>PAHs</u>
<u>Phase I</u>					
SBC-SW-1	Slate Bottom Creek	X	X	X	
SBC-SW-2	Slate Bottom Creek	X	X	X	
SBC-SW-3	Deer Lik Creek	X	X	X	
SBC-SW-4	Slate Bottom Creek	X	X	X	
SBC-SW-5	Deer Lik Creek	X	X	X	
MA-SW-1	Marsh	X	X	X	
MA-SW-2	Marsh	X	X	X	
MA-SW-2C	Marsh (undisturbed contaminated water)	X	X		
MA-SW-2D	Marsh (disturbed contaminated water)	X	X		
MA-SW-3	Marsh	X	X	X	
<u>Phase II</u>					
SS2-SW	Drainage Ditch Tributary to Deer Lik Creek				X

2.2.10 Phase II Investigation Surface Water Sampling

2.2.10.1 Drainage Ditch Sampling

One surface water sample was obtained from the drainage ditch which flows south under Losson Road and discharges into Deer Lik Creek at a point approximately 50 feet south of Losson Road (see Figure No. 2-15). The sample was obtained with a long handled stainless steel scoop. Sampling was performed in accordance with procedures contained in the Work Plan. The sample was analyzed for polycyclic aromatic hydrocarbons (PAHs) only. This sample was obtained upstream from Satellite Site No. 2 where elevated levels of PAHs were found during the Phase I investigation to better define/confirm the suspected source of contamination.

2.2.10.2 Creek Flow Measurement

Creek flow measurements were obtained from both Deer Lik and Slate Bottom Creeks on a regular basis when conditions permitted the safe acquisition of data. Specifically, measurements were taken in Deer Lik Creek at approximately the 1400N grid line and in Slate Bottom Creek at approximately the 1200N grid line. Flow rates were approximated by measuring the creek velocity utilizing a float and stopwatch over a 20-foot long interval and then measuring the approximate cross sectional area of the creek by taking depth measurements at 6-inch intervals across the width of the creek. Creek flow data is reported on the Daily Site Dust/Weather Conditions Report form contained in the Phase II Investigation Field Record Report.

2.2.11 Phase I Investigation Surface Water Sediment Sampling

2.2.11.1 Slate Bottom and Deer Lik Creek Sampling

A total of five surface water sediment samples were obtained from Slate Bottom and Deer Lik Creeks. Each of the sampling locations is shown in Figure No. 2-15. The sediment sample locations were the same as those for the surface water samples. (The sediment samples were obtained sequentially downstream to upstream and after the water samples to preclude the introduction of disturbed sediment into the water column which would result in a non-representative sample.) As shown in this figure, one sample was taken at a downstream location in the creek just before the entrance to the underground culvert ([SBC]SD-1). Another sample was obtained at an upstream location in Slate Bottom

Creek, east of the confluence with Deer Lik Creek ([SBC]SD-4). Another sample was taken from Deer Lik Creek at a location upstream of the site Disposal Area ([SBC]SD-5). The other two samples were obtained from segments of Slate Bottom Creek contiguous to the site, one of which was taken just upstream of the confluence of Deer Lik Creek and Slate Bottom Creek ([SBC]SD-3), and the other downstream of this point adjacent to the site ([SBC]SD-2).

All of the surface water sediment samples were obtained by utilizing a stainless steel scoop and inserting it approximately 3 to 4 inches into the sediment, and removing the sample and transferring it into the sample containers with a disposable wooden tongue depressor. Sampling was performed in accordance with the procedures outlined in the Work Plan. Each of the five samples was analyzed for TCL +30 substances and petroleum hydrocarbons. Table No. 2-12 lists each sediment sample by sample designation and location, and identifies the types of analyses performed on each sample.

2.2.11.2 Marsh Sampling

A total of three surface water sediment samples were obtained from three locations in the marsh area. As shown in Figure No. 2-13, one sample was obtained at a location in the marsh in a pond area immediately adjacent and downstream of the waste lagoon ([MA]SD-1), one sample just downstream of the USEPA filter fence ([MA]SD-2), and one sample at the southern outlet of the marsh area to Deer Lik Creek ([MA]SD-1). Similar to the sampling of Slate Bottom Creek, sediment samples of the marsh were at the same locations as the water samples, and the sediment samples were obtained sequentially downstream to upstream and subsequent to the water samples.

Each of the sediment samples from the marsh was obtained using a stainless steel scoop and inserting it approximately 3 to 4 inches into the bottom sediment, and removing the sample and transferring it into the sample containers with a disposable wooden tongue depressor. Sampling was performed in accordance with the procedures contained in the Work Plan.

All three of the sediment samples were analyzed for TCL +30 substances and petroleum hydrocarbons. One of these samples (MA-SD-2), which appeared to be significantly contaminated, was analyzed for EP Toxicity and Hazardous Waste Characteristics. Table No. 2-12 lists each sample by sample designation and location, and identifies the types of analyses performed on each sample.

Table No. 2-12

**SUMMARY OF PHASE I AND PHASE II RI
SURFACE WATER SEDIMENT SAMPLING**

<u>Sample Designation</u>	<u>Sample Location</u>	<u>Analyses Performed</u>				
		<u>TCL +30</u>	<u>Petroleum Waste Hydro- carbons</u>	<u>Character- ization</u>	<u>EP Toxicity</u>	<u>PAHs</u>
<u>Phase I</u>						
SBC-SD-1	Slate Bottom Creek	X	X			
SBC-SD-2	Slate Bottom Creek	X	X			
SBC-SD-3	Deer Lik Creek	X	X			
SBC-SD-4	Slate Bottom Creek	X	X			
SBC-SD-5	Deer Lik Creek	X	X			
MA-SD-1	Marsh	X	X			
MA-SD-2	Marsh	X	X	X	X	
MA-SD-3	Marsh	X	X			
<u>Phase II</u>						
DLC-SD1	Drainage Ditch Tributary to Deer Lik Creek					X
SS2-SD	Drainage Ditch Tributary to Deer Lik Creek					X
SBC-BW1	Slate Bottom Creek		X			X
SBC-BW2	Slate Bottom Creek	X*				
SBC-SD6	Slate Bottom Creek		X			X
SBC-SD7	Slate Bottom Creek		X			X
DLC-SD4	Deer Lik Creek	X*				

* VOCs not analyzed.

2.2.12 Phase II Investigation Surface Water Sediment Sampling

2.2.12.1 Drainage Ditch Sampling

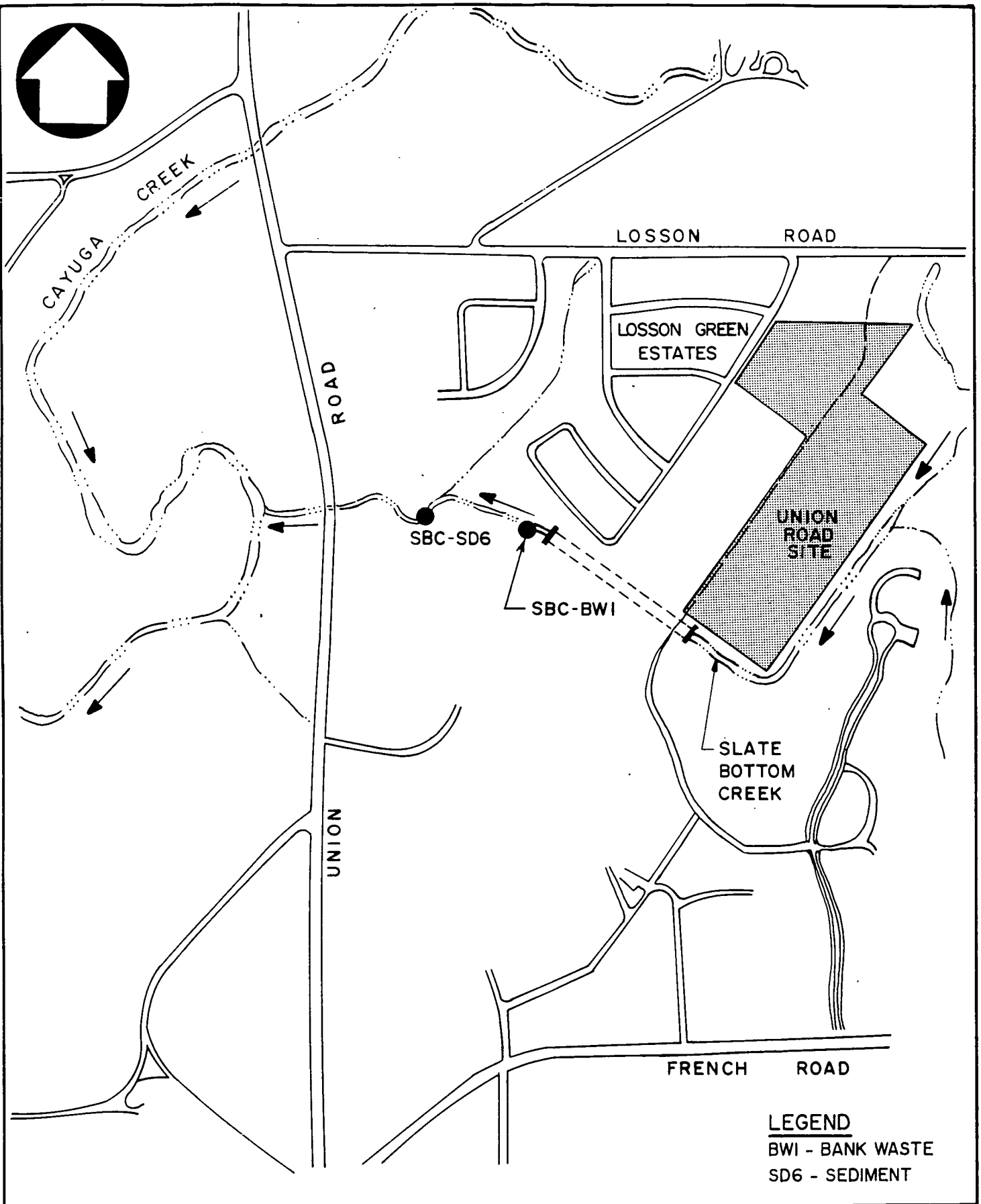
A total of two surface water sediment samples were obtained from the drainage ditch which flows south under Losson Road and discharges into Deer Lik Creek as shown in Figure No. 2-15 and analyzed for polycyclic aromatic hydrocarbons to determine/confirm the source of high levels of PAHs found at Satellite Site No. 2 during the Phase I RI. Both of the samples were obtained with stainless steel scoops. Sampling was performed in accordance with the procedures contained in the Work Plan. Table No. 2-12 lists each sample by designation and location, and identifies the types of analyses performed on each sample.

2.2.12.2 Slate Bottom and Deer Lik Creek Sampling

A total of five samples were obtained from along the banks of Slate Bottom and Deer Lik Creeks (four from Slate Bottom and one from Deer Lik Creek) as illustrated in Figures 2-15 and 2-16. Three of the samples were from sediments and two were from waste deposits. These samples were obtained to confirm the high levels of contamination in the creek bank sediment and waste material found during the Phase I RI. Samples were obtained using a sterile wooden tongue depressor and in accordance with the Work Plan. Two of the samples were analyzed for TCL+30 (without VOCs since essentially none were found during the Phase I RI) and three for petroleum hydrocarbons and lead only. Table 2-12 lists each sample by designation and locations, and identifies the types of analyses performed on each sample.

2.2.12.3 Marsh Sampling

A total of 14 sediment samples were obtained from 15 locations designed to define both the horizontal and vertical extent of contamination in the marsh area as shown in Figure No. 2-13. All of the samples were obtained with a stainless steel split spoon sampler. Twelve of the sampling locations (MB-1 through MB-12) were sampled with a drill rig using 2.25 inch ID hollow stem augers. The procedure at each of these locations was to take continuous split spoon samples until the "clean clay" underlying the marsh sediments was encountered. Because of soft marsh conditions which rendered locations



UNION ROAD SITE

LOCATION OF OFF-SITE BANK WASTE AND
SURFACE WATER SEDIMENT SAMPLES



MB-13, 14 and 15 inaccessible to the drill rig, continuous samples were obtained at these locations with a split spoon sampler which was driven into the subsurface manually using a hand-held drive hammer. Except for the last three marsh borings (MB-13, 14 and 15), sampling was performed in accordance with the procedures contained in the Work Plan. All samples were analyzed for petroleum hydrocarbons, and selected samples analyzed for TCL +30, lead and/or lead EP Toxicity. Table No. 2-13 lists each sample by designation and location, and identifies the types of analyses performed on each sample.

2.2.13 Drum Sampling

As part of the Phase I field program, an inspection of drums found on-site was performed and all of the drums (that were accessible) were observed to be empty except for two drums that were located immediately east of the Tar Pit. One of these drums contained a coarse grained white material and the other contained what appeared to be asphalt (small stone with binder). Only one sample (DA-DR-1) was taken from the drum that contained the coarse white material. The sample was obtained using a stainless steel scoop and transferred to the sample containers. Sampling was performed in accordance with the procedures outlined in the project Work Plan. The sample was analyzed for TCL +30 substances, petroleum hydrocarbons, Hazardous Waste Characteristics and EP Toxicity. There were no drums sampled as a part of the Phase II field program.

2.2.14 Air Monitoring

As part of both the Phase I and II RI, basic climatological/meteorological data, such as general weather conditions, wind speed and direction, and temperature was recorded on a daily basis. In addition, an air monitoring program was implemented to establish ambient air conditions both in various locations within the boundary of the site during field activities as well as at the perimeter of the site based on total organic vapors. The air monitoring program utilized portable field instrumentation including a photoionization organic vapor detector (Photovac TIP) and flame ionization organic vapor detector (Century OVA) to measure total volatile organic vapors. Draeger tubes were used to monitor levels of hydrogen sulfide (H_2S) and BTX compounds (benzene, toluene, xylene). In addition, the Century OVA was utilized to monitor methane levels and a Neotronics Model 400 FH multi-gas monitor was used to measure percent oxygen, toxicity (including H_2S), and explosive levels. Particulates were measured with a Miniram Aerosol Monitor

Table No. 2-13

**SUMMARY OF PHASE II RI
MARSH SEDIMENT SAMPLING**

<u>Sample Designation</u>	<u>Sample Location</u>	<u>Analyses Performed</u>			
		<u>TCL +30</u>	<u>Petroleum Hydrocarbons</u>	<u>Lead</u>	<u>Lead EP Toxicity</u>
MS (2-4 feet)	Marsh		X	X	
MB2 (2-4 feet)	Marsh		X	X	X
MB3 (2-4 feet)	Marsh		X	X	
MB5 (2-4 feet)	Marsh		X	X	X
MB6 (2-4 feet)	Marsh		X	X	
MB7 (2-4 feet)	Marsh		X	X	X
MB7 (4-8 feet)	Marsh	X	X		X
MB8 (2-4 feet)	Marsh		X	X	
MB9 (2-4 feet)	Marsh	X	X		X
MB10 (2-4 feet)	Marsh		X	X	X
MB11 (4-6 feet)	Marsh		X	X	X
MB12 (3-4 feet)	Marsh	X	X		X
MB12 (5-6 feet)	Marsh		X	X	X
MB14 (2-4 feet)	Marsh	X	X		X
MB15 (2-4 feet)	Marsh	X	X		X

Model PDM-3 continuously during drilling operations. In addition, during the Phase II field program, a separate particulate monitoring program to collect dust information for the health risk assessment was undertaken daily at two different locations within the site. These locations were immediately southwest of the former roundhouse and adjacent to the waste lagoon in the vicinity of the MW-4 monitoring well cluster.

2.2.15 Satellite Site Investigation

2.2.15.1 Phase I Investigation Sampling

Although a detailed description and results of the investigation of the Satellite Sites is provided in a separate document as provided for in the scope of work for this project, a brief discussion is provided in this report for those sites which were sampled on or immediately contiguous to the Union Road Site and are suspected to be directly related to the site, these sites being SS-2, 3, 6 and 7 as illustrated in Figure No. 2-15.

Waste material/sediment samples were obtained at each of these four Satellite Sites. Tar-like waste material found on the western bank of Slate Bottom Creek was sampled at Satellite Site No. 3 using a wooden tongue depressor and transferred directly to the sample containers. Sediment samples were taken at Satellite Site Nos. 2 and 6 using a stainless steel scoop and were transferred to the sample containers using wooden tongue depressors. The material sampled at Satellite Site No. 7, also collected with a stainless steel scoop and transferred to sample containers with a wooden tongue depressor, was representative of a mix of sediment and waste material/leachate discharging from the bank of Deer Lik Creek immediately north of the northern most outlet from the marsh. Each of the four samples were analyzed for TCL +30 substances and petroleum hydrocarbons.

Soil and waste material/sediment sampling was performed in accordance with the procedures outlined in the Work Plan. A summary of the sampling program and analyses performed is contained in Table No. 2-14.

2.2.15.2 Phase II Investigation Sampling and Site Inspection

As part of the Phase II field program, an additional sediment sample was obtained from the location of Satellite Site No. 2 shown in Figure No. 2-15. The sample was obtained by utilizing a stainless steel scoop and inserting it approximately 3 to 4 inches

into the sediment, removing the sample and transferring it into the sample containers with a disposable wooden tongue depressor. Sampling was performed in accordance with the procedures outlined in the Work Plan. The sample was analyzed for polycyclic aromatic hydrocarbons. In addition, the creek bed of Slate Bottom Creek in the vicinity of Satellite Site Nos. 3 and 4 was probed using a shovel. Tar/grease-like waste deposits were observed several inches below the sediment surface. Surficial sediments adjacent to Slate Bottom Creek to the east of the confluence with Deer Lik Creek were probed and found to contain "clean" material. The bed of Deer Lik Creek in the vicinity of Satellite Site No. 7 was also probed and found to consist of "clean" material.

2.2.16 Health and Safety Program

Subsequent to the Phase I RI and as part of the project Work Plan, a Health and Safety Plan was prepared in order to establish occupational health and safety requirements, responsibilities and procedures to protect workers during the field investigation at the Union Road Site. The requirements for worker health and safety were based on the following:

- o The Standard Operating Safety Guides. US Environmental Protection Agency (EPA), Office of Emergency and Remedial Response;
- o The Occupational Health and Safety Administration (OSHA) Regulations, 29 CFR Parts 1019.120 and 1926;
- o Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. NIOSH, OSHA, USCG and EPA;
- o Health and Safety Procedures for Hazardous Waste Sites. Dvirka and Bartilucci Consulting Engineers; and
- o Superfund Amendments and Reauthorization Act (SARA), Title I, Section 126.

All activities associated both with the Phase I and II RI were performed in accordance with this Health and Safety Plan. A detailed description of the Health and Safety Plan is contained in Section 8.0 of the Work Plan.

Table No. 2-14

**SUMMARY OF PHASE I AND PHASE II RI
SATELLITE SITE* SAMPLING**

<u>Sample Designation</u>	<u>Sample Location</u>	<u>Sample Depth</u>	<u>Analyses Performed</u>		
			<u>TCL +30</u>	<u>Petroleum Hydrocarbons</u>	<u>PAHs</u>
<u>Phase I</u>					
SS2-LE	Satellite Site No. 2	1-4 inches	X	X	
SS3-TA	Satellite Site No. 3	3-4 inches	X	X	
SS6-LE	Satellite Site No. 6	1-3 inches	X	X	
SS7-LE	Satellite Site No. 7	1-3 inches	X	X	
<u>Phase II</u>					
SS2-SD	Satellite Site No. 2	3-4 inches			X

* Only those Satellite Sites immediately contiguous to the Union Road Site and suspected to be related directly to the site.

2.2.17 Quality Assurance/Quality Control Program

As part of the Remedial Investigation and project Work Plan, a Quality Assurance and Quality Control (QA/QC) Plan was prepared which developed and described the detailed sample collection and analytical procedures to be used to ensure high quality, valid data collected as part of this project. This QA/QC Plan included detailed descriptions of the following.

- o Objective and Scope
- o Data Usage
- o Monitoring Network Design and Rationale
- o Monitoring Parameters
- o Schedule of Tasks and Products
- o Project Organization and Responsibilities
- o Data Quality Requirements and Assessments
- o Detailed Sampling Procedures
- o Decontamination Procedures
- o Laboratory Sample Custody Procedures
- o Field Management Documentation
- o Calibration Procedures and Preventive Maintenance
- o Documentation, Data Reduction and Reporting
- o Data Validation
- o Performance and System Audits
- o Corrective Action
- o Trip Blanks
- o Field Blanks
- o Matrix Spikes/Matrix Spike Duplicates
- o Method Blanks
- o Field Management Forms
- o NYSDEC Sample Identification, Preparation and Analysis Summary Forms
- o Data Validation Reporting Forms

All work undertaken during both the Phase I and II RI was performed in accordance with the procedures outlined in the QA/QC Plan contained in the project Work Plan. For a detailed description of the QA/QC Plan, see Section 7.0 of the Work Plan.

2.2.18 Data Validation

York Laboratories, Inc., which is a NYSDEC approved laboratory meeting requirements for performing sample analysis according to 1987 Contract Laboratory Protocol (CLP), was utilized to perform all the chemical analyses for the samples obtained during both the Phase I and II RI. Summary documentation regarding data validation was completed by the laboratory using NYSDEC forms and submitted with the data package as required in the QA/QC Plan.

Data validation, undertaken by Dvirka and Bartilucci Consulting Engineers and subconsultant, C.C. Johnson and Malhotra, P.C., was performed to determine and document analytical data quality in accordance with NYSDEC CLP requirements. The analytical and validation processes were conducted in conformance with the CLP and are based on the United States Environmental Protection Agency's (USEPA) Contract Laboratory Protocol "Statement of Work" documents and the associated "CLP Functional Guidelines for Data Validation" documents.

Throughout both the Phase I and II RI, all aspects of the data validation process were followed in accordance with the procedures outlined in the QA/QC Plan included in the project Work Plan. For a detailed description of Data Validation, see Section 7.0 of the Work Plan. A discussion of the data validation results is contained in Section 4.2 and Appendix E of this report.

Section 3



3.0 PHYSICAL CHARACTERISTICS OF STUDY AREA

3.1 Results of Field Activities/Physical Characteristics

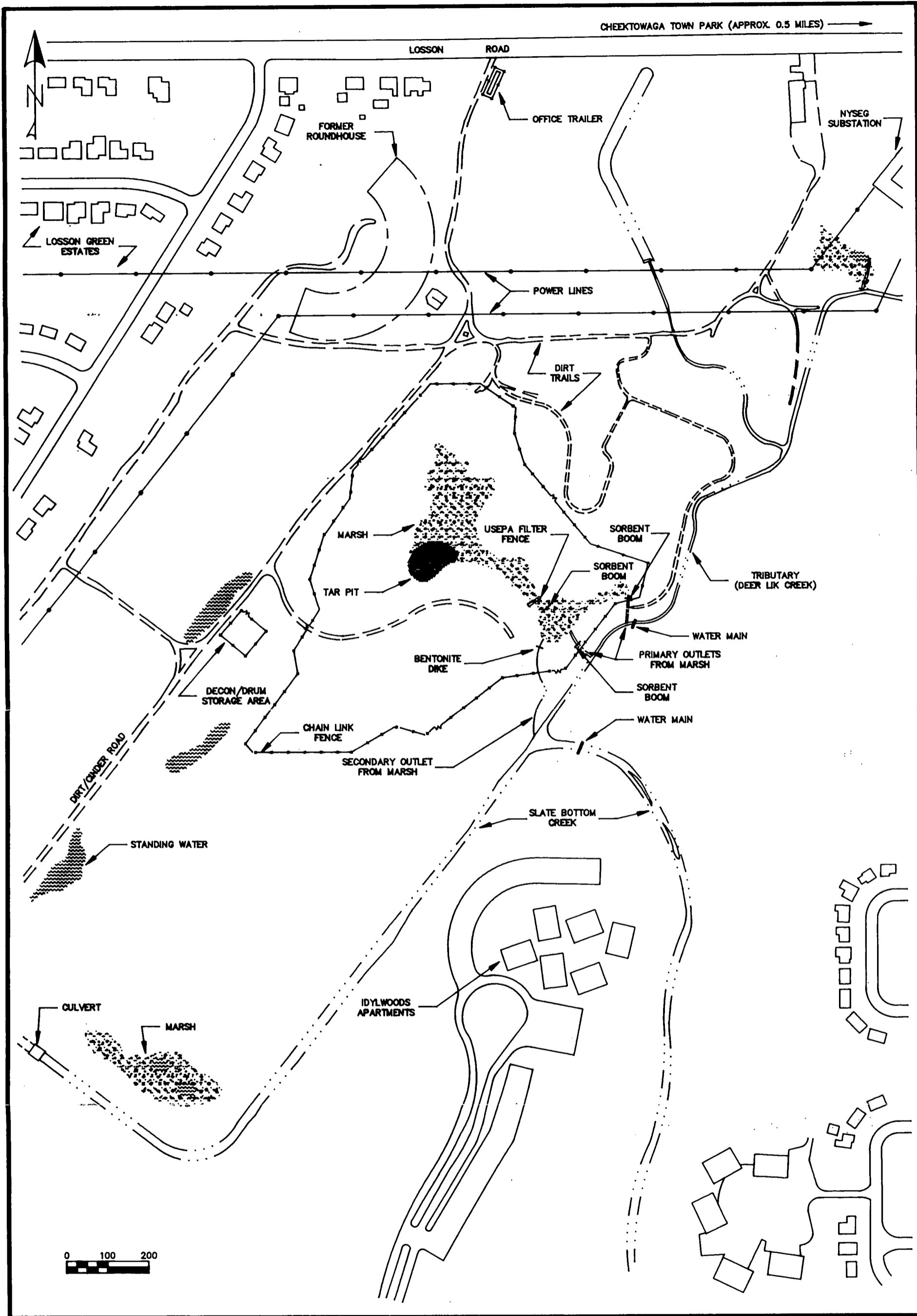
3.1.1 Surface Features

The Union Road Site study area, as defined in Figure No. 1-2, encompasses an area of approximately 60 acres. The site is bounded on the north by Losson Road, on the west by a housing development (Losson Green Estates), and on the south and east by Slate Bottom Creek and also on the east by its tributary, Deer Lik Creek (see Figure No. 3-1). Primary access to the site is from Losson Road although the site can be easily accessed at numerous points along the perimeter. In addition to Losson Green Estates located to the west of the site, housing developments are situated north of the site along Losson Road, just to the east of Slate Bottom Creek (Idylwoods Apartments), as well as to the south of Slate Bottom Creek.

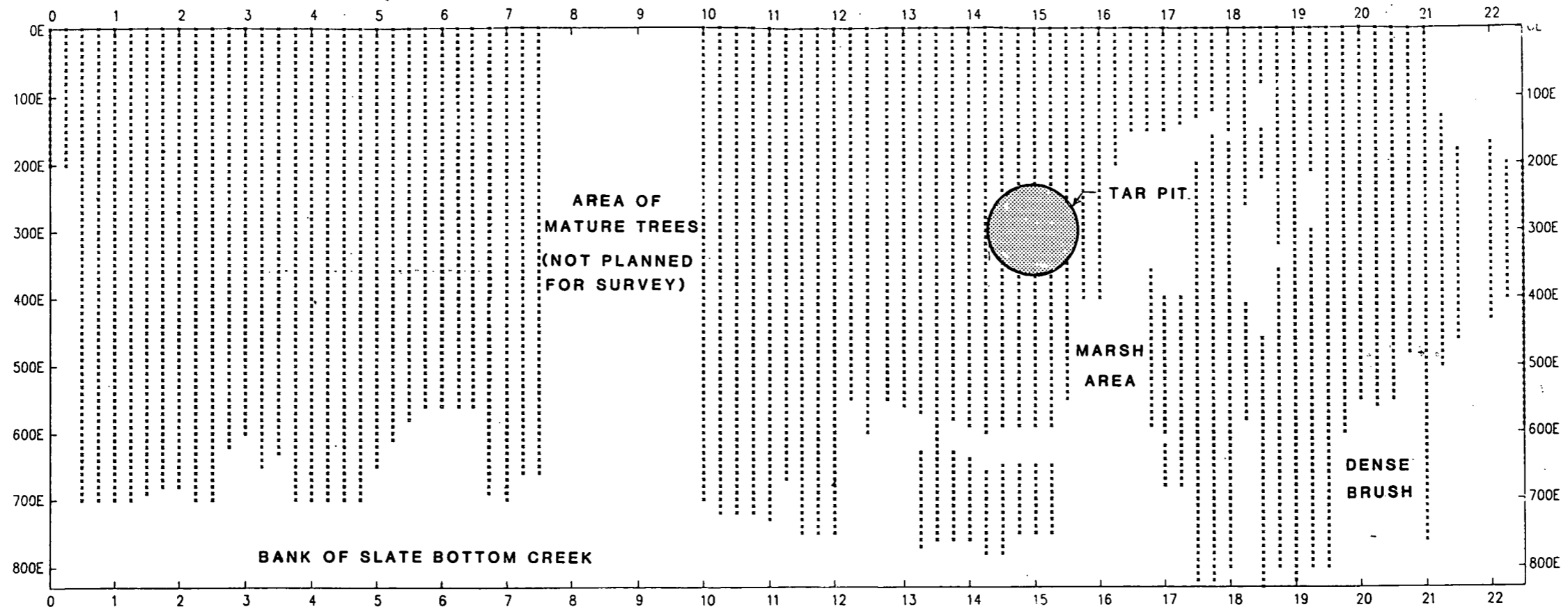
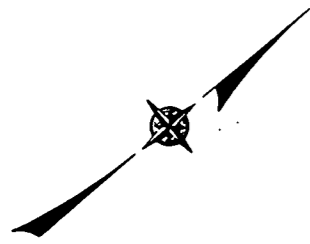
The area included within the site was the former location of a large railroad classification and maintenance yard that was in operation from about 1915 until the mid-1950's, and was dismantled sometime between 1951 and 1958. Several structures in the Roundhouse Area are still present including the roundhouse foundation (see Appendix H). A dirt/cinder road runs in a northeast-southwest direction through the site to the west of the Disposal Area and Tar Pit, and serves as the main point of access to the site from Losson Road.

The Union Road Site is characterized by generally flat topography with a maximum relief of approximately 25 feet. Maximum slopes are found along Slate Bottom Creek and surrounding the waste lagoon and marsh area depression. (See Appendix I for a topographic map of the site and immediately surrounding area.)

A large concrete culvert, approximately 16 feet in diameter, is present in the Southern Area of the site channeling Slate Bottom Creek underground beneath the former railroad yard. Power lines, emanating from a New York State Electric and Gas (NYSEG) substation located in the extreme northeast corner of the site, cross the northern portion of the site and run parallel with the western border of the site. Numerous dirt trails are concentrated in an area to the northeast of the Tar Pit. In addition, a water main crosses Deer Lik Creek and Slate Bottom Creek to the east of the site.



UNION ROAD SITE
SURFACE FEATURES



Source: HAGER-RICHTER GEOSCIENCE, INC.

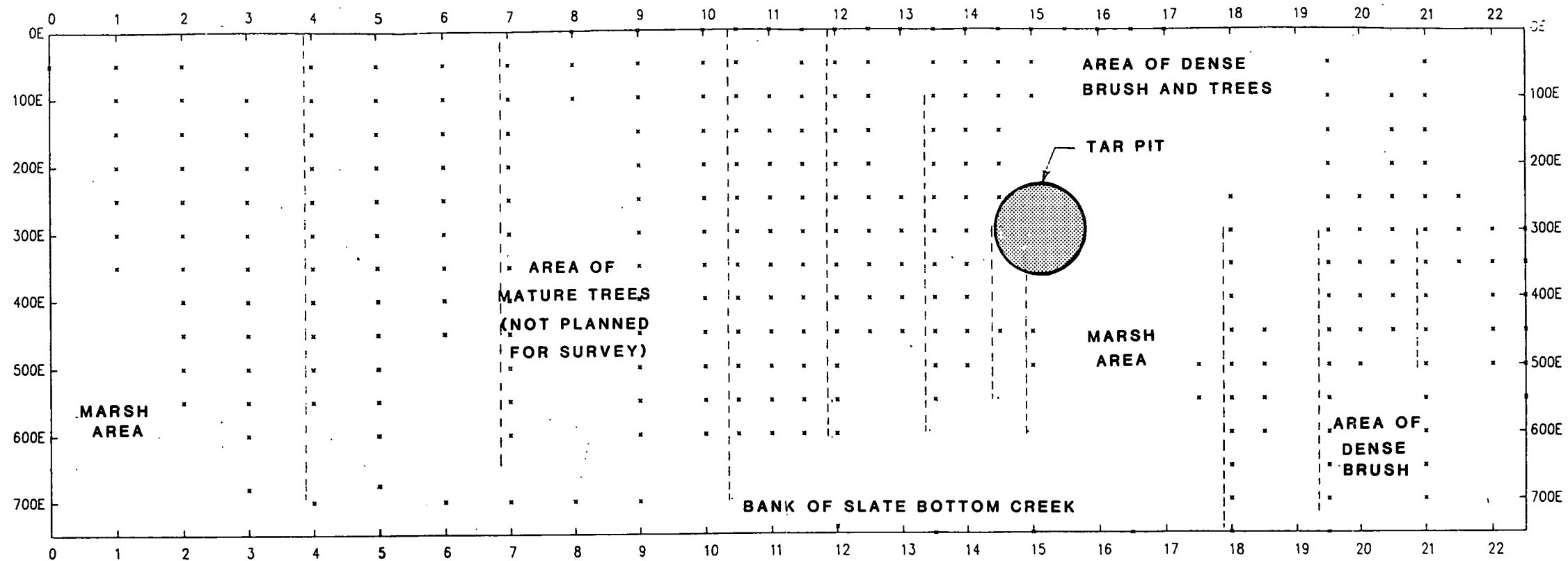
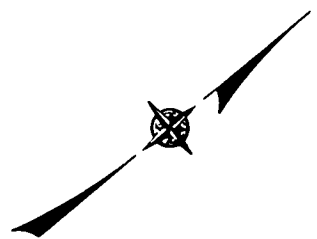
SCALE: 1" = 200'

UNION ROAD SITE

MAGNETIC SURVEY STATION MAP



FIGURE NO. 3-2



LEGEND

- x RESISTIVITY
- CONDUCTIVITY

Source: HAGER-RICHTER GEOSCIENCE, INC.

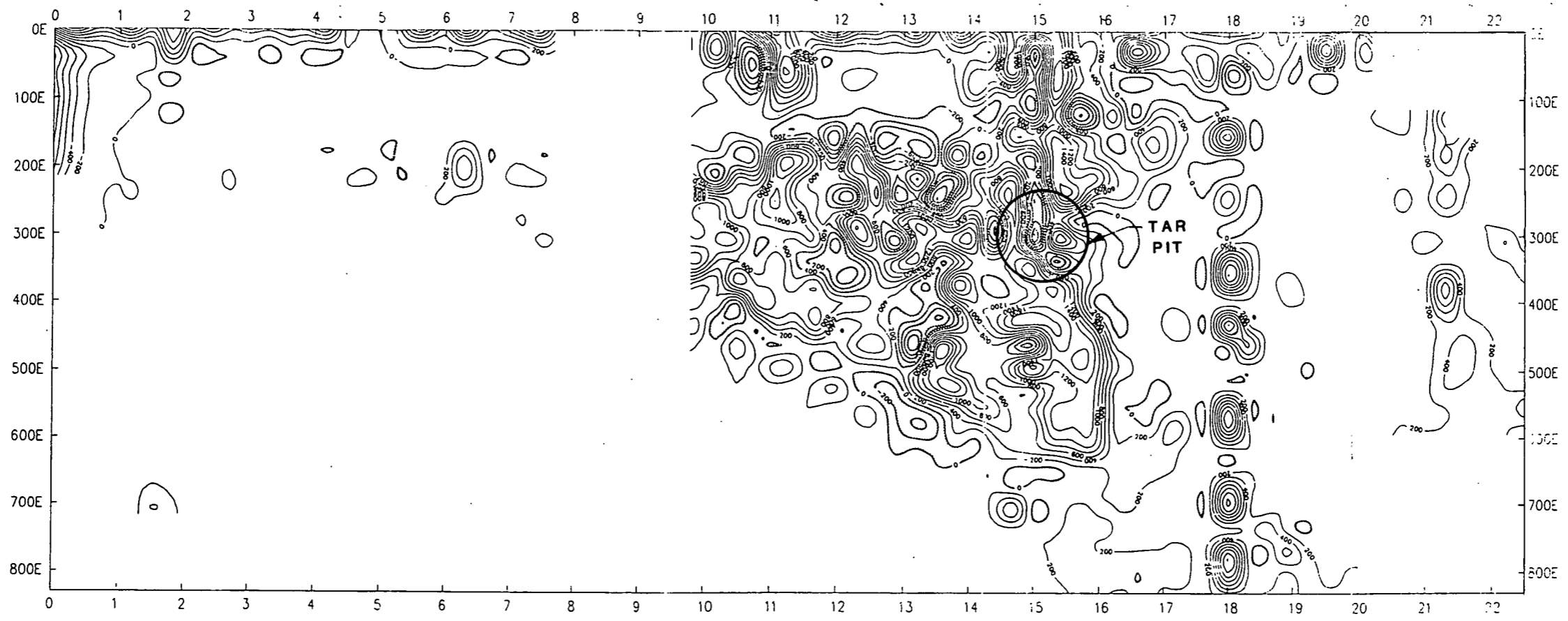
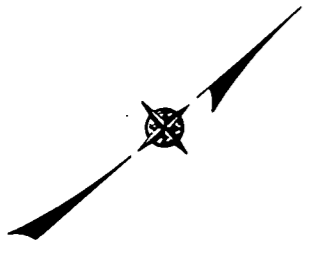
SCALE: 1" = 200'

UNION ROAD SITE

RESISTIVITY AND TERRAIN CONDUCTIVITY SURVEY STATION MAP



FIGURE NO. 3-3



Source: HAGER-RICHTER GEOSCIENCE, INC.

SCALE: 1" = 200'

UNION ROAD SITE

MAGNETIC FIELD CONTOUR MAP



FIGURE NO. 3-4

A waste lagoon/Tar Pit is located in the north-central portion of the site and is readily visible in recent aerial photographs as a dark, circular feature bordering the marsh area (see Appendix H). The marsh extends both to the north and east of the Tar Pit with drainage toward Deer Lik Creek. Prominent areas of standing water are located along both sides of the cinder road in the Southern Area of the site and in the southeast corner of the site immediately to the northwest of the sharp (90°) bend in Slate Bottom Creek.

A 3,300 foot long, 6 foot high chain link fence with five truck gates encircles the Tar Pit, marsh and Disposal Areas.

3.1.2 Geophysical Survey

Surface geophysical surveys were conducted by Hager-Richter Geoscience, Inc. at the Union Road Site in January, 1989. Geophysical techniques utilized during the investigation included magnetic surveying, resistivity surveying and terrain conductivity profiling. These surveys were used as an aid in the location of areas of buried waste and contaminated ground water, and placement of monitoring wells, waste borings and test pits. Maps illustrating magnetic and resistivity survey stations are illustrated in Figure Nos. 3-2 and 3-3. (As explained in Section 2.2.2, not all planned stations were accessible for surveying, either because of marsh and standing water, or very dense brush.) The following is a summary of results derived from the surface geophysical survey report prepared by Hager-Richter Geoscience, Inc. (see Appendix C).

Magnetic surveying revealed numerous magnetic disturbances in the vicinity of the Tar Pit. Disturbances that did not correlate with surface objects were interpreted to be caused by the presence of metallics in the subsurface. Due to steep magnetic gradients, the objects were interpreted to be buried close to the surface (see Figure No. 3-4). Magnetic disturbances correlate closely with the edge of the ridge around the south side of the Tar Pit and a 2 1/2 foot high berm that occurs in the woods to the south and southeast of the Tar Pit which, based upon historical aerial photographs, indicates the limits of the fill area in the eastern portion of the site. To the north of the Tar Pit, most of the magnetic disturbances correlate with visible objects such as overhead powerlines, underground sewer lines and fence posts. There does not appear to have been systematic dumping of metal objects in this region. In the Southern Area, magnetic disturbances occur only in the area between the geophysical survey baseline and about line 250E where a small berm occurs. The magnetic data was interpreted to indicate that no fill containing metallic objects has been disposed in the Southern Area east of about line 250E.

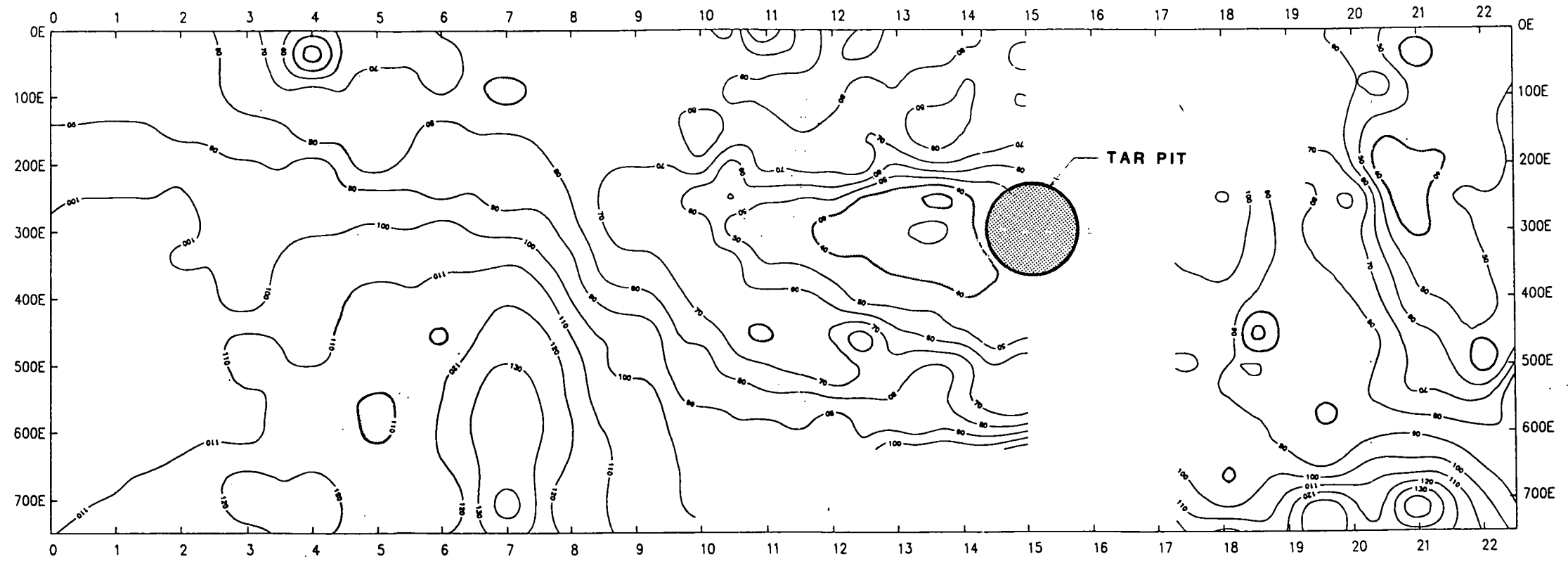
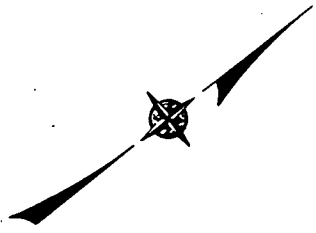
Resistivity surveying displayed a prominent low resistivity region south of the Tar Pit, indicating probable southward extension of the tar-like material found in the Tar Pit under the fill area (see Figure No. 3-5). The waste material was estimated to extend for at least 300 feet along the alignment of the former railroad spur. There was no indication of buried waste in the areas north of the Tar Pit. Apparent resistivities increase moving from the Tar Pit through the Southern Area toward Slate Bottom Creek. This trend in a generally level site may reflect changes in the local stratigraphy or bedrock rising closer to ground surface toward the creek or both. Resistivity traversing data was interpreted to indicate that tar-like waste was not disposed in the Southern Area.

Terrain conductivity profiling results correlated closely with the magnetic and resistivity data in the vicinity of the Tar Pit. The profiles of geophysical lines 1800E and 1950E north of the Tar Pit contain sharp positive and negative (inversion) spikes at about 690E and 760E, respectively (see Figure Nos. 3-6 and 3-7). These spikes generally occur in the vicinity of buried metal objects and correlate in this situation with magnetic anomalies noted in the magnetic survey. The water main running through the site was inferred to occur in areas of the spikes. Reconnaissance terrain conductivity profiles were obtained along lines 700 and 400 in the Southern Area (see Figure Nos. 3-8 and 3-9). The profiles correlate well with the results of the magnetic survey. Terrain conductivity values between the baseline (unpaved road) and about 225E and 250E, respectively, fluctuate and probably reflect scattered metal objects in the area west of the small berm marking the edge of the former railroad yard. To the east of the small berm, the values level off to background levels.

Geophysical surveys in the Roundhouse Area were deemed impractical due to the abundant metal rebar/reinforced concrete and old tracks in the roundhouse foundation as well as the overhead powerlines. Three reconnaissance terrain conductivity profiles were attempted in the Roundhouse Area. However, it was concluded that the data were too strongly influenced by the physical features mentioned above to be useful for determining if dumping of tar-like material or other contaminants had occurred in the area and the survey was discontinued.

On the basis of the geophysical surveys conducted at the Union Road Site, it was concluded that:

1. Buried metal objects, some of which could be drums, are broadly distributed in the fill on the south side of the Tar Pit;



Source: HAGER-RICHTER GEOSCIENCE, INC.

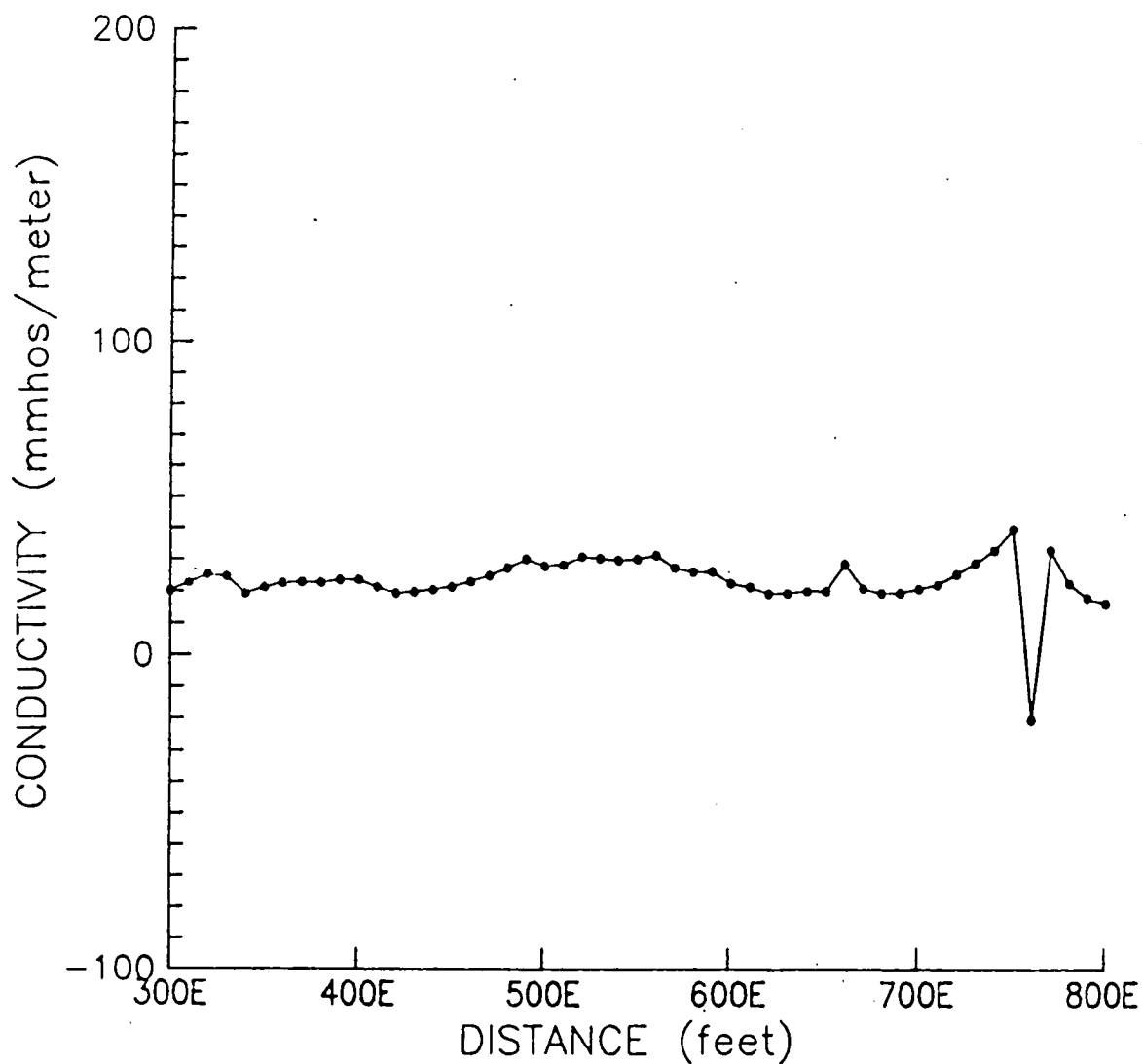
SCALE: 1" = 200'

UNION ROAD SITE

RESISTIVITY CONTOUR MAP



FIGURE NO. 3-5

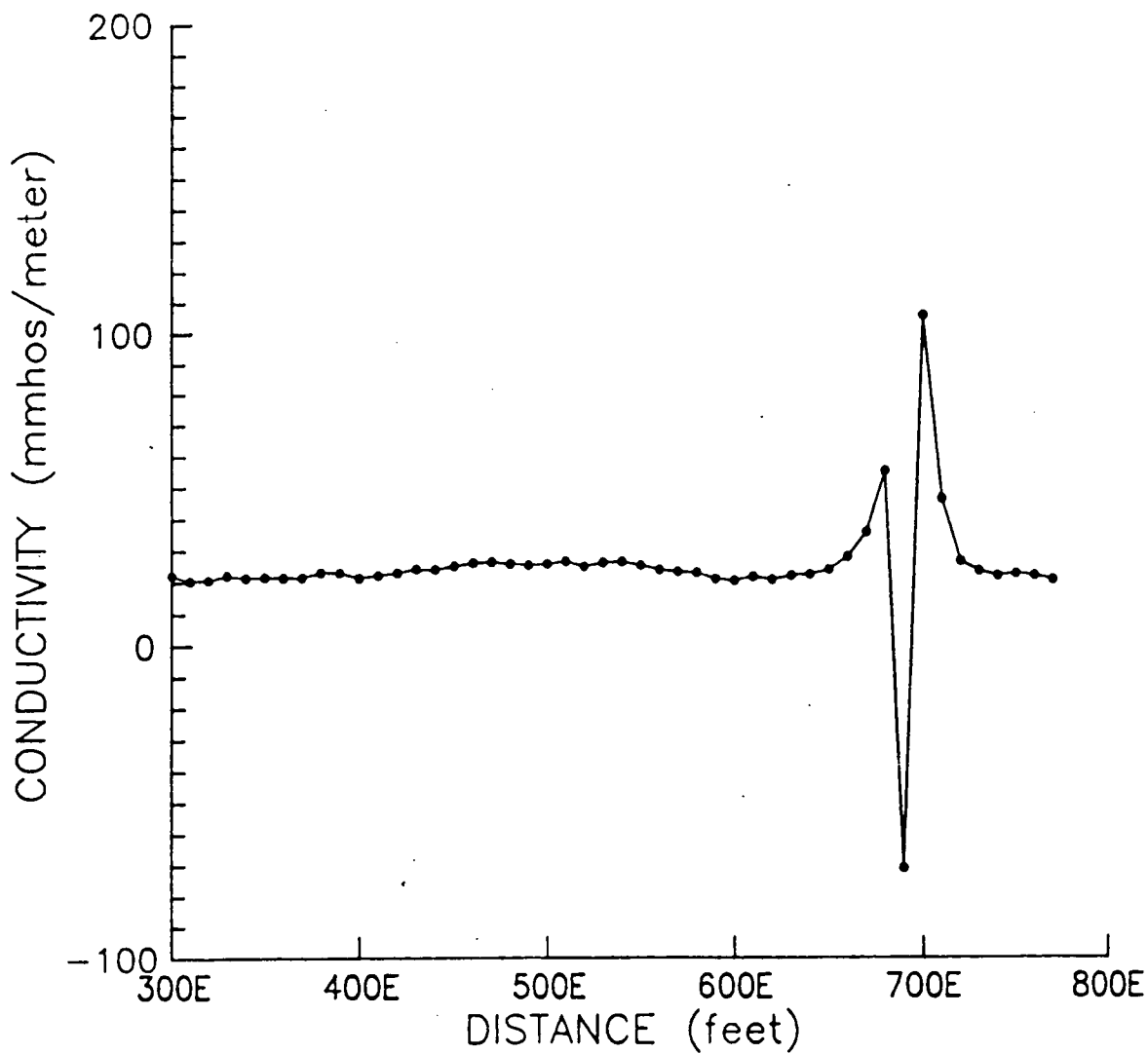


Source: HAGER-RICHTER GEOSCIENCE, INC.

**PROFILE OF TERRAIN CONDUCTIVITY ALONG LINE 1800E
(DISPOSAL AREA)**



FIGURE NO. 3-6

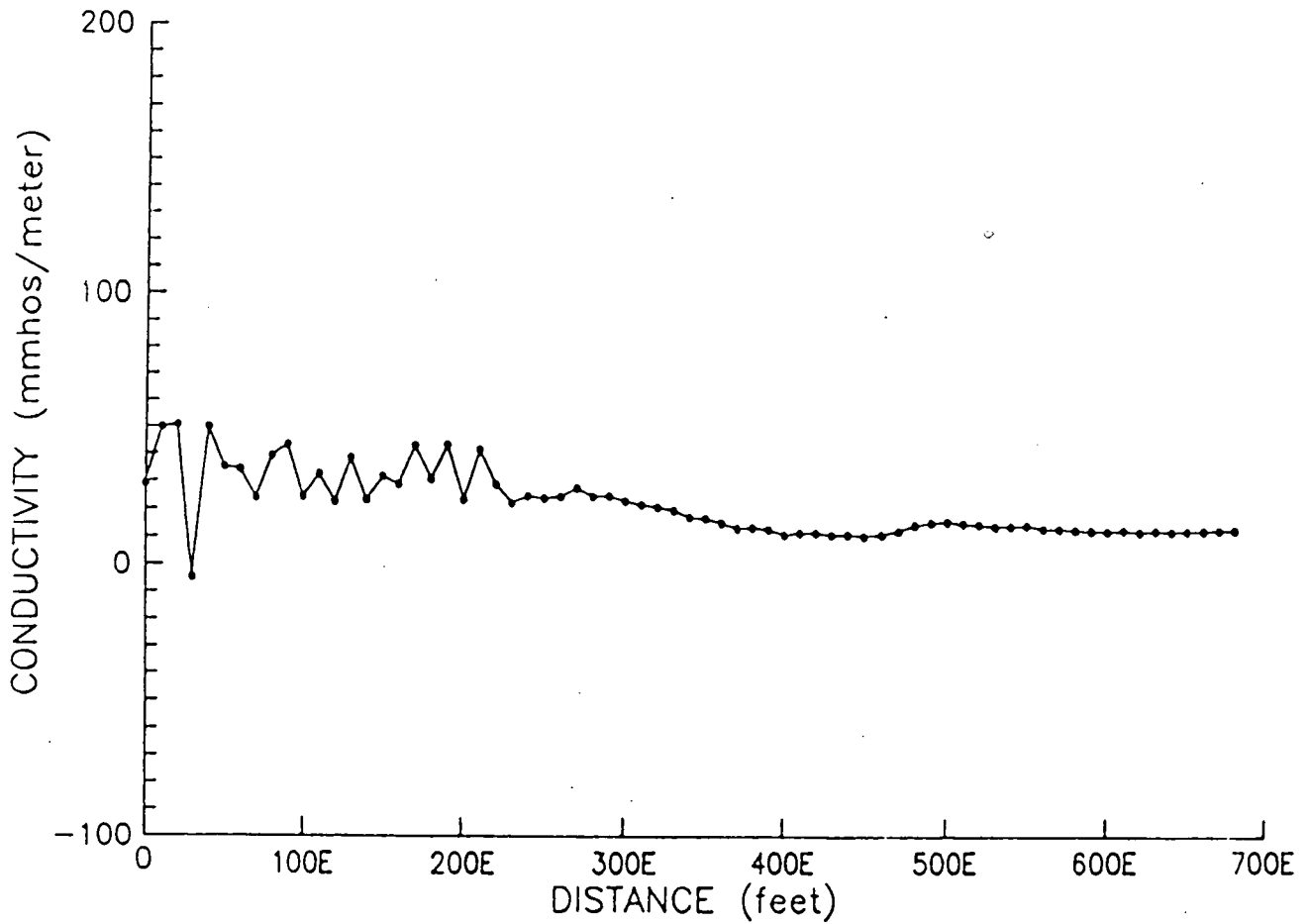


Source: HAGER-RICHTER GEOSCIENCE, INC.

**PROFILE OF TERRAIN CONDUCTIVITY ALONG LINE 1950E
(DISPOSAL AREA)**



FIGURE NO. 3-7

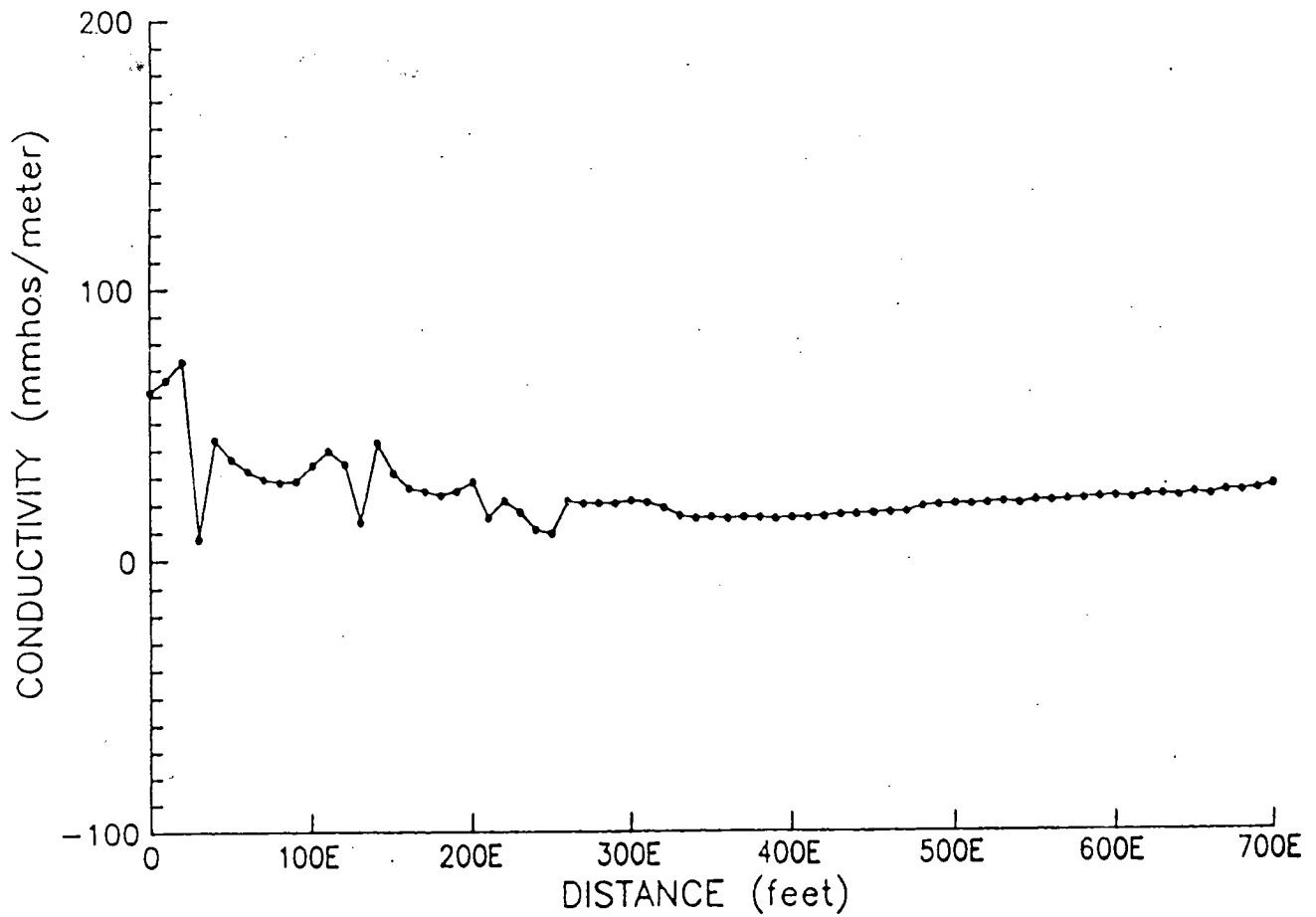


Source: HAGER-RICHTER GEOSCIENCE, INC.

PROFILE OF TERRAIN CONDUCTIVITY ALONG LINE 700E (SOUTHERN AREA)



FIGURE NO. 3-8



Source: HAGER-RICHTER GEOSCIENCE, INC.

PROFILE OF TERRAIN CONDUCTIVITY ALONG LINE 400E

(SOUTHERN AREA)



FIGURE NO. 3-9

2. Material inferred to be tar-like because of its electrical properties (low resistivity) extends for about 300 feet to the southwest of the present open Tar Pit, approximately along the alignment of the former railroad spur at the site;
3. There is no evidence of the presence of tar-like material buried in the areas north of the Tar Pit;
4. There is no evidence of tar-like waste or caches of drums in the Southern Area; and
5. The geophysical methods were not useful for investigation of the Roundhouse Area due to interference from the structures present and the overhead power lines.

3.1.3 Geology

3.1.3.1 Bedrock

The bedrock of western New York is composed chiefly of carbonate rock formed during the Silurian and Devonian Periods. Bedrock encountered at the Union Road Site consists of the Onondaga Limestone, a unit which was deposited under marine conditions in an epeiric sea during Lower to Middle Devonian time. Bedrock throughout the site was uniformly grey in color, fine grained and very hard. Brachiopod and bryozoan fossils, as well as some isolated chert zones were observed in cores obtained from the limestone. Cores obtained during the Phase I investigation at each bedrock well reached maximum depths of 30 feet below the bedrock surface. Bedrock data from cores taken during the Phase II investigation was limited to the upper 12.5 feet of bedrock as further coring would have resulted in the increased risk of encountering natural gas.

Throughout the site, the upper 5 to 10 feet of bedrock was found to be both significantly weathered and fractured with the exception of locations MW-7D and MW-9D. Analysis of cores found the limestone to be extremely competent from approximately 10 to 25 feet below the bedrock surface at each of the well cluster locations (MW-1, MW-2, MW-3 and MW-4) where this depth was attained. At depths ranging from 25-29 feet below the bedrock surface, natural gas was encountered during bedrock coring operations at each Phase I investigation well cluster with the exception of MW-2. The exact composition of this gas was not determined although a strong hydrogen

sulfide odor was observed at each location and confirmed as containing hydrogen sulfide through the use of gas detection (Draeger) tubes. The hydrogen sulfide odor was also observed, but to a lesser extent, at all bedrock wells where the gas was not encountered.

A descriptive term referred to as the Rock Quality Designation or RQD (which is the total length of rock core greater than twice the rock core diameter, divided by the run length) calculates a relative value of rock competency (fracturing). The greater the RQD value, the greater the relative competency of the rock unit (decreased fracturing). A review of the RQD values calculated for the individual rock core runs obtained from the Union Road Site reveals RQD values generally increasing with depth. Lowest RQD values typically are found in the upper 5 to 10 feet of bedrock with values increasing to 85-100% at depths of greater than 10 feet into bedrock. The majority of fracture orientations were in the 0 to 20 degree angle range although several fractures approaching 90 degrees (vertical) were observed.

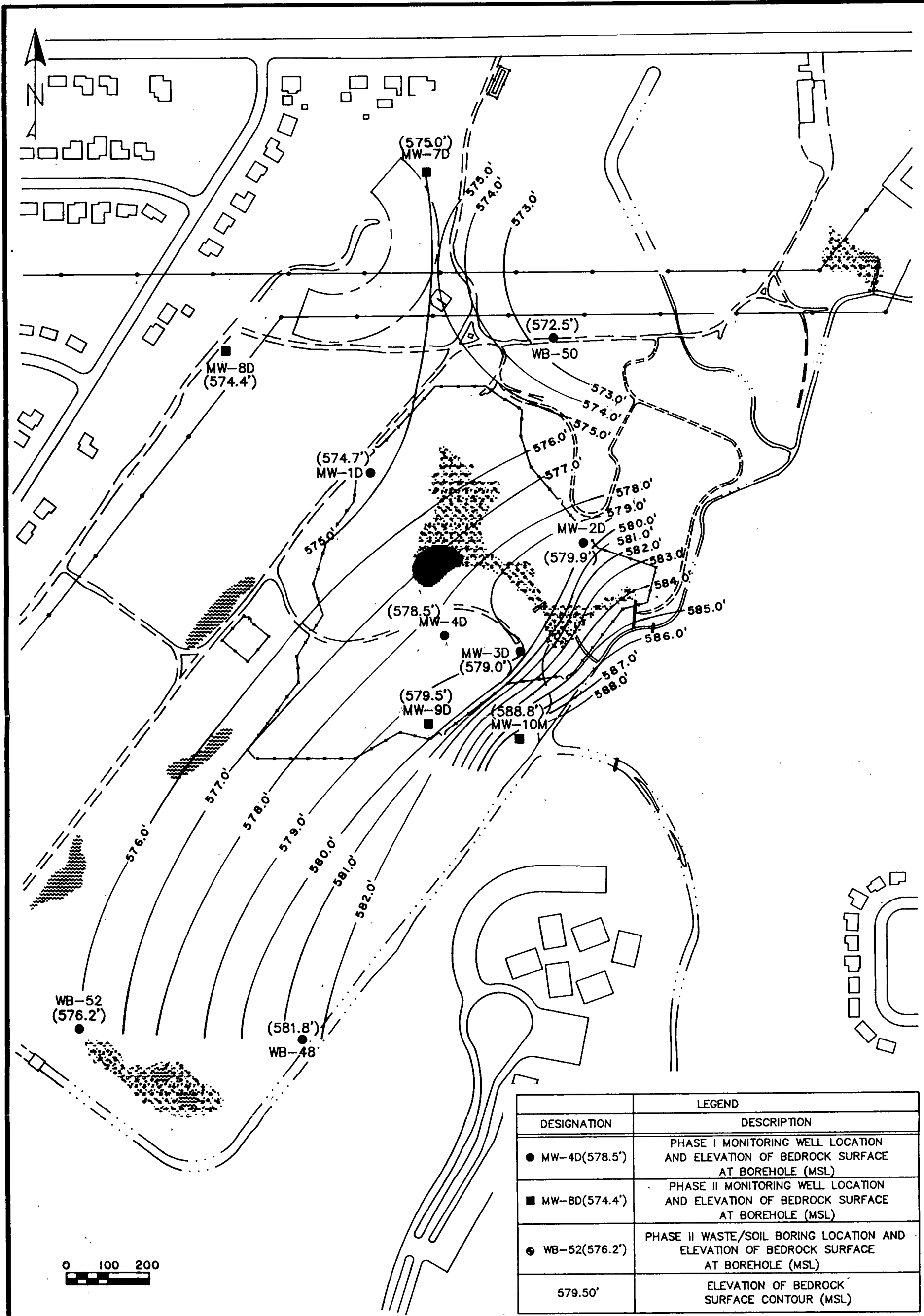
Bedrock surface elevations range from a high of 588.8 feet (MSL) at MW-10M to a low of 572.5 feet (MSL) at WB-50. Contouring of the bedrock elevation data at the site shows bedrock to slope downward from the vicinity of Slate Bottom Creek in both northerly and westerly directions (see Figure No. 3-10).

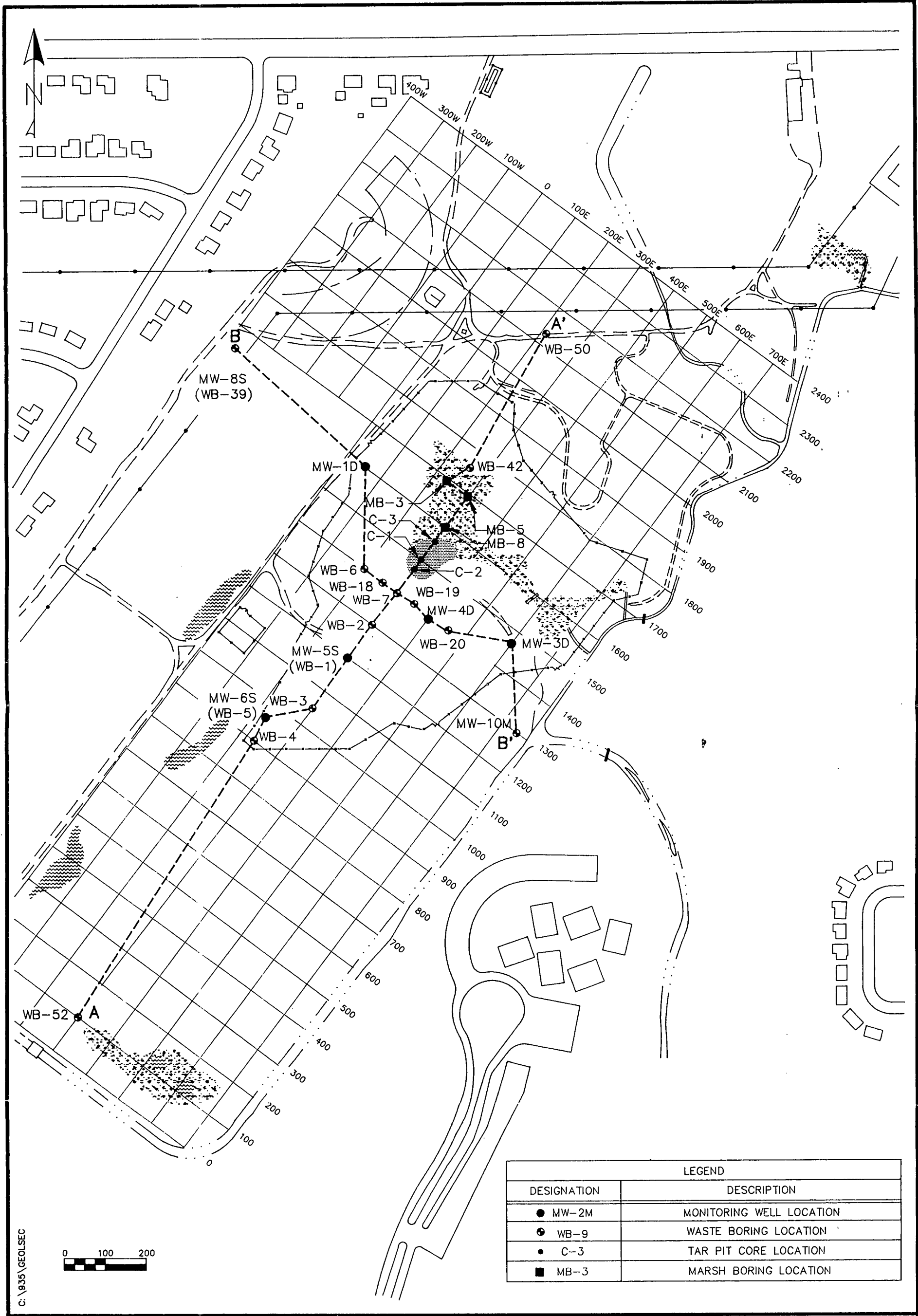
3.1.3.2 Unconsolidated

Native soils (predominantly silt and clay) found in the area of the Union Road Site are largely lake bottom deposits formed during the early stages of deposition in the Lake Erie Basin.

A total of eight cross sections were prepared for the Union Road Site based on stratigraphic data gathered from both monitoring well and waste borings. Two of the cross sections show geologic units solely and the remaining six illustrate the extent of buried waste material/contaminated soil in addition to the geology. The location of the geologic cross sections are illustrated in Figure No. 3-11 and the location of the buried waste cross sections are shown in Figure No. 3-12. The following discussion on site stratigraphy was derived from these cross sections (Figure Nos. 3-13, 3-14, 3-15, 3-16, 3-17, 3-18, 3-19, and 3-20).

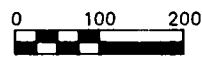
Throughout the site, bedrock was found to be generally overlain by a layer of till ranging in content from fine to medium gravel with a clayey silt matrix at some locations to a fine to medium gravel with a trace of clay at others. The deposits are commonly



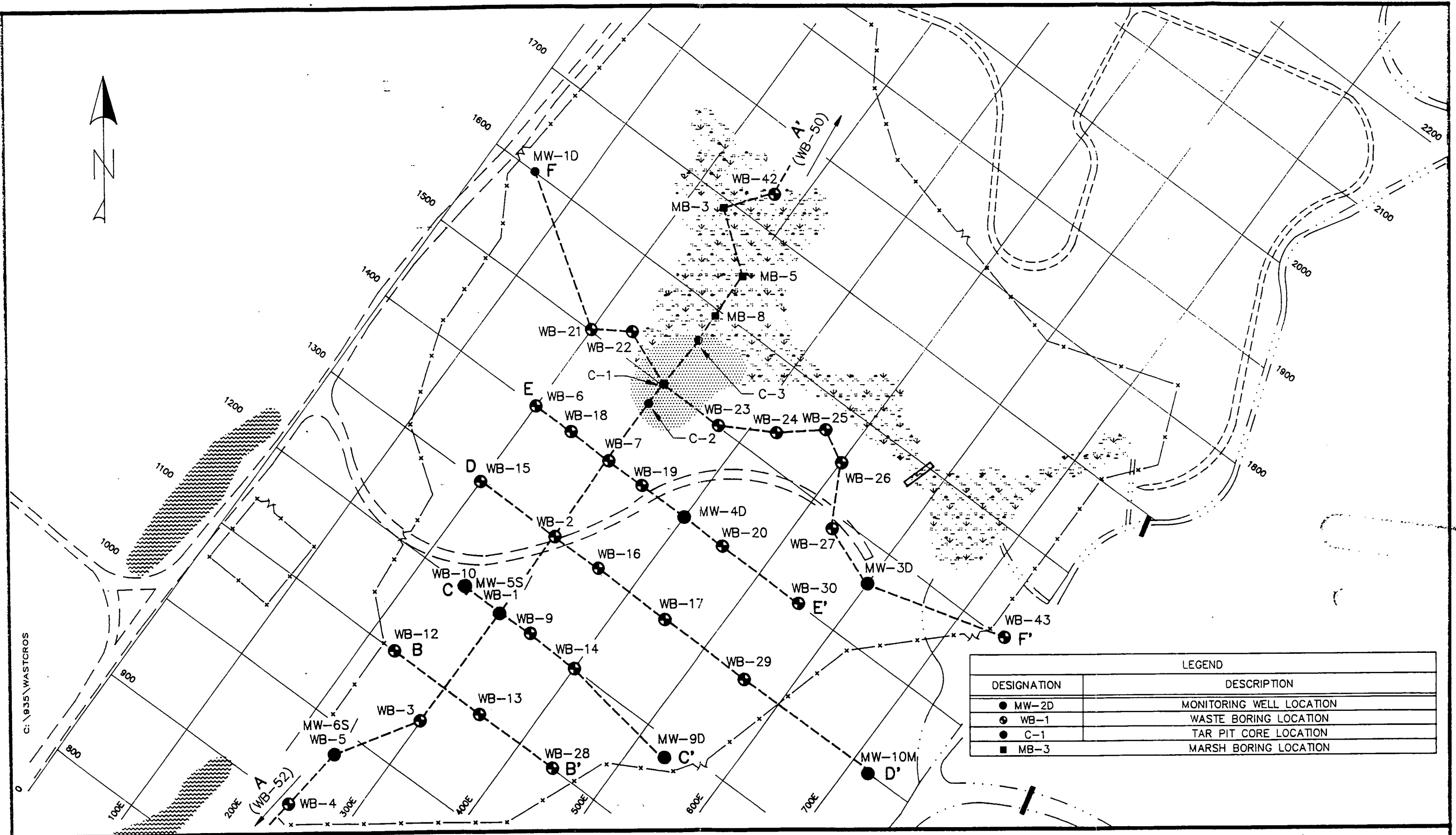


LEGEND	
DESIGNATION	DESCRIPTION
● MW-2M	MONITORING WELL LOCATION
⊙ WB-9	WASTE BORING LOCATION
• C-3	TAR PIT CORE LOCATION
■ MB-3	MARSH BORING LOCATION

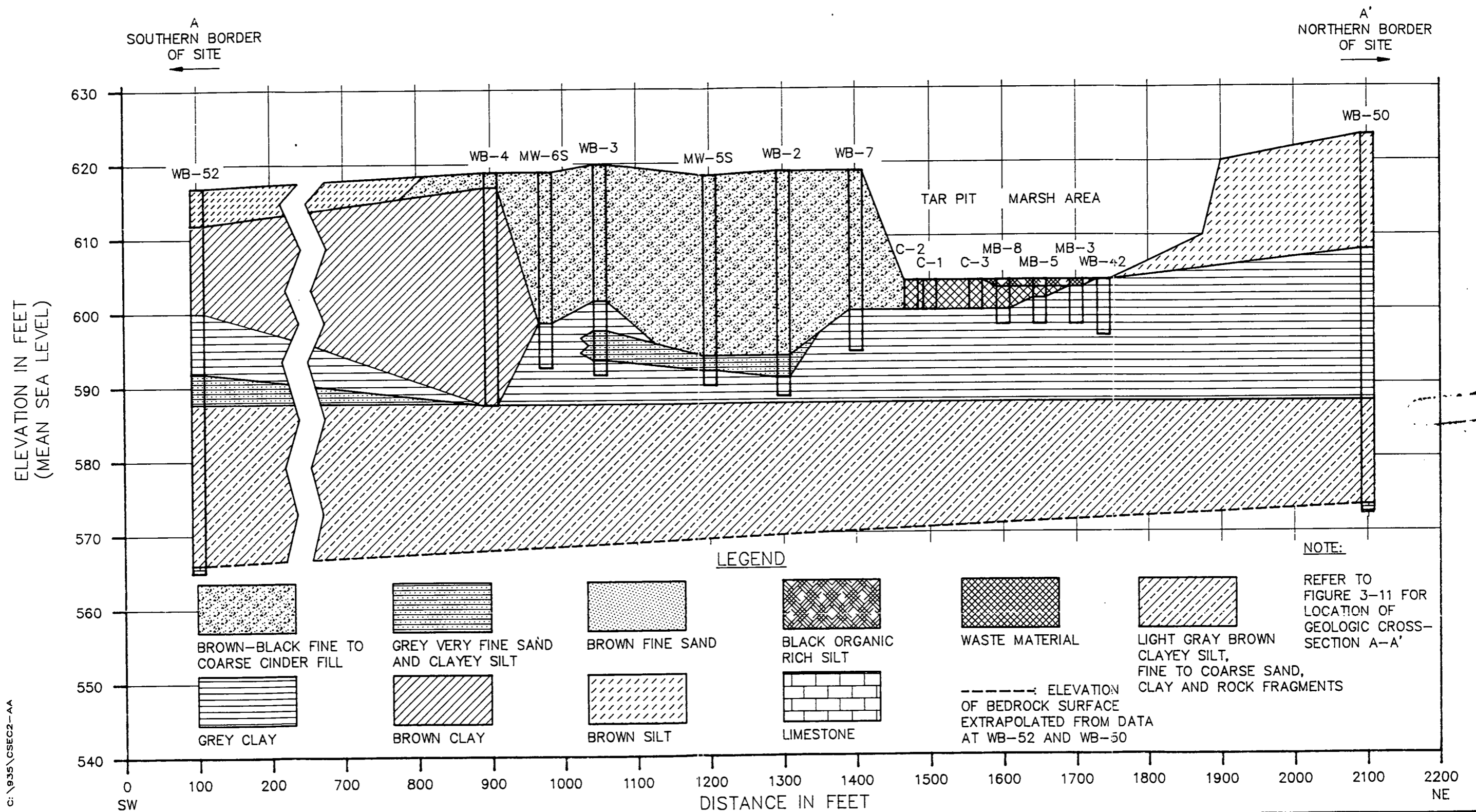
C:\935\GEOLSEC



UNION ROAD SITE
**LOCATIONS OF GEOLOGIC
 CROSS SECTIONS**



UNION ROAD SITE
 LOCATIONS OF BURIED
 WASTE CROSS SECTIONS



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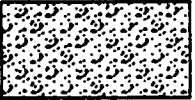
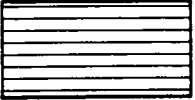

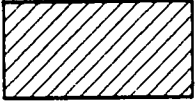
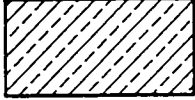
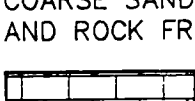
UNION ROAD SITE

GEOLOGIC CROSS-SECTION A-A'



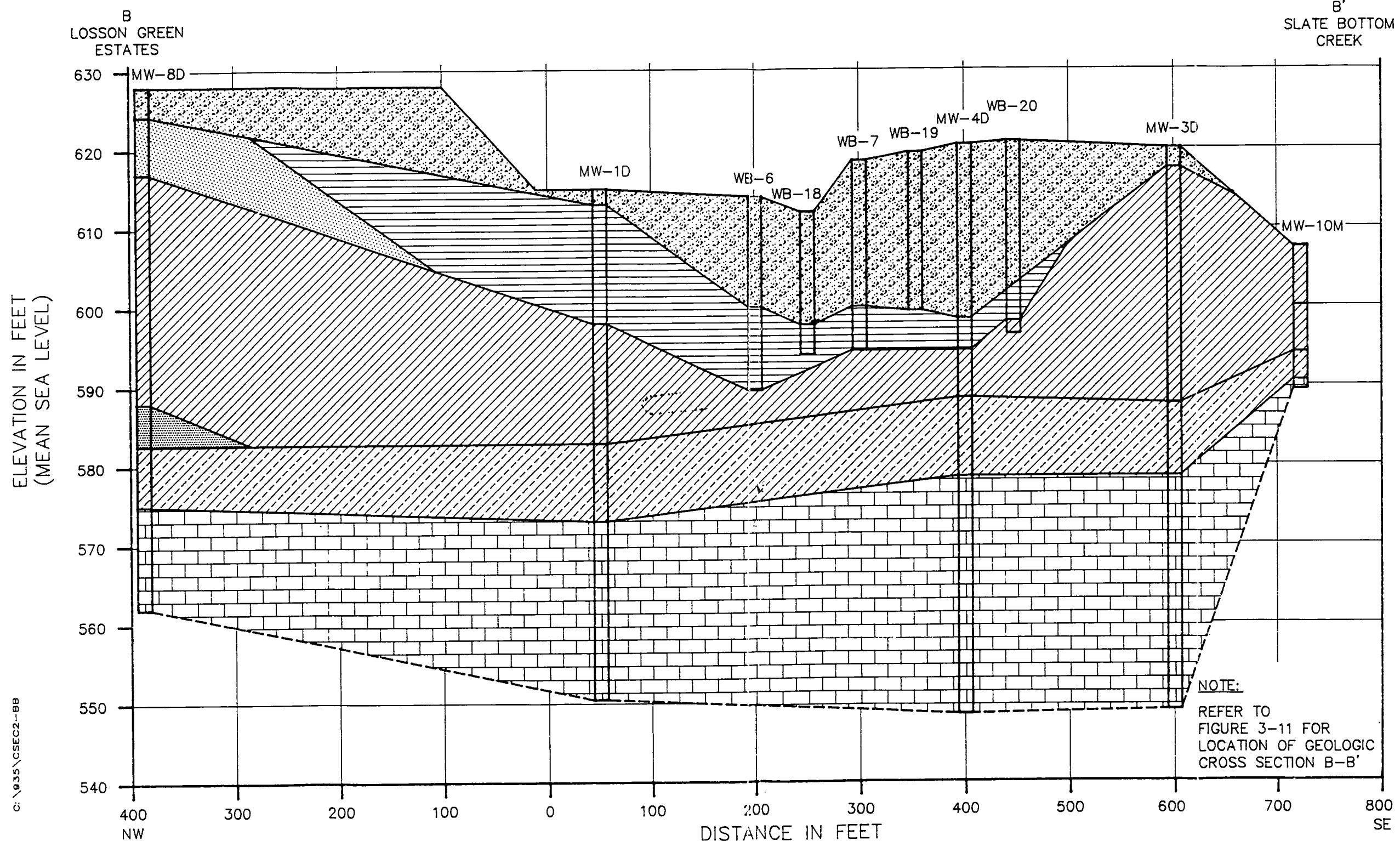
FIGURE NO. 3-13

LEGEND

-  BROWN-BLACK FINE TO COARSE CINDER FILL
-  GREY CLAY
-  GREY VERY FINE SAND AND CLAYEY SILT
-  BROWN CLAY
-  BROWN FINE SAND
-  LIGHT GREY TO BROWN CLAYEY SILT, FINE TO COARSE SAND, CLAY AND ROCK FRAGMENTS
-  LIMESTONE

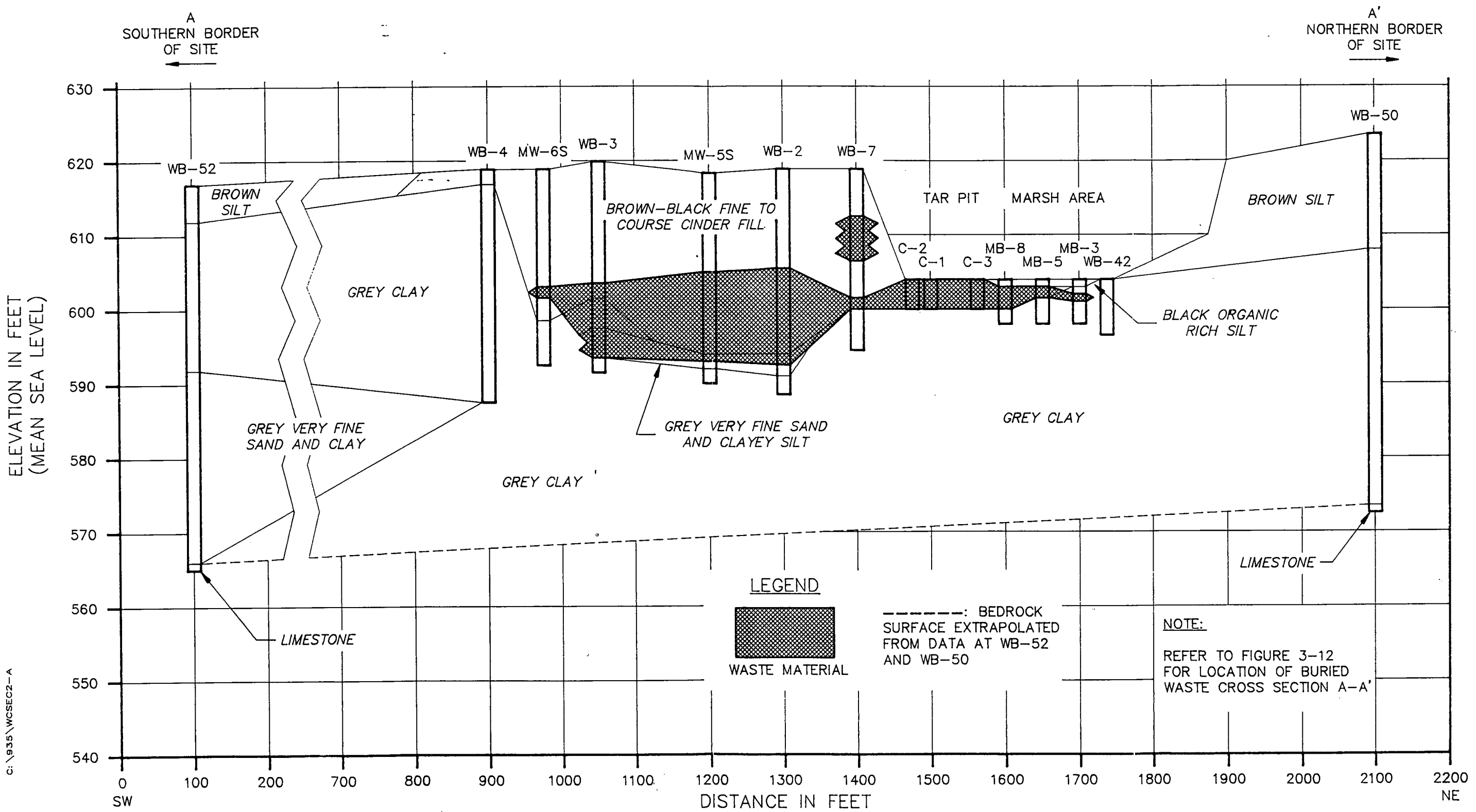
-----: LOWER EXTENT OF BEDROCK INTERSECTED AT MW-8D, MW-1D, MW-4D, MW-3D AND MW-10M

NOTE:
REFER TO
FIGURE 3-11 FOR
LOCATION OF GEOLOGIC
CROSS SECTION B-B'



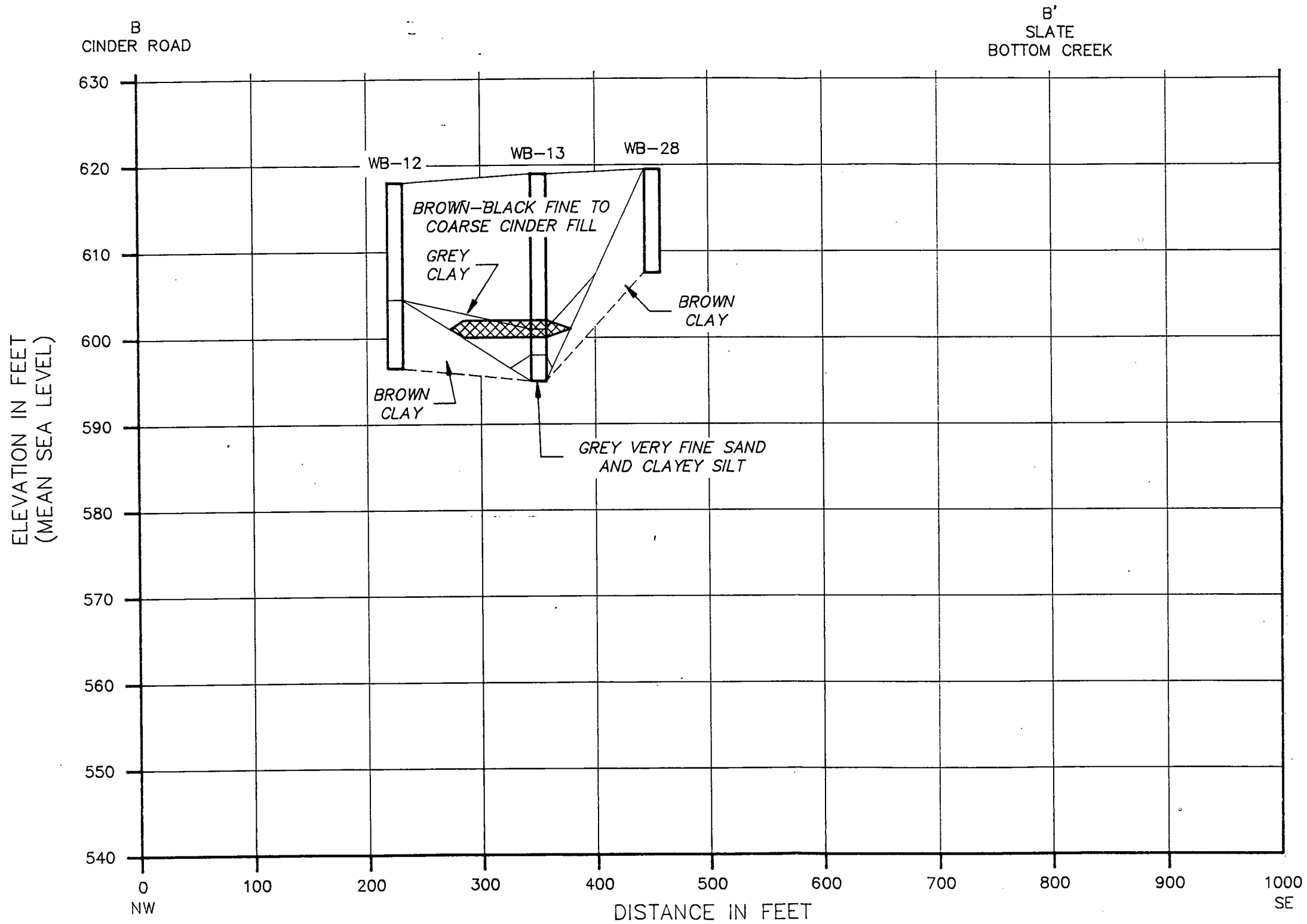
C:\935\CSEC2-BB

UNION ROAD SITE
GEOLOGIC CROSS-SECTION B-B'

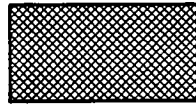


UNION ROAD SITE
BURIED WASTE CROSS SECTION A-A'

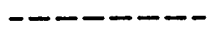
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LEGEND



WASTE MATERIAL



: LOWER EXTENT OF AVAILABLE DATA EXTRAPOLATED BETWEEN WB-12, WB-13 AND WB-28

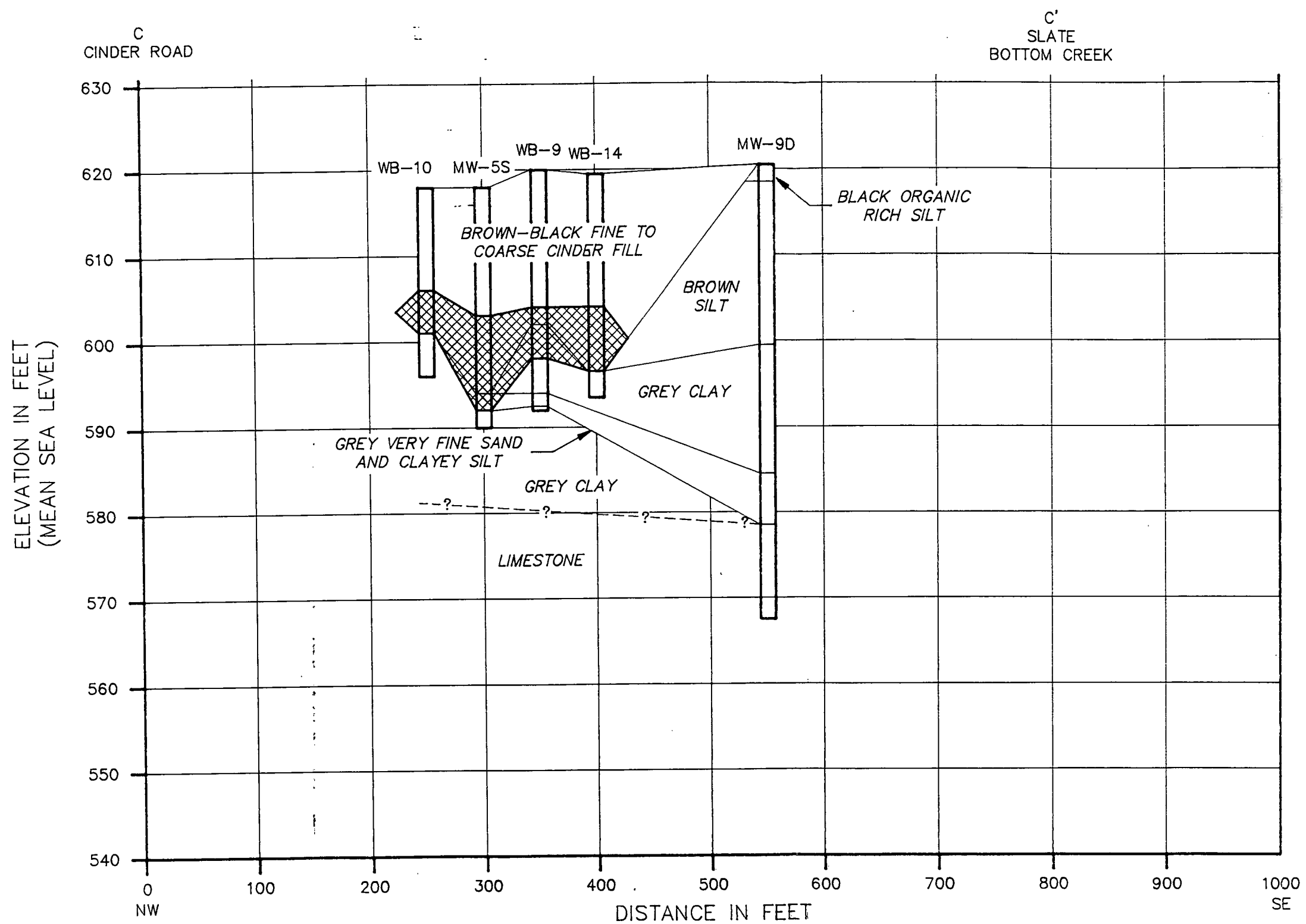
NOTE:

REFER TO FIGURE 3-12 FOR LOCATION OF BURIED WASTE CROSS SECTION B-B'



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CONSULTING ENGINEERS

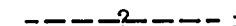
**UNION ROAD SITE
BURIED WASTE CROSS SECTION B-B'**



LEGEND



WASTE MATERIAL



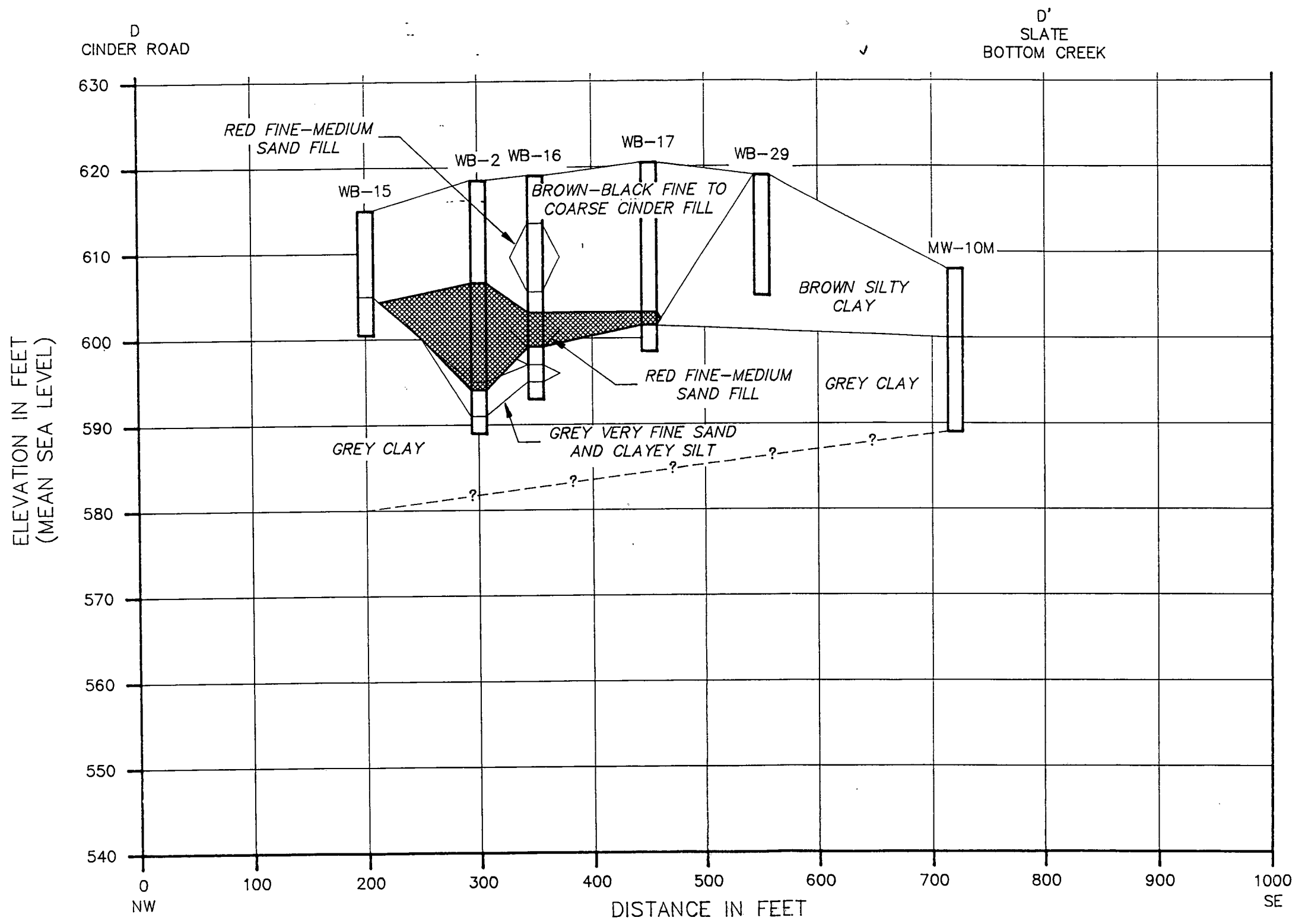
POSSIBLE BEDROCK SURFACE DEVELOPED FROM BEDROCK SURFACE STRUCTURE CONTOUR MAP (FIGURE 3-10)

NOTE:

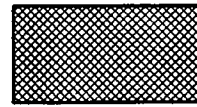
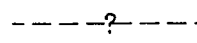
SEE FIGURE 3-12 FOR LOCATION OF BURIED WASTE CROSS SECTION C-C'

C:\935\WCSEC2-C

C:\935\WCSEC2-D



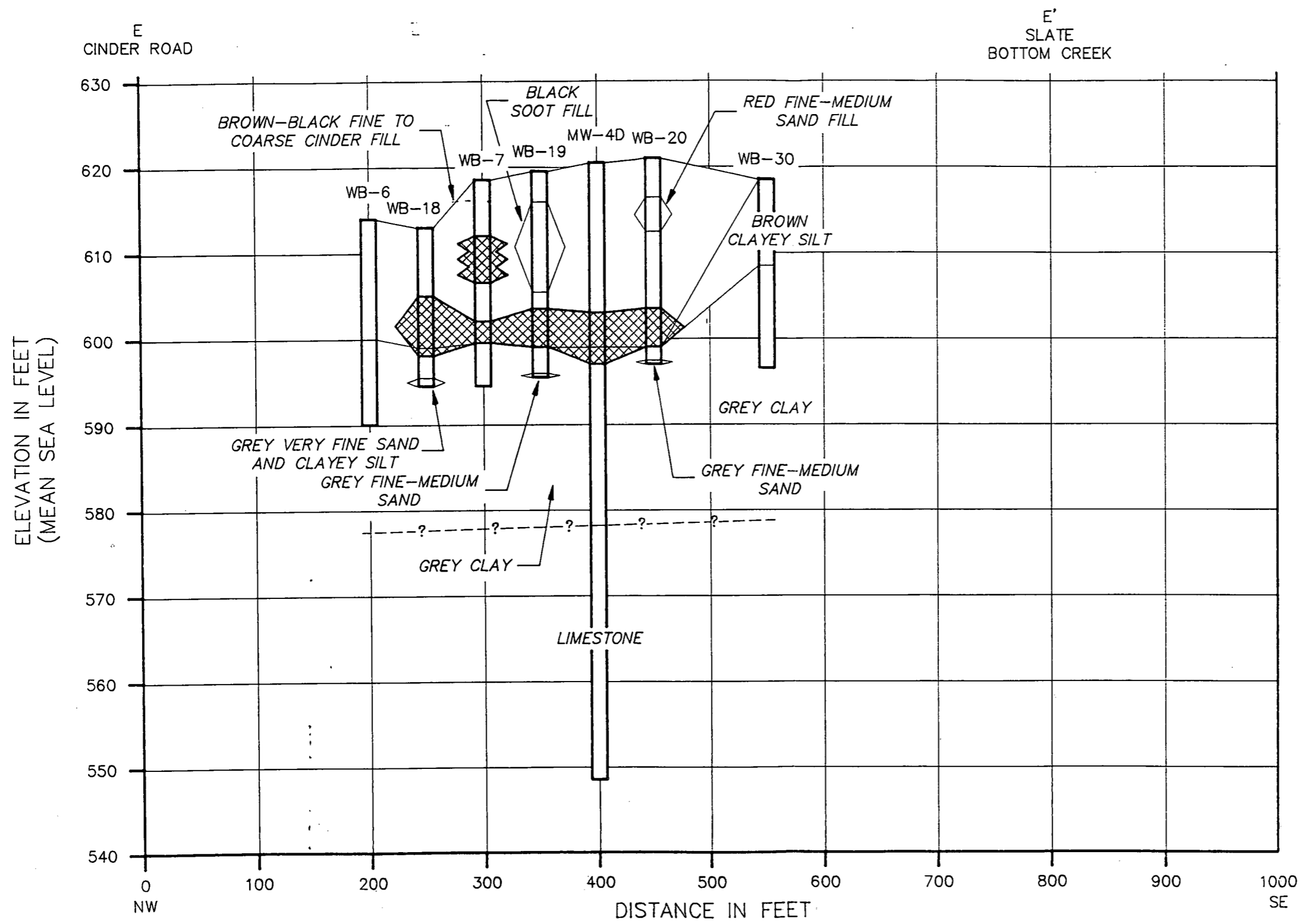
LEGEND

-  WASTE MATERIAL
-  : POSSIBLE BEDROCK SURFACE DEVELOPED FROM BEDROCK SURFACE STRUCTURE CONTOUR MAP (FIGURE 3-10)

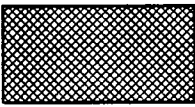
NOTE:
 SEE FIGURE 3-12 FOR LOCATION OF BURIED WASTE CROSS-SECTION D-D'

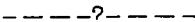
UNION ROAD SITE
BURIED WASTE CROSS SECTION D-D'





LEGEND

 WASTE MATERIAL

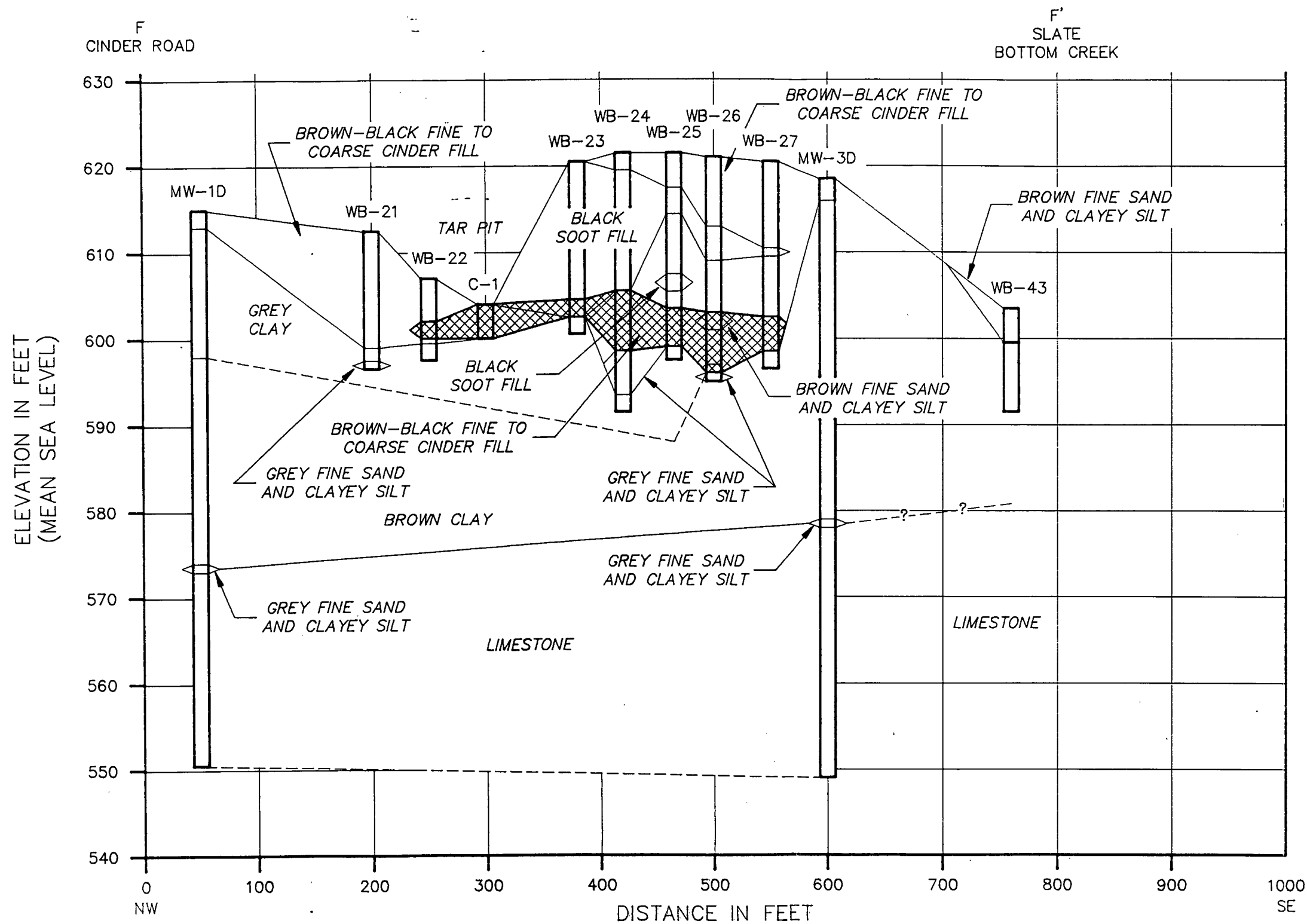
 : POSSIBLE BEDROCK SURFACE DEVELOPED FROM BEDROCK SURFACE STRUCTURE CONTOUR MAP (FIGURE 3-10)

NOTE:
SEE FIGURE 3-12 FOR LOCATION OF BURIED WASTE CROSS SECTION E-E'

C:\935\WCSEC2-E



UNION ROAD SITE
BURIED WASTE CROSS SECTION E-E'



UNION ROAD SITE
BURIED WASTE CROSS SECTION F-F'

poorly sorted. The thickness of the till unit ranges from a minimum of approximately 5 feet at the MW-10M location to a maximum of approximately 23 feet at the MW-7D location. In general, the thicker sections appear to be associated with coarser deposits.

Overlying the bedrock and/or till layers is a unit of predominantly cohesive sediments which, for mapping purposes, as well as discussion, is referred to as a clay unit ranging from brown to reddish grey in color. Within this clay unit, the silt content is found to increase in isolated lenticular zones to the point where classification changes to a clayey silt. Within the Disposal Area, the contact of the upper portion of this clay unit with the overlying fill material is characterized in some locations by coarser lenses containing sands and ranging up to at least 2 feet in thickness. The extent of these coarse lenses with depth is difficult to determine because the borings at which they were encountered were terminated in order to prevent the creation of a pathway where overlying contamination could migrate downward into "clean" material.

Based on the boring log from MW-4D, however, the coarser lenses appear to be confined to the upper portion of the clay unit. The clay unit ranges in thickness from approximately 12 feet at the MW-4D location to approximately 30 feet at the MW-1D location. It appears that the upper portion of the clay unit in the Disposal Area may have been partially excavated at some point in time and replaced with fill material. With the exception of the Disposal Area and portions of the Roundhouse Area, the clay unit is the uppermost section on the site, commonly grades into slightly coarser silts and sands in the uppermost 10 feet, and is capped in some locations by an organic rich soil zone ranging from several inches to approximately 4 feet in thickness.

The uppermost unit encountered in portions of the Roundhouse Area and in the Disposal Area is one of fill material. The area occupied by the fill in the Disposal Area appears to be a trough when viewed in cross section whose axis trends northeast-southwest. The boundaries of the trough are very steep-sided, both to the north, south and east where there appears to be sharp contact with the clay. The fill material thins more gradually to the west. Based on early historical photographs, it is possible that this "trough" was the former creek bed and banks of Slate Bottom Creek before it was rerouted south of the site and under the railroad yard.

The most prevalent component of the fill material throughout the Disposal Area is a fine to course grained cinder-like material which contains an appreciable amount of fines in places. As a result of the extensive soil/waste boring programs undertaken as part of

the Phase I and II investigations, some local variations in the fill composition have been discerned.

Drilling into the bluff located immediately to the east of the Tar Pit revealed a relatively continuous zone containing a black soot-like material which was approximately 15 feet in thickness at the WB-23 location and thinned to the east where it was also observed at locations WB-24, 25, 26 and 27. A narrow strand-like deposit of fine to medium red sands was found at locations WB-16 and 20, as well as in test pit Nos. TP-7 and 13. Similar to the black soot-like deposits, the fine to medium red sands were not observed other than at the above mentioned locations.

Other prominent components of the fill material found scattered throughout the Disposal Area include a reddish slag, fragmented clay tiles/pipe, railroad ties and spikes, glass and other assorted debris. At several locations, a white, chalky, salt-like substance was incorporated within zones of the reddish-slag material.

Fill material found in the Roundhouse Area is confined to areas immediately surrounding the pre-existing roundhouse structures. Laterally, the fill is extremely discontinuous in nature reaching a maximum thickness of approximately 16 feet at the WB-40 location. The characteristics of the fill material in the Roundhouse Area differ from that of the fill found in the Disposal Area. The cinder fill is composed of a coarser gravel than that in the Disposal Area with less appreciable fines. Other major components of fill in the Roundhouse Area include slag, coal and some brown fine to medium sands. In addition, it appears that some of the silt and clayey silt found from ground surface to a depth of approximately 10 feet in several locations is the result of fill. This is assumed from several observations of debris (i.e., glass, metal, etc.) found intermingled with the silt and/or clayey silt. A detailed description of soil/fill material encountered during test pit excavation is provided in Table No. 3-1.

3.1.4 Hydrogeology

The Union Road Site can be divided hydrogeologically into three aquifer systems:

1. Bedrock;
2. Overburden/Bedrock Interface (Till Zone); and
3. Shallow/Perched Fill

Table No. 3-1

**TEST PIT/TRENCH DESCRIPTION
SUMMARY**

<u>Test Pit/ Trench No.</u>	<u>Location (Grid System Coordinates)</u>	<u>Total Depth (Ft.)</u>	<u>Soil/Fill/Waste Material Encountered</u>
1	1025/300E	8.0	Black Fine-Coarse Fill (ceramic, glass and iron fragments) (0-8.0')
2	1125/200E	8.0	Black Fine-Coarse Fill (0-8.0') [6" vein of white, chalky material (1-1.5')]
3	1125/275E	8.0	Black Fine-Coarse Fill and Reddish Slag (0-8.0')
4	1325/275E	8.0	Black Fine-Coarse Fill with numerous ceramic tile/pipe fragments (0-5.0') Black Fine Fill containing oil and grease (5.0-8.0')
5	1300/325E	8.0	Black Fine-Coarse Fill and Reddish Brown Slag (0-8.0')
6	1350/475E	8.0	Black Fine-Coarse Fill (0-8.0')
7	1375/375E	8.0	Black Fine-Coarse Fill (0-1.0') Red Fine Sand, trace silt (1.0-5.0') Black Fine-Coarse Fill (5.0-8.0')
8	1400/300E	8.0	Black Fine-Coarse Fill containing numerous ceramic tile/pipe fragments (0-8.0')
9	1450/050E	3.5*	Black Humus (0-0.5') Coarse Fill (0.5-1.5') Grey-Brown Mottled Clay (1.5-3.5')
10	1450/250E	2.5*	Assorted Debris (wood, metal etc.) (0-1.0') Black Fine-Coarse Fill (1.0-2.5')
11	1500/350E	8.0	Black Fine-Coarse Fill containing grease/oil and fabric (0-8.0')
12	1500/425E	8.0	Black Fine Fill and Reddish Brown Slag (0-8.0')

*Test pit construction was halted when ground water was encountered.

Table No. 3-1 (continued)

**TEST PIT/TRENCH DESCRIPTION
SUMMARY**

<u>Test Pit/ Trench No.</u>	<u>Location (Grid System Coordinates)</u>	<u>Total Depth (Ft.)</u>	<u>Soil/Fill/Waste Material Encountered</u>
13	1500/500E	8.0	Black Fine Fill (0-1.0') Black Fine-Coarse Gravel Fill (1.0-3.0') Red Fine-Coarse Sand, trace silt (3.0-8.0')
14	1525/075E	8.0	Ceramic Fragments (0-0.5') Assorted Debris and Course Gravel Fill (0.5-1.5') Grey-Brown Mottled Clay (1.5-8.0')
15	1525/175E	8.0	Debris (0-1.0') Black Fine-Coarse Fill (1.0-8.0')
16	1550/225E	5.5	Wood Fragments (0-2.0') Black Coarse Fill (2.0-4.0') Reddish-Brown Slag (4.0-5.5')
17	1525/375E	8.0	Black Fine Fill containing white, chalky material, ceramic fragments and small lenses of coarse gravel Fill (0-8.0')
18	1575/475E	8.0	Black Fine Fill (0-1.0') Brown Fine-Coarse Gravel Fill (1.0-2.0') Black Fine Fill with crushed brick, ceramic fragments (2.0-8.0')
21	1700/400E	4.5	Black Fine - Medium Fill (0-1.0') Black Coarse Gravel containing oil/grease (1.0-2.5') Brown Silty Clay (2.5-4.5')
22	1800/400W	8.0	Black Fine - Coarse Fill with orange staining (0-2.0') Brown Silty Clay (Mottled) (2.0-8.0')
23	1800/0	8.0	Coarse Fill (0-2.0') Grey-Brown Clay (2.0-8.0')
25	300/250E	8.0	Brown Clayey Silt (Mottled) (0-5.0') Grey Clay, little silt (5.0-8.0')
26	500/700E	8.0	Brown Clayey Silt (Mottled) (0.5-0') Grey Clay, little silt (5.0-8.0')

Note: No Test Pit/Trench Nos. 19 and 20.

During the Phase I investigation drilling program, natural gas under pressure was encountered in the lowermost portion of the bedrock wells (approximately 30 feet below bedrock surface). When encountered, this event produced large quantities of water and gas. In order to prevent possible hazardous drilling conditions due to the presence of high gas concentrations (hydrogen sulfide) in the breathing zone, it was decided (with approval of NYSDEC) to modify the bedrock drilling procedures outlined in the Work Plan for the Phase II investigation and terminate the coring operation at the first sign of significant ground water recharge rather than core the full 30 feet of bedrock as initially proposed. Significant quantities of ground water were obtained in the initial 12 feet of coring at each of the three Phase II bedrock well locations. Specifically, ground water was encountered in a moderately fractured zone from 7 to 10 feet below the bedrock surface. Due to the fact that Phase II bedrock wells (MW-7D, 8D and 9D) were drilled using the air rotary method, as opposed to introducing water into the borehole as undertaken during coring in Phase I, it was possible to more precisely define the depth in bedrock at which ground water was entering the borehole in significant quantities.

Although significant releases of gases were not observed during bedrock drilling during the Phase II field program, a noticeable hydrogen sulfide odor was noted at the point where ground water was encountered at each Phase II bedrock well location, as well as during well development. The fact that the natural gas is under pressure suggests that the bedrock ground water at depths where the gas was encountered has no connection with the overburden, at least in the immediate vicinity of the Union Road Site.

Overlying bedrock is the semiconfined till aquifer which ranges from 5 to 23 feet in thickness. The aquifer is comprised of fine to medium gravel which is poorly sorted along with varying amounts of silt and clay. The upper boundary of this aquifer is a clay unit which contains some siltier zones, as well as some lenses of fine sand. The clay appears to act as a semi-confining unit permitting very slow and limited ground water migration downward into the till aquifer.

A shallow/perched aquifer exists above the clay unit in fill material located in the Roundhouse and Disposal Areas. This unit consists of predominantly coarse grained cinder fill but varies in composition locally as discussed in Section 3.1.3.2.

3.1.4.1 Hydraulic Conductivity Testing

As a part of the Phase I investigation, slug tests were performed on each of the three overburden/bedrock interface wells screened in the till zone aquifer in order to

calculate hydraulic conductivities within this aquifer. In addition, soil samples obtained during monitoring well borehole construction were analyzed for either Atterberg limits (ASTM D-4318) and natural water content (ASTM D-2216) or mechanical analysis (ASTM D-422) depending on the cohesive nature of the soil (i.e., for a noncohesive soil, a mechanical analysis was performed). The results of these analyses can be found in Appendix J. The following is a list of soil sample locations, depths and screen depths for monitoring wells constructed at these locations:

<u>Sample Location</u>	<u>Depth of Sample (Feet)*</u>	<u>Depth of Screen (Feet)*</u>
MW-2M	30.0-32.0	29.0-39.0
MW-3D	28.0-38.0	23.0-38.0 (MW-3M)
MW-4D	34.0-36.0	31.0-41.0 (MW-4M)
MW-5S	14.0-16.0/22.0-24.0	14.0-24.0
MW-6S	14.0-22.0	17.0-22.0

*Below ground surface.

As a part of the Phase II investigation, slug tests were performed on three of the four overburden/bedrock interface wells screened in the till zone aquifer and one shallow/water table well screened in the shallow/perched aquifer in order to calculate hydraulic conductivities within these aquifers. Four soil samples taken from borings in the "clean" clay were analyzed for flexible wall permeability. In addition, soil samples obtained during both monitoring well borehole construction and soil borings were analyzed for natural water content (ASTM D-2216) and either Atterberg limits (ASTMD-4318) or mechanical analysis (ASTMD-422) depending on the cohesive nature of the soil (i.e., for a cohesive soil, an Atterberg limits analysis was performed). The results of this testing can be found on Appendix K. The following is a list of soil sample locations, depths and screen depths (if applicable) for monitoring wells and soil borings constructed at these locations:

<u>Sample Location</u>	<u>Depth of Sample (Feet)*</u>	<u>Depth of Screen (Feet)*</u>
MW-1D	30.0-32.0 35.0-37.0 40.0-42.0	29.1-39.1 (MW-1M)

<u>Sample Location</u>	<u>Depth of Sample (Feet)*</u>	<u>Depth of Screen (Feet)*</u>
MW-8S	4.0-6.0	5.2-10.2
	6.0-8.0	
	8.0-10.0	
MW-8D	40.0-42.0	42.0-52.0 (MW-8M)
	44.0-46.0	
	45.0-47.0	
	50.0-52.0	
MW-9D	5.0-7.0	29.0-39.0 (MW-9M)
	20.0-22.0	
	37.0-39.0	
	39.0-41.0	
MW-10M	14.0-16.0	13.2-18.2
WB-50	16.0-18.0	NA
WB-51	25.0-27.0	NA
WB-52	20.0-22.0	NA
	15.0-17.0	

*Below ground surface.

As shown in the above table, all samples taken at monitoring well cluster locations were taken at depths coinciding with screen depths at their respective locations. An exception was the sample from MW-9M at 20-22 feet which was obtained in order to analyze a representative sample of the "clean" clay as were samples obtained from WB-50, 51 and 52. Because of the cohesive nature of the soil, samples from MW-9M, WB-50, 51 and 52 were obtained using Shelby tubes. For samples obtained from the screened intervals of monitoring wells, the soil samples were analyzed in 2 foot intervals for the entire range of the screen length.

The results of slug tests performed as part of both the Phase I and Phase II investigations can be found in Table No. 3-2. Overburden/bedrock interface wells with the exception of MW-1M, appear to be screened in a moderately permeable zone with hydraulic conductivities ranging from 9.55×10^{-3} cm/s to 2.63×10^{-4} cm/s. The lower hydraulic conductivity value of 6.1×10^{-6} found for MW-1M is most likely a result of the screened interval being situated in a zone containing a higher clay fraction.

Table No. 3-2

SLUG TEST RESULTS

<u>Monitoring Well</u>	<u>Rising Head Test Hydraulic Conductivity (k) (cm/s)</u>	<u>Falling Head Test Hydraulic Conductivity (k) (cm/s)</u>	<u>Average Hydraulic Conductivity (k) (cm/s)</u>
MW-1M	NA	6.1×10^{-6}	6.1×10^{-6}
MW-2M	1.7×10^{-3}	1.1×10^{-3}	1.4×10^{-3}
MW-3M	1.1×10^{-3}	1.8×10^{-2}	9.55×10^{-3}
MW-4M	1.3×10^{-3}	7.1×10^{-4}	1.0×10^{-3}
MW-5S	1.5×10^{-3}	5.4×10^{-3}	3.5×10^{-3}
MW-8S	2.16×10^{-4}	NA	2.16×10^{-4}
MW-8M	3.42×10^{-4}	4.33×10^{-4}	3.88×10^{-4}
MW-9M	4.01×10^{-4}	1.24×10^{-4}	2.63×10^{-4}

Monitoring wells screened in the shallow/perched fill aquifer (MW-5S and MW-8S) also show moderate hydraulic conductivity values of 3.5×10^{-3} cm/s and 2.16×10^{-4} cm/s, respectively. It should be noted that although they are both screened in shallow/perched aquifer, MW-5S is located in the Disposal Area and MW-8S in the Roundhouse Area.

A clay unit extends from the top of the till zone to within approximately 1 to 5 feet below ground surface in the vicinity of monitoring well locations MW-1, MW-2 and MW-3, and waste boring WB-4 at the southern extent of the Disposal Area. The clay unit extends to approximately 20 to 25 feet below ground surface in the Disposal Area immediately south and east of the Tar Pit where it is overlain by fill material. Several samples of the clay were analyzed for Atterberg limits as part of the Phase I investigation, the results of which are as follows.

<u>Atterberg Limits</u>	<u>MW-4D (34-36')</u>	<u>MW-5S (22-24')</u>	<u>MW-6S (14-22')</u>
Liquid Limit (%)	38	20	36
Plastic Limit (%)	22	12	20
Plasticity Index (%)	16	8	16

All of the above samples exhibit a medium plasticity index and are most likely represented by permeability values ranging from 10^{-6} to 10^{-8} cm/s.

As part of the Phase II investigation, Shelby tube samples were collected from soil borings located in both the northern and southern areas of the site for purposes of characterizing the clay at these locations. Flexible wall permeability tests and Atterberg limits were performed on these samples. In addition, Shelby tube samples were obtained from "clean" clay at MW-9M located just outside the Disposal Area for the same characterization. Permeability testing was not possible on MW-9M (5-7') due to a damaged Shelby tube. The results of the above mentioned analysis are as follows:

<u>Atterburg Limits</u>	<u>MW-9M (5-7')</u>	<u>MW-9M (20-22')</u>	<u>WB-50 (25-27')</u>	<u>WB-51 (20-22')</u>	<u>WB-52 (15-17')</u>
Liquid Limits (%)	27.2	44.5	36.5	37.1	32.2
Plastic Limits (%)	20.3	21.9	21.1	20.8	21.2
Plasticity Index (%)	6.9	22.6	15.4	16.3	11.0

<u>Permeability</u>	<u>MW-9M</u> <u>(20-22')</u>	<u>WB-50</u> <u>(25-27')</u>	<u>WB-51</u> <u>(20-22')</u>	<u>WB-52</u> <u>(15-17')</u>
	6.77 10 ⁻⁸ cm/s	2.86 10 ⁻⁸ cm/s	3.13 10 ⁻⁸ cm/s	4.81 10 ⁻⁸ cm/s

All of the above samples exhibit a medium plasticity index are represented by permeabilities in the range of 2.86×10^{-8} cm/s to 6.77×10^{-8} cm/s.

The Hazen method was applied to grain size information obtained from the screen depths of overburden/water table and overburden/bedrock interface monitoring well boreholes as part of both the Phase I and Phase II investigations. The Hazen method was originally developed to determine permeabilities of well sorted medium sands in alluvial deposits and consequently does not work as well for poorly sorted sand, and/or sand with appreciable fines. The most reliable determination of hydraulic conductivities is obtained through slug tests and any values calculated by the Hazen Method at the Union Road Site should be regarded with caution.

The Hazen approximation is $K = C(D_{10})^2$, where K is the hydraulic conductivity, in cm/s, and is a function of permeability, gravity and fluid (i.e., water) density and viscosity. The effective grain size, D_{10} , is taken directly from the grain-size gradation curve determined by the results of the sieve analyses. D_{10} is the grain size diameter at which 10% by weight of the soil particles are finer and 90% coarser. The coefficient C is based upon grain size and the sorting of the soil in a given study area or sample and values are obtained from the following table:

<u>Soil Description</u>	<u>C Value</u>
Very fine sand and poorly sorted	40 - 80
Fine sand with appreciable fines	40 - 80
Medium sand, well sorted	80 - 120
Coarse sand, poorly sorted	80 - 120
Coarse sand, well sorted, clean	120 - 150

For the soil samples obtained from overburden/bedrock interface wells as part of the Phase I investigation, a value of 80 was chosen for C, indicating a fine sand with appreciable fines. Applying the Hazen method, the following hydraulic conductivities were approximated for the screened intervals at MW-2M and MW-3M.

MW-2M

$$\begin{aligned} C &= 80 \\ D_{10} &= 0.0015 \text{ mm} \\ K &= 80 (0.0015)^2 \\ &= 1.8 \times 10^{-4} \text{ cm/s} \end{aligned}$$

MW-3M

$$\begin{aligned} C &= 80 \\ D_{10} &= 0.002 \text{ mm} \\ K &= 80 (0.002)^2 \\ &= 3.2 \times 10^{-4} \text{ cm/s} \end{aligned}$$

As these calculations show, the hydraulic conductivities derived using the Hazen method for samples obtained from MW-2M and MW-3M are 1.8×10^{-4} cm/s and 3.2×10^{-4} cm/s, respectively. These values show fairly good correlation with those obtained as a result of the slug tests conducted, specifically within an order of magnitude (see Table No. 3-2).

For soil samples obtained from overburden/water table wells as part of the Phase I investigation, a value of 80 was also chosen for C, indicating a fine sand with appreciable fines. Applying the Hazen Equation to grain size information for the soil sample obtained from MW-5S resulted in a hydraulic conductivity of 3.2×10^{-4} cm/s as can be seen below.

MW-5S

$$\begin{aligned} C &= 80 \\ D_{10} &= 0.002 \\ K &= 80 (0.002)^2 \\ &= 3.2 \times 10^{-4} \text{ cm/s} \end{aligned}$$

This value also shows fairly good correlation with that obtained from the slug test, specifically within an order of magnitude (see Table No. 3-2).

As part of the Phase II investigation, hydraulic conductivities were approximated using the Hazen method for the screened intervals at MW-1M, MW-8S, MW-8M, MW-9M and MW-10M applying soil sample descriptions and grain size data obtained from each monitoring well cluster location. For monitoring wells screened within a uniform geologic unit, a single hydraulic conductivity value was approximated. Where monitoring wells were screened across varying stratigraphy, values were approximated for each stratigraphic unit and then averaged. Values for C were selected based on sample descriptions from the individual monitoring well locations. Applying the Hazen method, the following hydraulic conductivities for screened intervals at monitoring wells MW-1M, MW-8S, MW-8M, MW-9M and MW-10M were approximated:

MW-1M

$$C = 40$$

$$D_{10} = 0.004 \text{ mm}$$

$$K = 40 (0.004)^2$$

$$= 6.4 \times 10^{-4} \text{ cm/s}$$

MW-8S

$$C = 60$$

$$D_{10} = 0.03 \text{ mm}$$

$$K = 60 (0.03)^2$$

$$= 5.4 \times 10^{-2} \text{ cm/s}$$

MW-8M (42-46')

$$C = 80$$

$$D_{10} = 0.01 \text{ mm}$$

$$K = 80 (0.01)^2$$

$$= 8.0 \times 10^{-3} \text{ cm/s}$$

MW-8M (46-52')

$$C = 40$$

$$D_{10} = 0.008 \text{ mm}$$

$$K = 40 (0.008)^2$$

$$= 2.6 \times 10^{-3} \text{ cm/s}$$

MW-8M (Average)

$$K = 5.3 \times 10^{-3} \text{ cm/s}$$

MW-9M

$$C = 40$$

$$D_{10} = 0.01 \text{ mm}$$

$$K = 40 (0.01)^2$$

$$= 4.0 \times 10^{-3} \text{ cm/s}$$

MW-10M (14-16')

$$C = 80$$

$$D_{10} = 0.015$$

$$K = 80 (0.015)^2$$

$$= 1.8 \times 10^{-2} \text{ cm/s}$$

MW-10M (16-18')

$$C = 80$$

$$D_{10} = 0.006$$

$$K = 80 (0.006)^2$$

$$= 2.9 \times 10^{-3} \text{ cm/s}$$

MW-10M (Average)

$$K = 1.0 \times 10^{-2} \text{ cm/s}$$

As these calculations show, the hydraulic conductivities derived using the Hazen method for screened intervals at MW-1M, MW-8S, MW-8M, MW-9M and MW-10M are 6.4×10^{-4} cm/s, 5.4×10^{-2} cm/s, 5.3×10^{-3} cm/s, 4.0×10^{-3} cm/s and 1.0×10^{-2} cm/s, respectively. A comparison of these values to those obtained through slug tests shows a fairly good correlation for all of the overburden/bedrock interface wells, specifically within an order of magnitude (see Table No. 3-2). A poor correlation was noted in the values obtained for MW-8S. A slug test was not performed on MW-10M due to the previously mentioned damaged well casing.

3.1.4.2 Ground Water Flow Patterns

Measurements of ground water elevations were obtained as part of the Phase I investigation on April 19, 1989 and June 15, 1989 (see Table Nos. 3-3 and 3-4), in all monitoring wells installed as part of the Phase I RI. Measurements were obtained on June 15, 1989 after a prolonged period of above normal precipitation.

Measurements of ground water elevations in all monitoring wells installed at the Union Road Site were obtained as part of the Phase II investigation on December 12, 1989 and again on February 8, 1990, and are shown in Table Nos. 3-5 and 3-6.

Table No. 3-3

GROUND WATER ELEVATIONS
APRIL 19, 1989
(MEASURED IN FEET)

<u>Monitoring Well/ Piezometer Number</u>	<u>Depth of Well Below Ground Surface</u>	<u>Depth to Ground Water (From Top of Well Casing)</u>	<u>Well Elevation (Mean Sea Level) (Top of Well Casing)</u>	<u>Ground Water Elevation (Mean Sea Level)</u>
MW-1D	64.75'	14.79'	617.46'	602.67'
MW-2M	39.0'	18.72'	621.09'	602.37'
MW-2D	68.5'	18.16'	620.43'	602.27'
MW-3M	38.25'	19.72'	622.06'	602.34'
MW-3D	71.17'	18.83'	621.05'	602.22'
MW-4S	23.0'	17.54'	622.98'	605.44'
MW-4M	41.0'	20.59'	622.91'	602.32'
MW-4D	72.0'	20.10'	622.46'	602.36'
MW-5S	24.0'	13.74'	620.33'	606.59'
MW-6S	22.0'	14.20'	620.90'	606.70'
P-1	7.25'	6.18'	610.84'	604.66'
P-2	7.24'	5.24'	619.88'	614.64'
P-3	7.24'	5.79'	620.48'	614.69'
P-4	17.35'	10.46'	629.69'	619.23'

Table No. 3-4

GROUND WATER ELEVATIONS
JUNE 15, 1989
(MEASURED IN FEET)

<u>Monitoring Well/ Piezometer Number</u>	<u>Depth of Well Below Ground Surface</u>	<u>Depth to Ground Water (From Top of Well Casing)</u>	<u>Well Elevation (Mean Sea Level) (Top of Well Casing)</u>	<u>Ground Water Elevation (Mean Sea Level)</u>
MW-1D	64.75'	14.20'	617.46'	603.26'
MW-2M	39.0'	18.07'	621.09'	603.02'
MW-2D	68.5'	17.56'	620.43'	602.87'
MW-3M	38.25'	18.10'	622.06'	603.96'
MW-3D	71.17'	19.21'	621.05'	601.84'
MW-4S	23.0'	16.99'	622.98'	605.99'
MW-4M	41.0'	19.92'	622.91'	602.99'
MW-4D	72.0'	19.62'	622.46'	602.84'
MW-5S	24.0'	13.26'	620.33'	607.07'
MW-6S	22.0'	13.36'	620.90'	607.54'
P-1	7.25'	6.18'	610.84'	604.66'
P-2	7.24'	5.00'	619.88'	614.88'
P-3	7.24'	5.38'	620.48'	615.10'
P-4	17.35	9.06'	629.69'	620.63'

Table No. 3-5

**GROUND WATER ELEVATIONS
DECEMBER 12, 1989
(MEASURED IN FEET)**

<u>Monitoring Well/ Piezometer Number</u>	<u>Depth of Well Below Ground Surface</u>	<u>Depth to Ground Water (From Top of Well Casing)</u>	<u>Well Elevation (Mean Sea Level) (Top of Well Casing)</u>	<u>Ground Water Elevation (Mean Sea Level)</u>
MW-1M	39.0'	17.59'	617.72'	600.13'
MW-1D	64.75'	16.19'	617.46'	601.27'
MW-2M	39.0'	19.99'	621.09'	601.1'
MW-2D	68.5'	19.33'	620.43'	601.1'
MW-3M	38.25'	20.97'	622.06'	601.09'
MW-3D	71.17'	19.93'	621.05'	601.12'
MW-4S	23.0'	18.60'	622.98'	604.38'
MW-4M	41.0'	21.82'	622.91'	601.09'
MW-4D	72.0'	21.31'	622.46'	601.15'
MW-5S	24.0'	15.50'	620.33'	604.83'
MW-6S	22.0'	15.95'	620.90'	604.95'
MW-7D	63.3'	26.94'	628.02'	601.08'
MW-8S	10.2'	6.38'	628.00'	621.62'
MW-8M	52.0'	21.17'	626.90'	605.73'
MW-8D	65.8'	26.68'	627.92'	601.24'
MW-9M	39.0'	19.31'	619.13'	599.82'
MW-9D	52.8'	18.22'	620.46'	602.24'
MW-10M	18.2	6.96'	607.77'	600.81'
P-1	7.25'	6.23'	610.84'	604.61'
P-2	7.24'	6.12'	619.88'	613.76'
P-3	7.24'	6.58'	620.48'	613.90'
P-4	17.35'	14.93'	629.69'	614.76'
P-5	4.0'	7.03'	628.39'	621.36'
P-6	4.0'	5.65'	628.81'	623.16'
P-7	14.0'	11.42'	616.13'	604.71'

Table No. 3-6

**GROUND WATER ELEVATIONS
FEBRUARY 8, 1990
(MEASURED IN FEET)**

<u>Monitoring Well/ Piezometer Number</u>	<u>Depth of Well Below Ground Surface</u>	<u>Depth to Ground Water (From Top of Well Casing)</u>	<u>Well Elevation (Mean Sea Level) (Top of Well Casing)</u>	<u>Ground Water Elevation (Mean Sea Level)</u>
MW-1M	39.0'	13.08'	617.72'	604.64'
MW-1D	64.75'	15.04'	617.46'	602.42'
MW-2M	39.0'	18.75'	621.09'	602.34'
MW-2D	68.5'	18.20'	620.43'	602.23'
MW-3M	38.25'	19.91'	622.06'	602.15'
MW-3D	71.17'	18.77'	621.05'	601.28'
MW-4S	23.0'	17.76'	622.98'	605.22'
MW-4M	41.0'	20.62'	622.91'	601.29'
MW-4D	72.0'	20.21'	622.46'	602.25'
MW-5S	24.0'	14.00'	620.33'	606.33'
MW-6S	22.0'	14.34'	620.90'	605.56'
MW-7D	63.3'	25.80'	628.02'	602.22'
MW-8S	10.2'	4.88'	628.00'	623.12'
MW-8M	52.0'	19.60'	626.90'	607.30'
MW-8D	65.8	25.70'	627.92'	602.22'
MW-9M	39.0'	17.16'	619.13'	601.97'
MW-9D	52.8'	18.24'	620.46'	602.22'
MW-10M	18.2'	-	607.77'	-
P-1	7.25'	6.25'	610.84'	604.59'
P-2	7.24'	5.05'	619.88'	614.83'
P-3	7.24'	5.29'	620.48'	615.19'
P-4	17.35'	10.14'	629.69'	615.55'
P-5	4.0'	5.53'	628.39'	622.86'
P-6	4.0'	4.63'	628.81'	622.86'
P-7	14.0'	10.64'	616.13'	605.49'

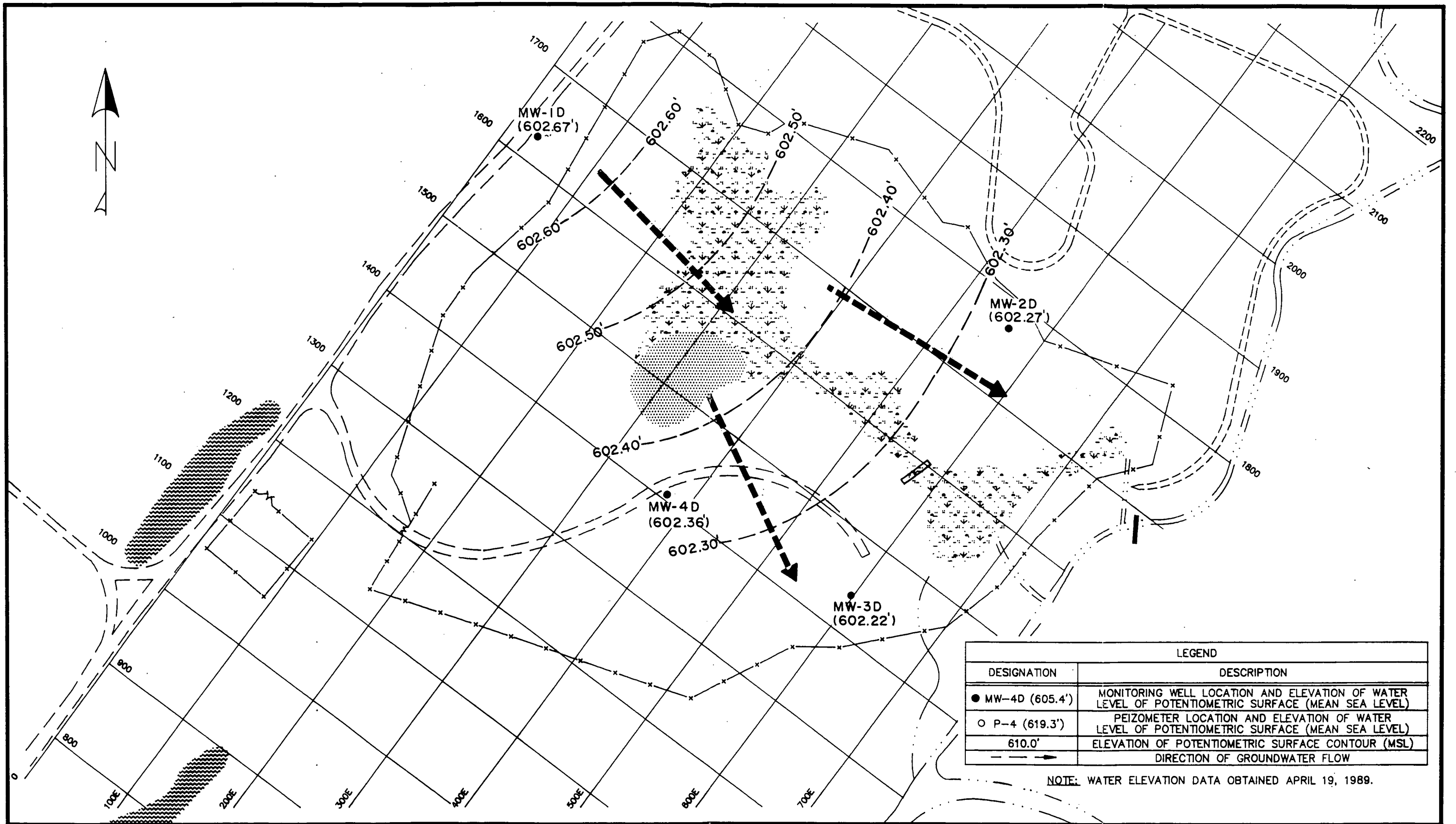
3.1.4.2.1 Bedrock Aquifer

Analysis of ground water elevation measurements obtained as part of the Phase I RI from the four bedrock monitoring wells on April 19, 1989, indicates a general southeasterly flow of ground water through the site (see Figure No. 3-21). The ground water gradient is approximately 7.5×10^{-4} foot of head loss per foot of horizontal distance. Analysis of ground water elevation measurements obtained on June 15, 1989, indicates that ground water is migrating towards the Tar Pit and marsh area in easterly and southerly directions (see Figure No. 3-22). The ground water gradient is approximately 2.4×10^{-3} foot of head loss per foot of horizontal distance. This information is based on a limited number of data points and all interpretation of ground water flow directions should be considered accordingly.

Analysis of ground water elevation measurements obtained from the seven bedrock monitoring wells on December 12, 1989, indicates a general northeasterly flow of ground water through the site (see Figure No. 3-23). The ground water gradient throughout the majority of the site is extremely slight at 5.5×10^{-4} foot of head loss per foot of horizontal distance. The exception is an area south of the Tar Pit in the vicinity of MW-9D, MW-3D and MW-4D where the gradient steepens slightly to 5.9×10^{-3} foot of head loss per foot of horizontal distance.

Ground water velocities were not calculated for bedrock flow due to both the extreme difficulty in determining fracture flow velocity and the lack of hydraulic conductivity data. Slug tests were not performed on the bedrock wells.

Based on ground water elevation data obtained on April 19, 1989 (see Table No. 3-3), the bedrock aquifer was being recharged by downward moving ground water from the overlying till zone aquifer at monitoring well clusters MW-2 and MW-3 (there were no overburden wells at the MW-1 location at the time). Specifically, the downward vertical potential gradients for well cluster MW-2 and MW-3 are 3.4×10^{-3} and 3.6×10^{-3} feet of head loss per foot of vertical distance, respectively. Bedrock ground water at the MW-4 location exhibits an upward vertical potential gradient of 1.29×10^{-3} foot of head loss per foot of vertical distance. Based on ground water elevation data obtained on June 15, 1989 (see Table No. 3-4), bedrock ground water was being recharged by downward moving ground water from the overlying till zone aquifer at monitoring well clusters MW-2, MW-3 and MW-4 with vertical potential gradients of 5.1×10^{-3} , 6.4×10^{-2} and 4.8×10^{-3} foot of head loss per foot of vertical distance, respectively.

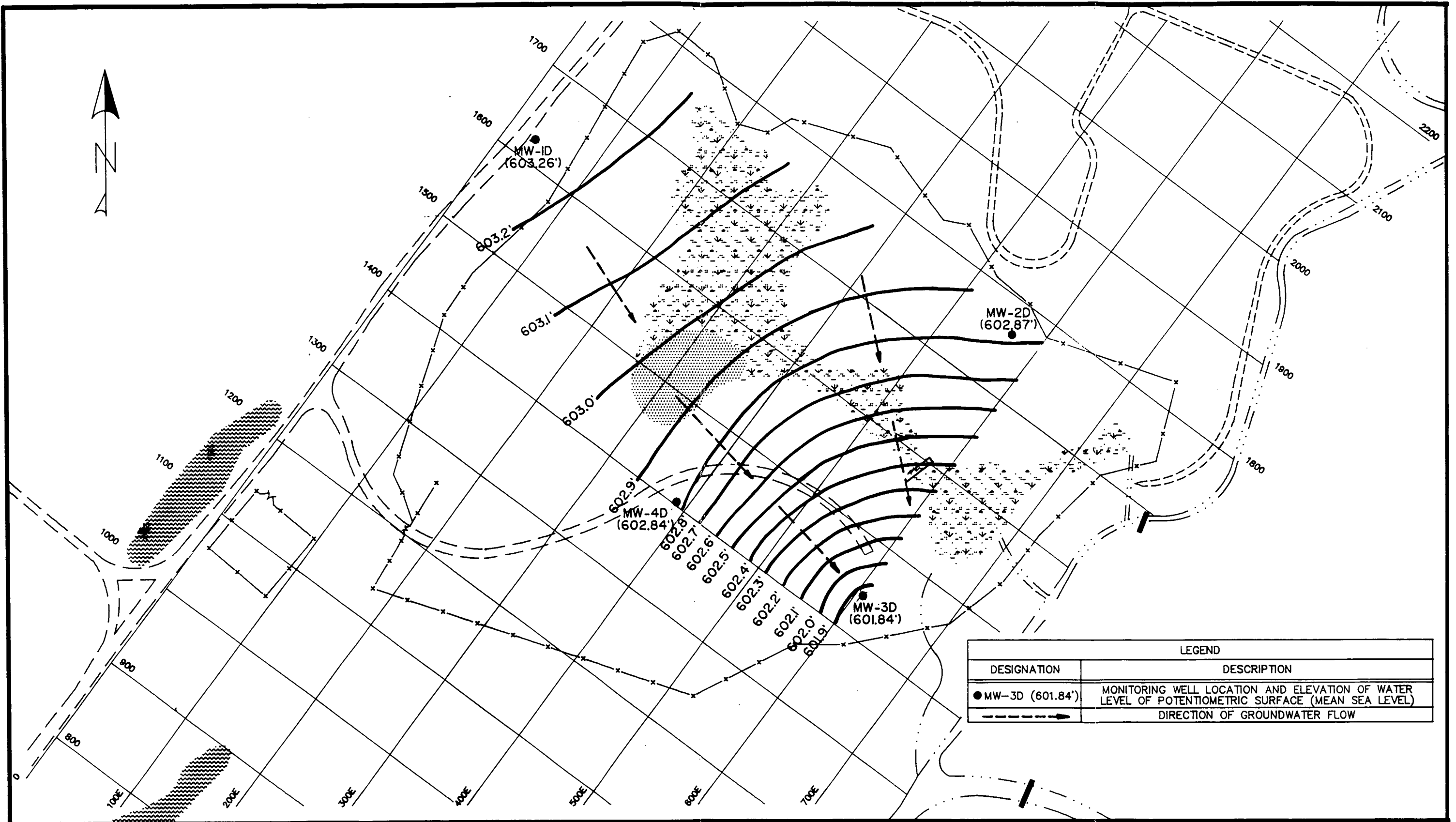


LEGEND	
DESIGNATION	DESCRIPTION
● MW-4D (605.4')	MONITORING WELL LOCATION AND ELEVATION OF WATER LEVEL OF POTENTIOMETRIC SURFACE (MEAN SEA LEVEL)
○ P-4 (619.3')	PEIZOMETER LOCATION AND ELEVATION OF WATER LEVEL OF POTENTIOMETRIC SURFACE (MEAN SEA LEVEL)
610.0'	ELEVATION OF POTENTIOMETRIC SURFACE CONTOUR (MSL)
--->	DIRECTION OF GROUNDWATER FLOW

NOTE: WATER ELEVATION DATA OBTAINED APRIL 19, 1989.

UNION ROAD SITE

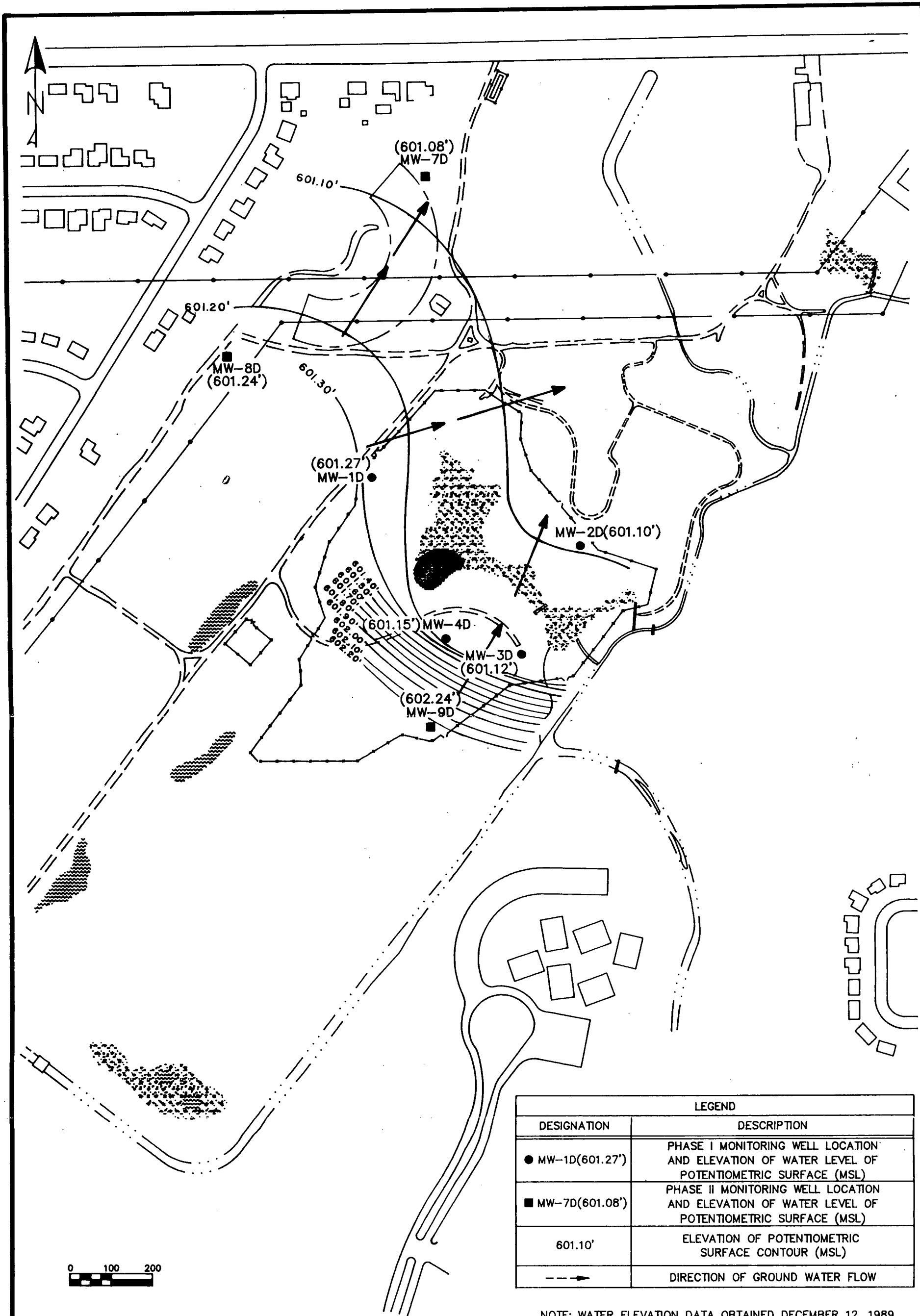
BEDROCK POTENTIOMETRIC SURFACE MAP



LEGEND	
DESIGNATION	DESCRIPTION
● MW-3D (601.84')	MONITORING WELL LOCATION AND ELEVATION OF WATER LEVEL OF POTENTIOMETRIC SURFACE (MEAN SEA LEVEL)
→	DIRECTION OF GROUNDWATER FLOW

UNION ROAD SITE

BEDROCK POTENTIOMETRIC SURFACE MAP



NOTE: WATER ELEVATION DATA OBTAINED DECEMBER 12, 1989

UNION ROAD SITE
**BEDROCK POTENTIOMETRIC
 SURFACE MAP**



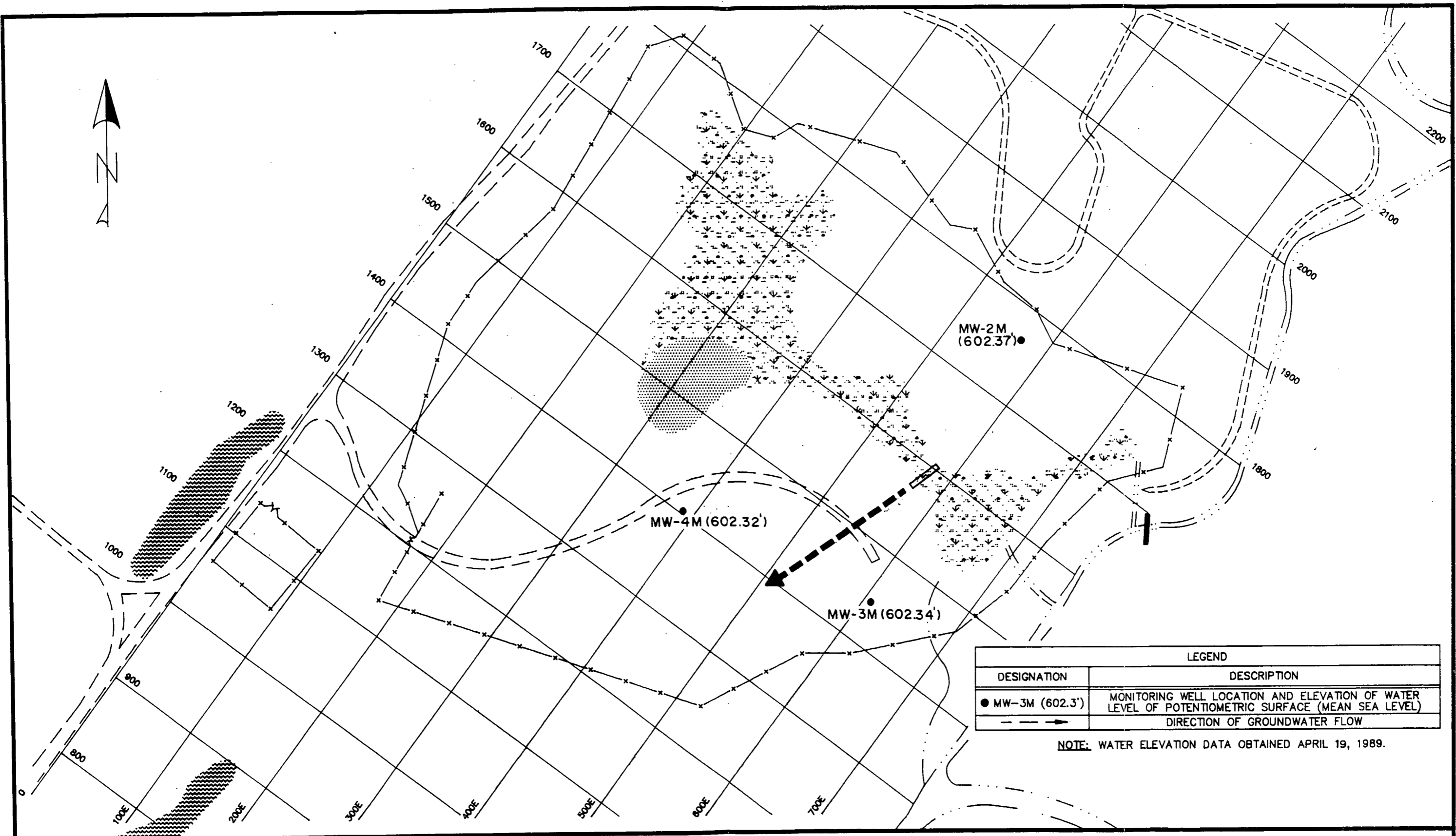
Ground water elevation data obtained on December 12, 1989 (see Table No. 3-5), shows ground water moving upward into the overlying till zone aquifer at monitoring well clusters MW-1, MW-3, MW-4 and MW-9 with vertical potential gradients of 5.4×10^{-3} , 9.1×10^{-4} , 1.9×10^{-3} and 0.18 foot of head loss per foot of vertical distance, respectively. During the time of water level measurement, bedrock ground water was being recharged by downward moving ground water from the overlying till zone aquifer at monitoring well cluster MW-8 with a vertical potential gradient of 0.33 foot of head loss per foot of vertical distance. There was no vertical potential gradient at monitoring well cluster MW-2.

Ground water elevation data obtained on February 8, 1990 (see Table No. 3-6), shows ground water moving upward into the overlying till zone aquifer at monitoring well clusters MW-3 and MW-9 with vertical potential gradients of 3.9×10^{-3} and 1.9×10^{-2} foot of head loss per foot of vertical distance, respectively. The bedrock aquifer was being recharged by downward moving ground water from the overlying till zone aquifer at monitoring well clusters MW-1, MW-2, MW-4 and MW-8 with vertical potential gradients of 8.7×10^{-2} , 6.7×10^{-3} , 1.3×10^{-3} and 0.37 foot of head loss per foot of vertical distance, respectively.

3.1.4.2.2 Overburden/Bedrock Interface (Till Zone) Aquifer

Analysis of ground water elevations obtained from the three overburden/bedrock interface wells on April 19, 1989, reveals a general southwesterly flow of ground water through the site, as illustrated in Figure No. 3-24, at a velocity of approximately 0.20 ft./yr. The ground water gradient is approximately 1.25×10^{-4} foot of head loss per foot of horizontal distance. Analysis of overburden/bedrock ground water elevation measurements obtained on June 15, 1989, reveals a northwesterly migration of ground water (see Figure No. 3-25), at a velocity of approximately 0.12 ft./yr. The ground water gradient is approximately 4.4×10^{-3} foot of head loss per foot of horizontal distance. The fact that this ground water flow determination is based on only three data points, combined with an extremely shallow potentiometric surface gradient, implies that flow direction interpretation should be used with caution.

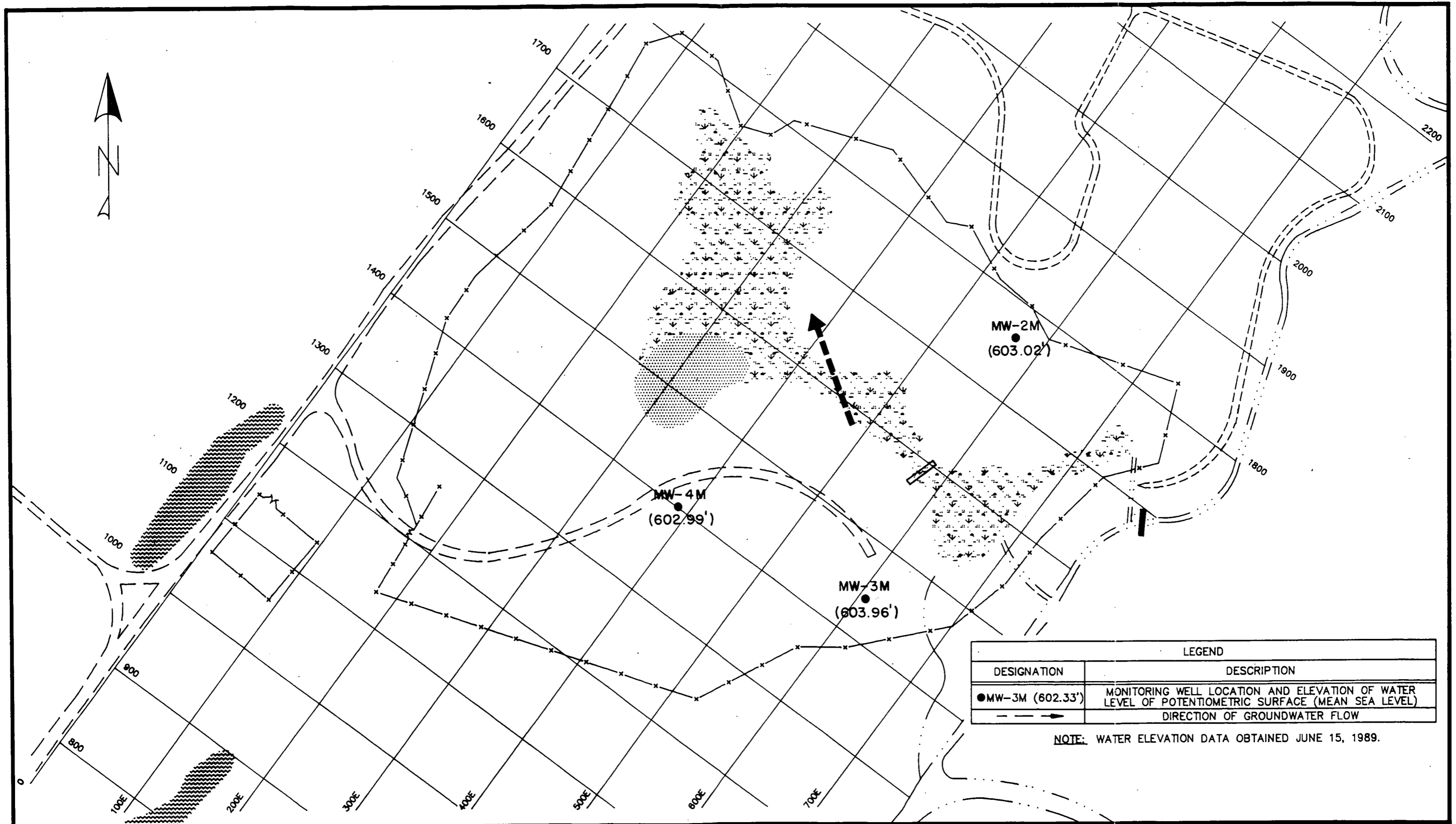
Analysis of ground water elevation measurements obtained from the seven overburden/bedrock interface wells on December 12, 1989, shows mounding of the potentiometric surface to exist in the vicinity of MW-8M and depressions in the potentiometric surface in the vicinity of both MW-1M and MW-9M, with a ground water velocity of 0.04 ft./yr. The resulting ground water flow pattern is shown in Figure No. 3-26. The ground water gradient in the area bounded by MW-8M, MW-1M and MW-9M is



LEGEND	
DESIGNATION	DESCRIPTION
● MW-3M (602.3')	MONITORING WELL LOCATION AND ELEVATION OF WATER LEVEL OF POTENTIOMETRIC SURFACE (MEAN SEA LEVEL)
- - - - ->	DIRECTION OF GROUNDWATER FLOW

NOTE: WATER ELEVATION DATA OBTAINED APRIL 19, 1989.

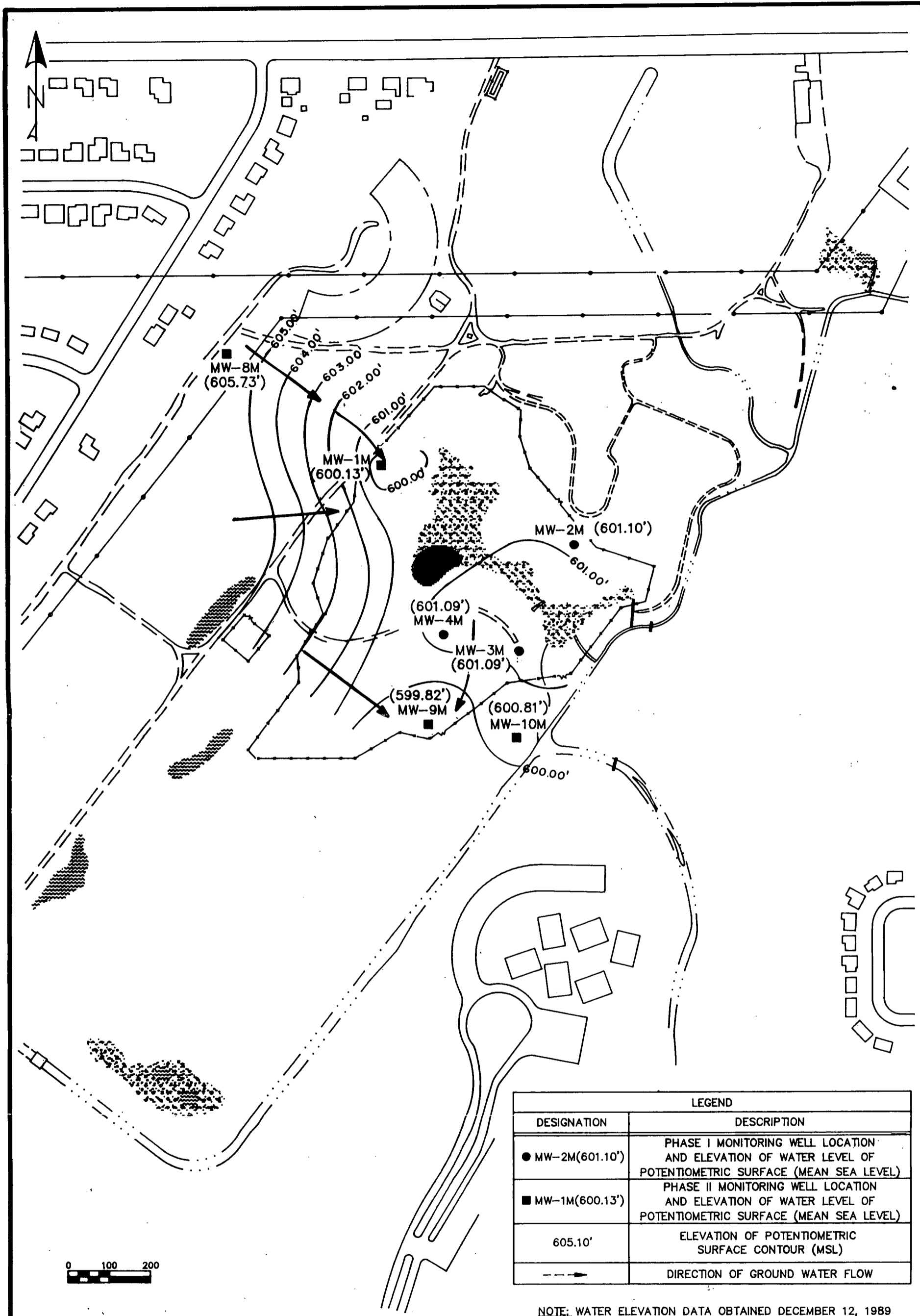
UNION ROAD SITE
OVERBURDEN/BEDROCK INTERFACE POTENTIOMETRIC SURFACE MAP



LEGEND	
DESIGNATION	DESCRIPTION
● MW-3M (602.33')	MONITORING WELL LOCATION AND ELEVATION OF WATER LEVEL OF POTENTIOMETRIC SURFACE (MEAN SEA LEVEL)
—→	DIRECTION OF GROUNDWATER FLOW

NOTE: WATER ELEVATION DATA OBTAINED JUNE 15, 1989.

UNION ROAD SITE
OVERBURDEN/BEDROCK INTERFACE POTENTIOMETRIC SURFACE MAP



LEGEND	
DESIGNATION	DESCRIPTION
● MW-2M(601.10')	PHASE I MONITORING WELL LOCATION AND ELEVATION OF WATER LEVEL OF POTENTIOMETRIC SURFACE (MEAN SEA LEVEL)
■ MW-1M(600.13')	PHASE II MONITORING WELL LOCATION AND ELEVATION OF WATER LEVEL OF POTENTIOMETRIC SURFACE (MEAN SEA LEVEL)
605.10'	ELEVATION OF POTENTIOMETRIC SURFACE CONTOUR (MSL)
--->	DIRECTION OF GROUND WATER FLOW

NOTE: WATER ELEVATION DATA OBTAINED DECEMBER 12, 1989



UNION ROAD SITE
OVERBURDEN/BEDROCK INTERFACE
POTENTIOMETRIC SURFACE MAP

FIGURE NO. 3-26

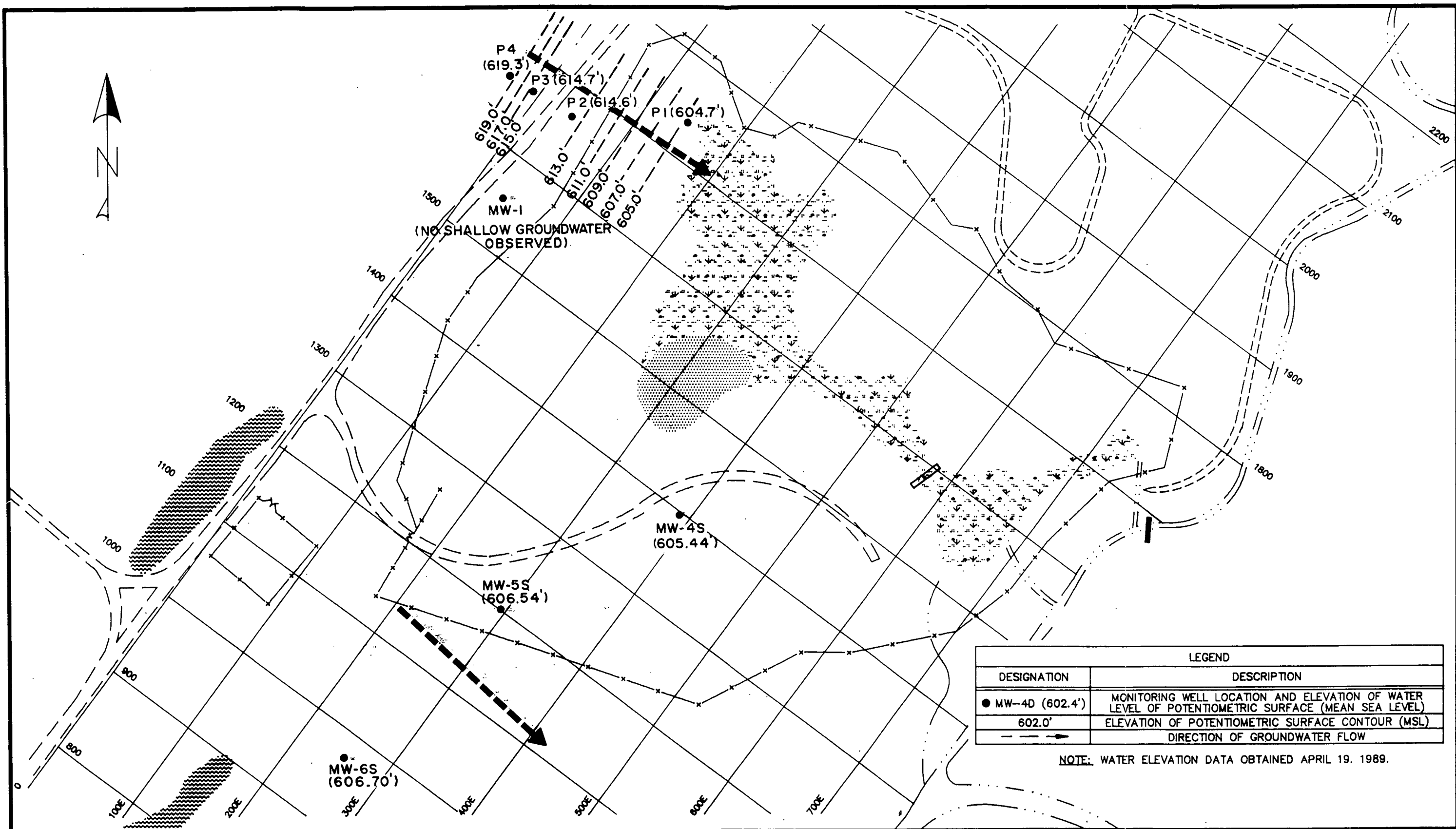
approximately 2.2×10^{-2} foot of head loss per foot of horizontal distance. The gradient becomes very low in the area bounded by MW-2M, MW-3M and MW-4M, which appears to be a local ground water divide.

3.1.4.2.3 Shallow (Perched) Fill Aquifer

Shallow ground water elevations in the perched aquifer were obtained both from four piezometers located to the northwest of the marsh area and three water table wells situated within the Disposal Area. It is noted that only a small amount of shallow groundwater was found to exist at the location of MW-1 and, therefore, at the time at which the borehole was drilled for MW-1D, it was decided not to install a shallow monitoring well at this location; rather a system of piezometers was installed at a later date, in order to determine shallow ground water flow direction. The piezometers are set in a perched aquifer of minimal thickness to the west of the Tar Pit.

Analysis of ground water elevation measurements obtained from the piezometers in the Roundhouse Area on April 19, 1989, shows a southeasterly flow of ground water towards the marsh area (see Figure No. 3-27) at a velocity of approximately 19.0 ft./yr. The ground water gradient is approximately 0.073 foot of head loss per foot of horizontal distance. Analysis of ground water elevation measurements obtained from the piezometers on June 15, 1989, and December 12, 1989, also show a southeasterly flow of ground water towards the marsh area (see Figure Nos. 3-28 and 3-29). The ground water gradients are approximately 0.080 and 0.060 foot of head loss per foot of horizontal distance. The addition of several piezometers prior to the December data collection showed some mounding of the water table in the vicinity of monitoring well location MW-8. Ground water appears to be recharging into the northwest portion of the marsh as evidenced by an 8°F elevation in surface water temperature in this area (during the winter) in comparison to other locations within the marsh area. Surface water temperatures were measured on February 6, 1989.

Analysis of ground water elevation measurements obtained from the water table wells on April 19, 1989, shows a southeasterly flow towards Slate Bottom Creek (see Figure No. 3-27) at a velocity of approximately 17.8 ft./yr. The ground water gradient is approximately 2.8×10^{-3} foot of head loss per foot of horizontal distance. Analysis of ground water elevations obtained from the water table wells on June 15, 1989, shows an east-southeasterly flow towards Slate Bottom Creek (see Figure No. 3-28) at a velocity of approximately 7.4 ft./yr. The ground water gradient is approximately 3.7×10^{-3} foot of



LEGEND	
DESIGNATION	DESCRIPTION
● MW-4D (602.4')	MONITORING WELL LOCATION AND ELEVATION OF WATER LEVEL OF POTENTIOMETRIC SURFACE (MEAN SEA LEVEL)
602.0'	ELEVATION OF POTENTIOMETRIC SURFACE CONTOUR (MSL)
---	DIRECTION OF GROUNDWATER FLOW

NOTE: WATER ELEVATION DATA OBTAINED APRIL 19, 1989.

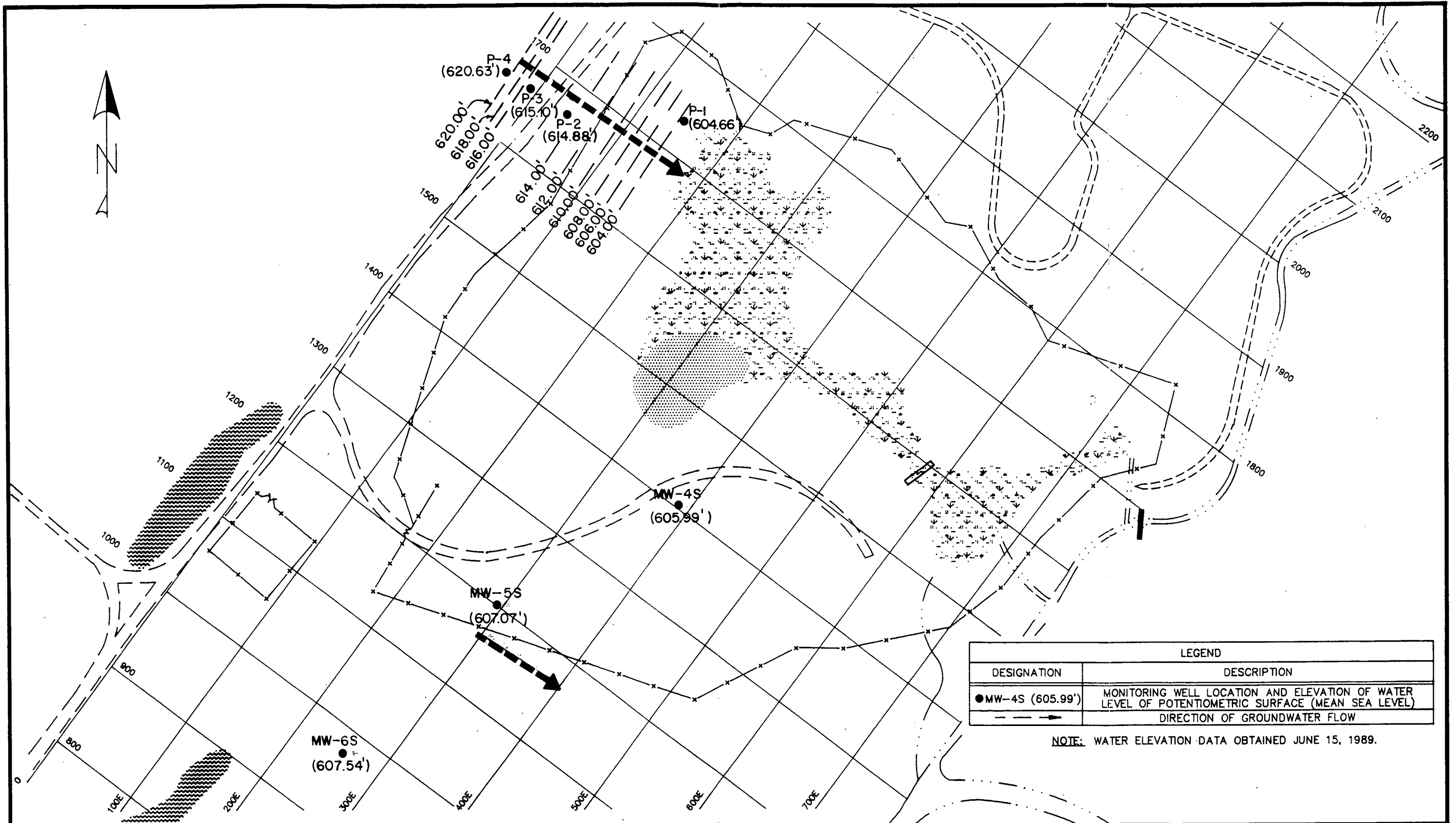
UNION ROAD SITE

WATER TABLE POTENTIOMETRIC SURFACE MAP



Dvirka
and
Bartilucci
CONSULTING ENGINEERS

FIGURE NO. 3-27

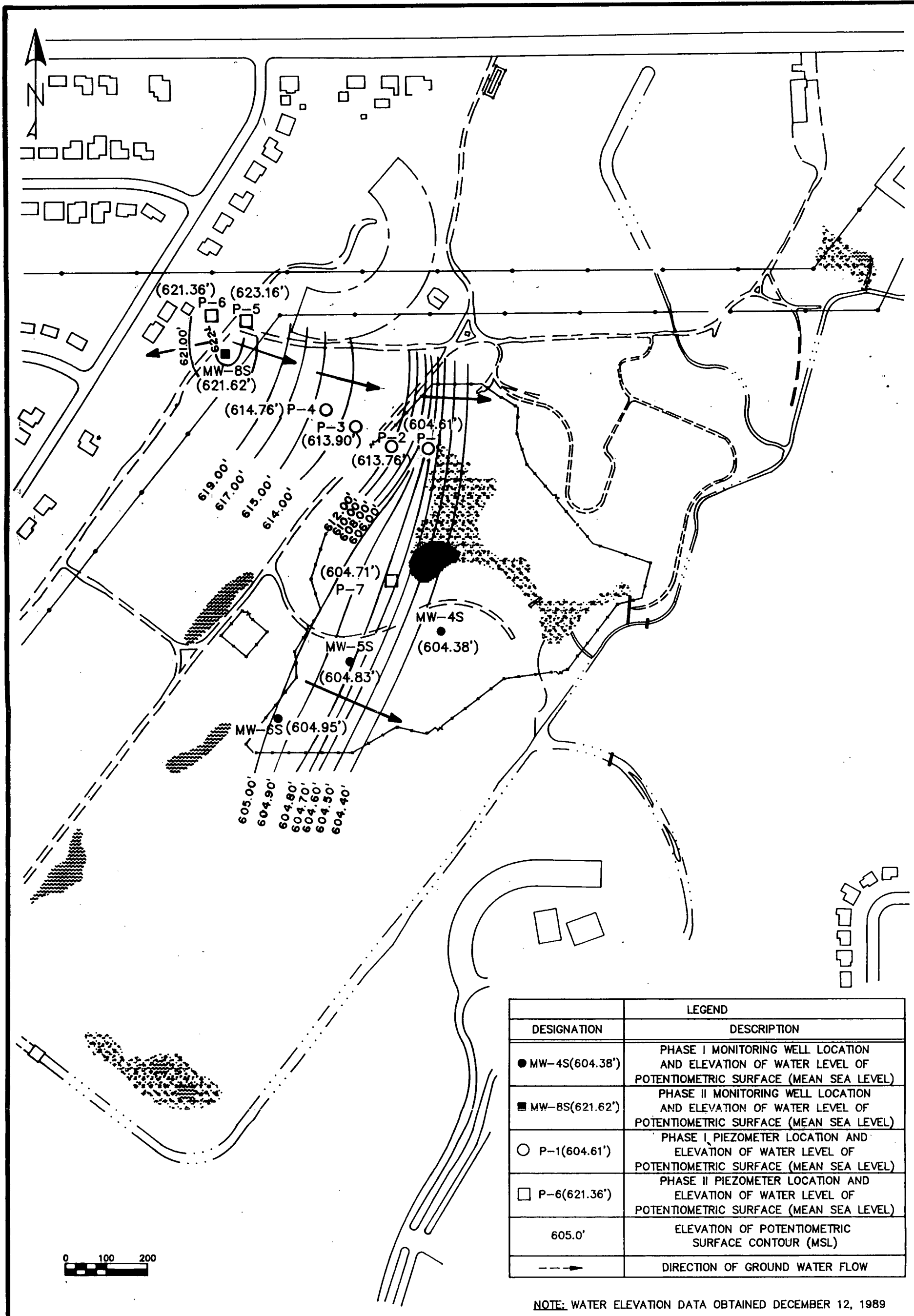


LEGEND	
DESIGNATION	DESCRIPTION
● MW-4S (605.99')	MONITORING WELL LOCATION AND ELEVATION OF WATER LEVEL OF POTENTIOMETRIC SURFACE (MEAN SEA LEVEL)
— — — — —	DIRECTION OF GROUNDWATER FLOW

NOTE: WATER ELEVATION DATA OBTAINED JUNE 15, 1989.

UNION ROAD SITE

WATER TABLE POTENTIOMETRIC SURFACE MAP



NOTE: WATER ELEVATION DATA OBTAINED DECEMBER 12, 1989

head loss per foot of horizontal distance. The ground water flow direction interpretation in this area is very preliminary due to the limited amount of data points and thus it should be used accordingly. In general, substantial precipitation appears to increase recharge of water and hydraulic gradients in all three aquifers found in the study area, and also appears to alter ground water flow direction in the bedrock and overburden/bedrock interface.

Analysis of ground water elevation measurements obtained from the four shallow/water table wells and seven piezometers on December 12, 1989, shows a general east to southeastward migration of ground water across the site towards Deer Lik and Slate Bottom Creeks (see Figure No. 3-29). A slight mounding of ground water is observed in the area just to the southeast of the former roundhouse. Ground water gradients vary markedly across the site. From the western boundary of the marsh area west across the site, the ground water gradient is approximately 0.06 foot of head loss per foot of horizontal distance. In contrast, the gradient in the Disposal Area is on the order of 4.4×10^{-3} foot of head loss per foot of horizontal distance. Ground water elevation measurements obtained on February 8, 1990, displayed almost identical relationships between wells to those obtained on December 12, 1990. As a result, a separate ground water map was not prepared for these dates.

3.1.4.3 Summary of Site Hydrogeology

Ground water movement in the bedrock aquifer is towards the northeast in both the Roundhouse and Disposal Areas, as well as throughout the site. Vertical potential ground water gradients show ground water moving downward from the overlying till zone aquifer to the bedrock aquifer in the Roundhouse Area, as well as in the vicinity of the MW-2 monitoring well cluster which is north of the marsh area. Vertical movement between these two aquifers appears to vary with respect to direction with time in the Disposal Area. Ground water movement is in an upward direction in the vicinity of the MW-9 cluster which is situated just to the east of the Disposal Area. Throughout the site, ground water elevation data obtained from bedrock wells reveals a very low hydraulic head.

The overburden/bedrock interface (till zone) aquifer is characterized by hydraulic conductivities within the 10^{-3} to 10^{-4} cm/s range throughout the site. Ground water moves in a generally eastward direction in the northern half of the site and to the south and east in the Disposal and Southern Areas of the site. Similar to the bedrock aquifer, a very low hydraulic head results in the extremely slow ground water velocities approximated for this aquifer of from 0 to 1 ft./yr.

A semi-confining unit separates the overburden/bedrock interface (till zone) aquifer from the shallow (perched) fill aquifer and exhibits hydraulic conductivities on the order of 10^{-6} to 10^{-8} cm/s. In addition, in areas of the site where the shallow cinderfill material is absent (north and south of the Disposal Area) hydraulic conductivities of soil from 5 to 10 feet below the ground surface to the till zone overlying the bedrock (approximately 40 feet in thickness) are also very low, on the order of 10^{-6} to 10^{-8} cm/s. These areas are optimum locations for potential clean borrow material.

Ground water movement in the shallow (perched) fill material aquifer is generally from west-northwest to east-southeast throughout the site with the exception of the immediate vicinity of the MW-8 cluster in the Roundhouse Area where mounding of the water table occurs. Hydraulic conductivities are within the 10^{-3} to 10^{-4} range throughout the Roundhouse and Disposal Areas. Hydraulic heads in the shallow (perched) fill aquifer are significantly greater than those in the underlying aquifers resulting in increased ground water velocities which average 20 ft./yr. The perched aquifer recharges the underlying till aquifer.

3.1.5 Surface Water Hydrology

The Union Road Site lies within the Buffalo River drainage basin. Slate Bottom Creek lies adjacent to the site on the east and south, and flows into Cayuga Creek about one mile west of the Site. Surface drainage from the Union Road Site ultimately discharges to Slate Bottom Creek, either directly or through a marsh in the Disposal Area. Two tributaries coalesce to form a single tributary (Deer Lik Creek) approximately 900 feet north of Slate Bottom Creek. Deer Lik Creek flows south along the northeast boundary of the site and into Slate Bottom Creek. The Tar Pit is located in the southwest corner of the marsh area. This waste lagoon is frequently covered with standing water after periods of precipitation, in particular at the northern end that drains eastward to the marsh. Ground water appears to be recharging the north western portion of the marsh area. In addition, ground water seeps have been observed on occasion along the slopes bordering the marsh.

As part of the Phase I investigation, flow rates were estimated for both Slate Bottom Creek and Deer Lik Creek on June 15, 1989, by measuring velocity and cross-sectional area. (It should be noted that these measurements were taken after approximately two weeks of above normal precipitation.) The flow rates for Slate Bottom Creek and Deer Lik Creek were determined to be 11 cfs and 3 cfs, respectively. Surface water drains to the east across the site to the above mentioned surface waters. The marsh area which exists in the north-central portion of the site, drains eastward into Deer

Lik Creek via two small outlets/channels. A flow rate of 1.5 cfs was measured at the northern marsh outlet and a rate of 1 cfs was measured at the southern marsh outlet. (Again, it should be noted that these measurements were taken after approximately two weeks of above normal precipitation). During extended dry weather periods, these outlets do not flow.

As part of the Phase II investigation, it was planned to obtain flow measurements from both Slate Bottom and Deer Lik Creeks either on a daily basis or when a significant change was observed. This procedure was carried out through the early part of November 1989. However, after this point in time, increased precipitation resulted in dangerous conditions along both creeks due to their slippery, steep slopes and greatly increased depth of water in the creeks, thereby precluding the collection of data. Daily observations of the creeks were carried out throughout the duration of the Phase II investigation. Surface water conditions observed during below average precipitation in September and October were most likely representative of base flow conditions which are approximately 5.0 cfs and 1.5 cfs for Slate Bottom Creek and Deer Lik Creek, respectively.

Both creeks are significantly affected by surface runoff resulting from storm events. It was observed that for several precipitation events during the months of October and November, when 0.5 to 1.5 inches of rain fell in less than a 24-hour period, a significant rise in the water levels of both creeks occurred. The rise of water levels was observed to begin within a matter of several hours after the onset of precipitation. After an event where approximately 1 inch of precipitation fell in a 12-hour period on a 6 inch snow pack, water levels rose greater than 3 feet in Slate Bottom Creek and 2 feet in Deer Lik Creek as recorded with temporary staff gauges. It should be noted that both staff gauges were dislodged by strong water currents and floating debris. In summary, it is apparent that precipitation events at the site significantly impact the flow rates of both Slate Bottom and Deer Lik Creeks.

3.1.6 Climate/Meteorology

Weather conditions were recorded each day at the Union Road Site as part of both the Phase I and II investigations. For the Phase I investigation, this information can be found in the Daily Field Activity Reports contained in a separate document entitled "Phase I Investigation Field Record Report." Weather conditions for the Phase II investigation can be found in the Site Weather/Dust Report forms contained in another separate document entitled "Phase II Investigation Field Record Report."

Monthly normal temperature and precipitation for the 30 year period 1951-1980 at the Buffalo Airport can be seen in Table No. 3-7. The Buffalo Airport is located approximately 10 miles northeast of the site. A comparison of daily temperatures and snowfall experienced at the site, with the normals computed at the Buffalo Airport, show that temperatures and snowfall during the Phase I field program (January, 1989 through April, 1989) were near normal. Average prevailing wind directions were recorded at the site on a total of 55 days. A breakdown of average prevailing wind direction, and the total number of days on which that wind direction was recorded, is as follows.

<u>Prevailing Wind Direction</u>	<u>Total No. of Days</u>	<u>%</u>
Southwest	24	44
West	9	16
Northeast	6	11
South	5	9
Northwest	4	7
Southeast	3	5
North	2	4
East	<u>2</u>	<u>4</u>
	55	100

As can be seen above, the predominant wind direction observed at the site during the Phase I investigation was from the southwest. The approximate average wind velocity recorded was 5 mph. Both prevailing wind direction and speed are consistent with the long-term averages recorded at the United States Coast Guard Station as presented in Section 1.2.1.3, Figure No. 1-5. There were a total of 22 days of measurable precipitation recorded.

As part of the Phase II investigation (September, 1989 through December, 1989), a more comprehensive program of meteorological data collection was performed. Meteorological data including cloud cover conditions, temperature, wind velocity and wind direction was collected twice a day during times when field work was being conducted at the site at two separate locations. One location was in the open area just to the south of the former roundhouse and the other was immediately to the southeast of the Tar Pit in the vicinity of monitoring well cluster MW-4, in an area of mature trees. In addition, daily precipitation was measured at the field office trailer location.

Table No. 3-7

**MONTHLY TEMPERATURE AND PRECIPITATION
DATA FOR BUFFALO AIRPORT 1951 - 1980**

Temperature (°F)													
	J	F	M	A	M	J	J	A	S	O	N	D	ANN
Max	30.0	31.4	40.4	54.4	65.9	75.6	80.2	78.2	71.4	60.2	47.0	22.5	88.8
Min.	17.0	17.5	25.6	36.3	46.3	56.4	61.2	59.6	52.7	42.7	33.6	22.5	39.3
Mean	23.5	24.5	33.0	45.4	56.1	66.0	70.7	68.9	62.1	51.5	40.3	28.8	47.6

Extremes (°F)													
Low	-11	-20	-4	17	29	38	46	38	32	20	9	-4	
High	61	60	78	83	88	94	94	93	90	82	80	60	

Precipitation (inches)													
Avg.	3.02	2.40	2.97	3.06	2.89	2.72	2.96	4.16	3.37	2.93	3.62	3.42	37.52
Max 24hr	2.40	2.31	2.14	1.49	2.03	3.04	3.38	3.88	3.63	3.49	2.51	2.16	

Snowfall (inches)													
Mean	22.3	17.8	12.1	2.6	0.2					0.2	12.6	20.2	88.0
Max	50.6	54.2	29.2	13.1	2.0					2.0	28.6	51.1	
Max 24hr	18.2	14.5	15.8	5.1	2.0					2.0	19.9	24.3	

A comparison of daily temperatures and precipitation experienced at the site, together with the normals computed from data collected at the Buffalo Airport, show that temperatures were near normal during the months of September and October, slightly below normal during November and well below normal during the month of December. Precipitation amounts were near normal for December, slightly above normal during October and below normal during September and November. Average prevailing wind directions were recorded at the site on a total of 66 days. A breakdown of average prevailing wind direction and the total number of days that wind direction was recorded is as follows:

<u>Prevailing Wind Direction</u>	<u>Total # of Days</u>	<u>%</u>
Southwest	36.0	55
Northeast	7.5	11
West	5.5	8
None (calm)	4.0	6
Northwest	3.5	5
East	3.0	5
South	2.5	4
North	2.0	3
Southeast	<u>2.0</u>	<u>3</u>
	66.0	100

As can be seen above, the predominant wind direction observed at the site during the Phase II field program was from the southwest. The approximate average wind speed recorded in the Roundhouse Area was 8 mph and the approximate average wind speed in the Disposal Area was 4 mph. This difference in wind speed is explained by the fact that the Disposal Area contains a considerable amount of trees and shrubs while the roundhouse is located in a basically open field.

3.1.7 Ecology

3.1.7.1 Major Habitat Types

The information and data provided in this section was obtained during the field investigation and supplemented by data from a number of outside sources. In general, the Union Road Site can be considered a predominately upland area bordered on the east and south by Slate Bottom Creek and its tributary, Deer Lik Creek. The former railroad yard generally borders the northern and western portions of the site.

The majority of the site is comprised of areas of early and mid-successional uplands which are reestablishing after demolition of the structures associated with the railroad yard and auxiliary buildings. Land within a one mile radius of the site can be considered predominately urbanized with a considerable number of stream and creek corridors within the area. Several distinct plant associations or communities have been identified within the study area. These are disturbed land, early successional, upland emergent marshland, open water, palustrine forested areas and undeveloped area.

Residential areas within the site vicinity are substantial. The site proper had in the past been used for industrial purposes resulting in on-site disturbances and contamination. The area of the demolished railroad roundhouse is essentially devoid of natural vegetation due to the presence of concrete footings remaining after demolition. This area supports patches of weeds and shrubs which also occur in other less active areas. These disturbed areas support plant species which can reproduce quickly and colonize areas between disturbances. Such plants include goldenrod (Soldago spp.) and thistle (Sonchus spp.)

The low lying disturbed Tar Pit/marsh area holds runoff water and supports reed grass (Phragmites spp.) and cattail (Typha spp.). Water is ponded in these areas and, as such, hydrophyllic forms dominate this environment. As presented in Section 1.2.1.8, no regulated wetlands are found on or contiguous to the Union Road Site.

At the approximate centroid of the site, stands of mature trees and low scrub predominate. These include american elm (Ulmus americana), sugar maple (Acer saccharum) and oak (Quercus spp.). This upland community also includes abundant shrub and wildflowers species and sporadic clumps of mosses in areas of high moisture.

The overall vegetative cover ranges from dense within the area of mature trees, to sparse within the area of the demolished railroad roundhouse. Open areas containing low grasses exist along sections of Deer Lik Creek and Slate Bottom Creek which border the eastern and southern boundaries of the site.

It appears that the early and mid-successional vegetation has become established as a result of open land area created by demolition of previous railroad structures on site.

3.1.7.2 Open Water Systems

The open water systems within the vicinity of this site consist of the marsh area adjacent to the Tar Pit, which holds considerable moisture at least on a seasonal basis, Slate Bottom Creek and an unnamed tributary (locally known as Deer Lik Creek). These two creeks can be characterized as fast moving. Smaller drainage outlets connect the Tar Pit/marsh complex to Deer Lik and ultimately Slate Bottom Creek along the southeastern edge of the site.

Slate Bottom Creek enters Cayuga Creek approximately 1/2 mile downstream of the site. Cayuga Creek, along with two other major creeks, Cazenovia Creek and Buffalo Creek, are all tributaries of the Buffalo River Watershed. There are five known listed hazardous waste sites which are within the drainage area of Cayuga Creek upstream of the Union Road Site. These are presented in Table No. 3-8. It is unclear as to the extent of contaminant contribution to the creek; however, a NYSDEC (1989) report for the Buffalo River notes that contaminant migration to the river is known to occur to Cayuga Creek from both the Land Reclamation Site and the Union Road Site. In addition, Buffalo Creek (two sites) contributes contaminants into the Buffalo River downstream of the confluence of Cayuga Creek and Slate Bottom Creek.

Within the marsh area, beyond the Tar Pit, the reed grasses and cattail plants encountered appear healthy and had extensive coverage. In the Tar Pit Area, sparse patches of these forms were found surrounding the waste lagoon.

Field investigations of the creek environment did not reveal any large colonies of macroalgae; however, in areas of rocky substrate, some green algae colonies were noted outside of areas of excessive water flow. In the transition zone between creek and marsh systems, low grasses and scrub vegetation predominate.

3.1.7.3 Mammals

Evidence of a number of mammals was found on site, such as cottontail rabbits (Sylvagus spp.), which occur on site within the upland areas around the marsh. Undoubtedly, breeding pairs of rabbits exist year round on the site and would occupy similar habitat off-site as well. Other species of mammals observed by sign within the Union Road Site include White Tailed Deer (Odocoileus virginianus), Woodchuck (Marmota monax), Vole (Microtus spp.), mice (Reithrodontomys spp.), and opossums (Oidelphis didelphis). Muskrat (Ondatra zibethica) may also be present within the marsh area.

Table No. 3-8

HAZARDOUS WASTE SITES PRESENT WITHIN
THE CAYUGA CREEK DRAINAGE BASIN
UPSTREAM OF THE UNION ROAD SITE

<u>Site Number</u>	<u>Site Name</u>	<u>Site Code</u>	<u>Years in Operation</u>	<u>Site Size</u>	<u>Contents</u>	<u>Distance to Surface Water Course</u>
915082	Stocks Pond	2A	1961-1977	1.5 acres	lube oil, brick, bentonite clay sludge, foundry sand, etc.	Approximately 50 feet from Cayuga Creek
915064	Dresser Industries	2A	unkn-1986	16 acres	foundry sand w/phenolics, slag, bentonite clay sludge, lube oil	Approximately 2000 feet from Cayuga Creek
915015	Village of Depew Borden Road	2A	1940-1962	5 acres	unknown, foundry sand used as cover material	Approximately 50 feet from Cayuga Creek
915070	Land Reclamation	3	1965-1983	100 acres	foundry sands, pine tar pitch, ink slab chemicals, waste colors, acids	Less than 50 feet from Cayuga Creek
915129	Old Land Reclamation	2A	between 1958-1960 to 1978	64 acres	foundry sand, slag, flyash, oil sludge, inks, waste colors	Approximately 50 feet from Cayuga Creek

Source: NYSDEC 1989

The entire Town of Cheektowaga is within the confines of a closed hunting area. These areas are specified portions of New York State where the taking of deer or bear is prohibited by the Environmental Conservation Law. This closed area covers the area around Buffalo from Tonawanda Creek from the East Branch of the Niagara River to Route 78, to Greiner Road, to Route 268, to Route 5, to Ransom Road and to Route 33, to Route 78, to Route 20, to 20A, to Lake Erie. Although it is difficult to determine if deer hunting actually occurs (illegally) at the Union Road Site, the 1987 entitled Deer Take by County and Town (NYSDEC 1988) reported no deer were taken within the Town of Cheektowaga. However, spent cartridges from firearms and ammunition cases were found within the site and, as such, some hunting in the study area, at least previously, can be assumed. Hunting or trapping of other forms of mammals within the Union Road Site is not known to occur at present.

3.1.7.4 Birds

The site hosts a number of common species of birds which typically frequent disturbed lands. Varieties of sparrow including tree sparrow (Iridoprolene bicolor) were noted. Other birds observed on site included crow (Corvus spp.), red winged blackbirds (Agelaius phoeniceus), gull (Larus spp.), morning dove (Columba livia), killdeer (Charadrius vociferus) and American robin (Turdus migratorius). Table No. 3-9 presents information concerning birds noted to occur within Erie County and those found during site reconnaissance activities.

3.1.7.5 Fish

The aquatic portions of the Union Road Site marsh area and off-site portions of Deer Lik Creek, Slate Bottom Creek and Cayuga Creek downstream undoubtedly support these types of fauna. Little data exists on fish found in the proximity of the site. However, observations of fish in Slate Bottom Creek made during the Phase I field investigation and discussions with NYSDEC concerning potential inhabitants of the creek system suggest these environments support a number of fish. Table No. 3-10 presents species of fish which may inhabit creeks in the study area. Presumably, individuals of those species would find their way from Cayuga Creek into Slate Bottom Creek or perhaps Deer Lik Creek adjacent to the site. It should be noted that crayfish were also observed in Slate Bottom Creek.

Table No. 3-9

BIRDS NOTED TO OCCUR WITHIN ERIE COUNTY

<u>Species</u>	<u>Breeding Status</u>			<u>Site Field Survey</u>
	<u>Possible</u>	<u>Probable</u>	<u>Confirmed</u>	
Pied Billed Grebe	X	X	X	
American Bittern	X	X		
Least Bittern	X	X	X	
Great Blue Heron	X	X	X	
Green Backed Heron	X	X	X	
Black Crowned Night Heron	X			
Canada Goose	X	X	X	
Wood Duck	X	X	X	
Green Winged Teal	X			
American Black Duck	X	X	X	
Mallard	X	X	X	
Northern Pin Tail	X			
Blue Winged Teal	X	X	X	
Gadwall	X	X		
American Wigeon		X	X	
Hooded Merganser		X	X	
Turkey Vulture	X	X		
Northern Harrier	X	X	X	
Sharp-Shinned Hawk	X	X	X	
Coopers Hawk	X	X	X	
Northern Goshawk	X	X		
Red Shouldered Hawk	X	X	X	
Broad Winged Hawk	X	X	X	
Red Tailed Hawk	X	X	X	
American Kestrel	X	X	X	
Red Necked Pheasant	X	X	X	
Ruffed Grouse	X	X	X	
Wild Turkey	X	X	X	
Virginia Rail	X	X	X	

Table No. 3-9 (continued)

BIRDS NOTED TO OCCUR WITHIN ERIE COUNTY

<u>Species</u>	<u>Breeding Status</u>			<u>Site Field Survey</u>
	<u>Possible</u>	<u>Probable</u>	<u>Confirmed</u>	
Sora	X	X	X	
Common Moorhen	X	X	X	
Killdeer	X	X	X	N
Spotted Sandpiper	X	X	X	
Upland Sandpiper	X	X	X	
Common Snipe	X	X	X	
American Woodcock	X	X	X	
Ring Billed Gull	X		X	N
Herring Gull			X	N
Rock Dove	X	X	X	
Mourning Dove	X	X	X	N
Black Billed Cuckoo	X	X	X	
Yellow Billed Cuckoo	X	X	X	
Eastern Screech Owl	X	X	X	
Great Horned Owl	X	X	X	
Common Night Owl	X	X	X	
Chimney Swift	X	X	X	
Ruby Throated Hummingbird	X	X	X	
Belted Kingfisher	X	X	X	
Red Headed Woodpecker	X	X	X	
Red Bellied Woodpecker	X	X	X	
Downy Woodpecker	X	X	X	P
Eastern Woodpewee	X	X	X	
Willow Flycatcher	X	X	X	
Least Flycatcher	X	X	X	
Eastern Kingbird	X	X	X	
Tree Swallow	X	X	X	N
Barn Swallow	X	X	X	N
Blue Jay	X	X	X	

Table No. 3-9 (continued)

BIRDS NOTED TO OCCUR WITHIN ERIE COUNTY

<u>Species</u>	<u>Breeding Status</u>			<u>Site Field Survey</u>
	<u>Possible</u>	<u>Probable</u>	<u>Confirmed</u>	
American Crow	X	X	X	N
Black Capped Chickadee	X	X	X	P
Nuthatcher (Red/White Breast)	X	X	X	
House Wren	X	X	X	N
Marsh Wren	X	X	X	N
Eastern Bluebird	X	X	X	
Veery	X	X	X	P
Wood Thrush	X	X	X	N
American Robin	X	X	X	N
Grey Catbird	X	X	X	
Cedar Wawing	X	X	X	
European Starling	X	X	X	P
Warbling Vireo	X	X	X	P
Yellow Warbler	X	X	X	
American Redstart	X	X	X	
Ovenbird	X	X	X	
Louisiana Water Thrush	X	X	X	
Mourning Warbler	X	X	X	
Common Yellow Throat	X	X	X	
Canada Warbler	X	X	X	
Scarlet Tanager	X	X	X	
Northern Cardinal	X	X	X	
Rose-breast Grosbeak	X	X	X	P
Indigo Bunting				
Rufous Sided Towhee	X	X	X	
Chipping Sparrow	X	X	X	
Field Sparrow	X	X	X	N
Savanna Sparrow	X	X	X	P
Swamp Sparrow	X	X	X	P

Table No. 3-9 (continued)

BIRDS NOTED TO OCCUR WITHIN ERIE COUNTY

<u>Species</u>	<u>Breeding Status</u>			<u>Site Field Survey</u>
	<u>Possible</u>	<u>Probable</u>	<u>Confirmed</u>	
White Throated Sparrow	X	X	X	
Babolink	X	X	X	
Red Winged Black Bird	X	X	X	N
Eastern Meadowlark	X	X	X	
Common Grackle	X	X	X	
Brown Headed Cowbird	X	X	X	
Northern Oriole	X	X	X	P
Purple Finch	X	X	X	
House Finch	X	X	X	
American Goldfinch	X	X	X	

N - Noted on site

P - Possibly on site, no positive identification

Source: Anderle and Carroll 1988, Atlas of Breeding Birds in New York State, Cornell University Press 1988.

Table No. 3-10

LIST OF FISH PRESUMED TO BE PRESENT IN CAYUGA CREEK
IN PROXIMITY TO THE UNION ROAD SITE

Species

Pimephales notatus
Ictalurus nebulosus
Perca flavescens
Lepomis spp.
Esox lucius
Cyprinus carpio
Carrasius auratus
Catostomus commersoni
Morone chrysops
Notropis atherinoides
Micropterus salmoides
Micropterus dolomieu
Lepomis gibbosus
Aplodinotus grunniens
Petromyzon marinus

Species

Moxostoma spp.
Notropis hudsonius
Notropis cornutus
Notemigonus crysoloueus
Ambloplites rupestris
Etheostoma nigrum
Semotilus acromaculatus
Umbra limi
Dorosoma cepedianum
Pimephales promelias
Hypentelium nigricans
Salmo gairdneri
Onchyrinchus kisutch
Onchyrinchus tshany tscha

Source: Personal Communications, Mr. Michael Wilkinson, NYSDEC, Bureau of Wildlife,
Region 9, Buffalo, New York.

Concerning existing Health Advisories for fish consumption, downstream of the site in the Buffalo River in Erie County, below the confluence of Cayuga Creek and Slate Bottom Creek, NYSDEC recommends no consumption of carp (Cyprinus carpio). It should be noted that during site reconnaissance, a number of dead fish, as well as live fish (perhaps catfish), about 6 to 10 inches in length, were observed in Slate Bottom Creek just upstream and adjacent to the site. Minnows approximately 3 inches in length, were observed in Deer Lik Creek.

3.1.7.6 Reptiles and Amphibians

The only form of these types of organisms observed on site were tadpoles, probably of leopard frog (Rana pipens), within the marsh/Tar Pit Area. On-site marshes would provide suitable habitat for a variety of turtles such as wood, painted or spotted varieties. Water snakes may also be present. Near the Roundhouse Area with the presence of rock, rubble, cement structures, a variety of snakes and lizards may be found during the warmer months, although none were noted during the May field reconnaissance. (It should be noted that a few dead frogs were observed in the area of the marsh downstream of the Tar Pit.)

3.1.7.7 Rare Species and Critical Habitats

No threatened or endangered species were observed on-site. The disturbed nature of the site and continued reforestation would continue to provide suitable habitat for overflow organisms common throughout the region to populate the site as a result of residential development in the area, especially to the north and east. The most major of these organisms would be deer.

To ensure that rare species have not been noted on-site, an endangered species review was requested of NYSDEC Significant Habitats Unit. The result of that correspondence is presented in Appendix D. As noted, no rare or critical habitats are indicated at the site. In addition from that survey, no potential impact to endangered, threatened or rare species or other significant habitats were identified.

3.1.7.8 Biological Associations Found in the Project Vicinity

As discussed earlier within the ecology section, the site consists of a number of vegetative cover types and communities. Specifically, eight distinct vegetative communities can be found on site. These include the following habitats:

- o Poned water habitats – Depression areas with low permeability soils which entrap water. These areas do not have a constant source of access to creek/river systems.
- o Flowing water habitats – Those areas on or adjacent to the site having water flow as typified by Deer Lik Creek, Slate Bottom Creek and two unmanned feeder creeks draining the wetlands/marsh area downstream of the Tar Pit.
- o Emergent wetlands are typically those areas which border the flowing water (limeric zone) and semi standing water permanent and have water during the year, especially at a high flood level. These areas typically provide for emergent wetland plant species, such as reed grasses, Phragmites spp. and cattails, Typha spp.
- o Forested wetlands are those areas having standing water at some time during the year which is sufficient to allow hydrophilic forms of scrubs and hardwoods to grow, such as Buttonbrush, Cephalanthus spp., Birches, Betula spp., Alders, Alnus spp. and Red Maple, Acer rubrum.
- o Vacant lands – As the name implies, these are open areas which had been previously disturbed via site operations and activities. These areas, at least outwardly, do not have structures, foundations or debris associated with these habitats. Typical vegetation in these areas consist of upland grasses, burrweeds and thistle.
- o Disturbed lands – Although the majority of the Union Road Site can be considered to be disturbed, in the present context, these areas include outward signs of past site use. Such areas include the old railroad Roundhouse Area and debris piles near the Tar Pit as well as the Tar Pit itself. These disturbed lands support plant species that have high tolerance to wastes as well as hardy

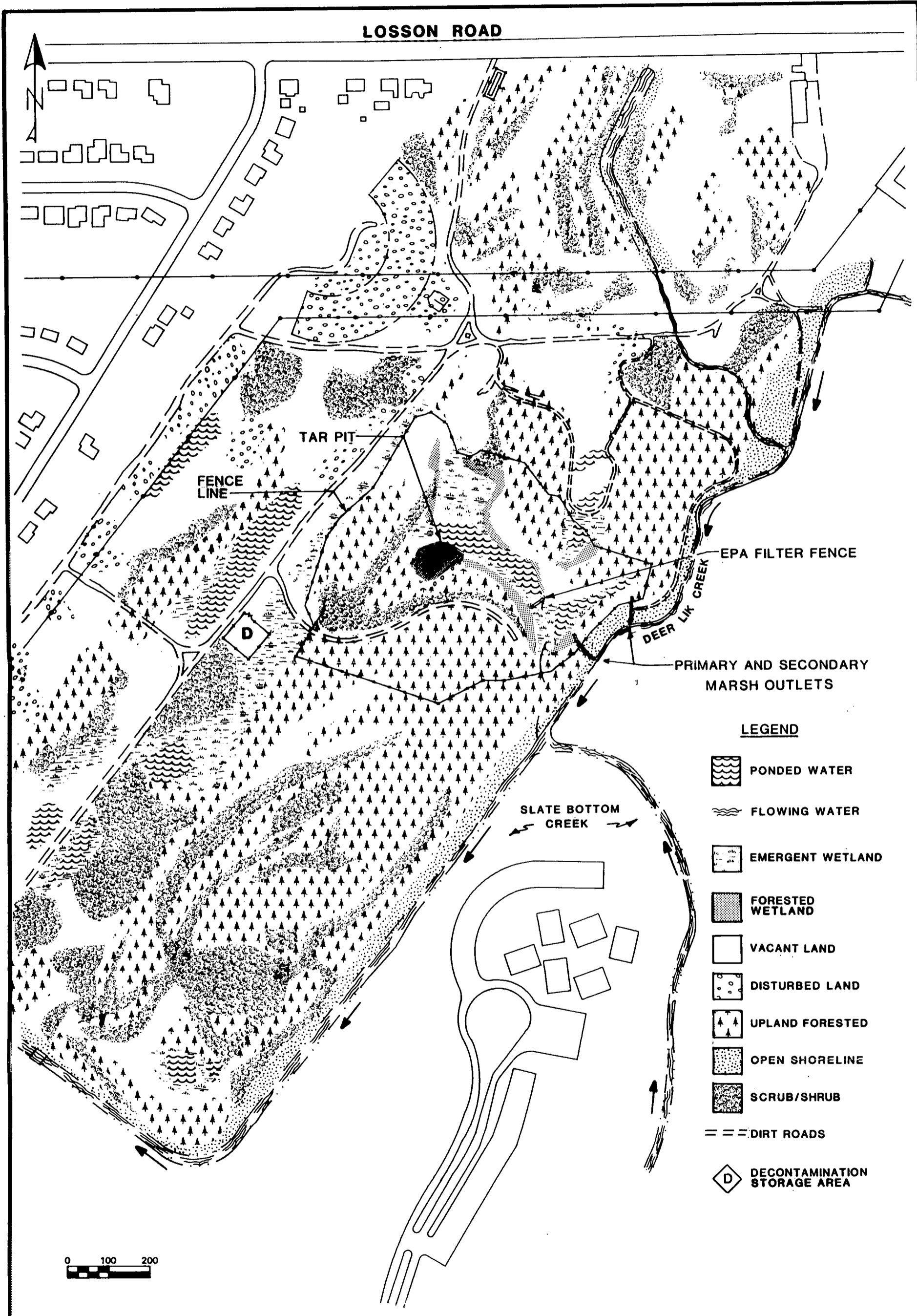
grasses and weeds that can reproduce quickly and colonize a small area between disturbances. Such plants include Black Eyed Susan, Rubeckia hirta, Goldenrod, Solidago spp. and Sow Thistle, Sonchus spp.

- o Upland forested areas - An early-mid successional upland community is also established within the site vicinity. This area is generally interspersed in the center of the site adjacent to scrub/shrub areas. These upland forested areas are divided into a number of smaller parcels separated by a network of dirt roads, paths and cleared areas resulting from previous and present site activities. These upland areas support a number of hardwood trees as well as some shrub species. However, throughout the site, these areas show only moderate vegetation coverage when compared to dense forested areas elsewhere in the County. Species which are dominant in these areas include White Birch, Quercus spp., American Elm, Ulmus americana and Sugar Maple, Acer saccharum. In these forested areas, the overall vegetation cover was predominantly sparse with some small densely vegetated areas.

- o Open shoreline - These areas are located in proximity to the creek system forming the site borders. These areas are essentially cleared of high vegetation and may coincide with flood plains of Deer Lik Creek and Slate Bottom Creek. These areas support an abundance of low grasses and some hydrophillic scrub/shrub species, such as bullrush, Scirpus spp. and pinkweed, Polygonum spp. and rushes, Juncus spp.

A presentation of the approximate locations of these vegetative communities appear in Figure No. 3-30.

Although quantitative data relating animal and plant abundance to the vegetative cover types was beyond the scope of the Remedial Investigation, qualitative associations of the plants and animals noted at the site, as well as other species not observed, but presumed to be present, can be made. A presentation of these associations is presented in Table No. 3-11.



UNION ROAD SITE

VEGETATIVE COVERTYPES

Table No. 3-11

ANIMAL AND VEGETATIVE COVERTYPE ASSOCIATIONS
WITHIN THE UNION ROAD SITE

<u>Species</u>	<u>Ponded Water</u>	<u>Flowing Water</u>	<u>Emergent Wetland</u>	<u>Palustrine Forested Wetland</u>	<u>Vacant Lands</u>	<u>Disturbed* Lands</u>	<u>Upland Forested</u>	<u>Open Shoreline</u>
<u>Plants</u>								
White Birch							X	
Common Ragweed					X	X		
Reed Grass	X		X			X		
Green Algae	X	X	X					
Mosses				X		X	X	
Cattails	X		X					
Oak							X	
Goldenrod					X	X		
Sumac					X	X		
Red Maple			X	X				
Switch Grass					X	X		
Thistle					X	X	X	
<u>Animals</u>								
Rabbits					X	X	X	
Mice			X				X	
Rat			X		X	X	X	
Meadow Vole			X		X	X	X	X
White Tailed Deer			X	X			X	X
WoodChuck			X	X			X	
Opossums			X	X				
Crow			X		X	X		
Red Winged Blackbird					X	X	X	
Morning Dove					X	X		
Killdeer					X		X	
American Robin					X	X		

Table No. 3-11 (continued)

ANIMAL AND VEGETATIVE COVERTYPE ASSOCIATIONS
WITHIN THE UNION ROAD SITE

<u>Species</u>	<u>Ponded Water</u>	<u>Flowing Water</u>	<u>Emergent Wetland</u>	<u>Palustrine Forested Wetland</u>	<u>Vacant Lands</u>	<u>Disturbed*</u> <u>Lands</u>	<u>Upland Forested</u>	<u>Open Shoreline</u>
<u>Animals (continued)</u>								
Hawks					X	X		X
Starling					X	X	X	
Woodpeckers				X			X	
Sparrows			X		X	X	X	
Blue Jay				X	X		X	
Wrens			X		X		X	
Northern Oriole			X	X			X	
Tadpole (<u>Rana Pipiens</u>)	X	X	X					
Fish Species	X	X						

* Although the entire site can be considered "disturbed land," in this context these lands include portions of the site which still have extant structures or debris piles which are largely unvegetated.

3.1.7.9 Habitat Values of Vegetative Zones Within the Project Site

The complete assessment of habitat values of the respective vegetative covertypes encountered in the Union Road Site is an involved process. In general, the assessment of habitat value provides for assessments of primary functions, such as food chain production, specialized habitat and hydrologic interactions. As part of the analysis, cultural values concerning recreation aesthetics or other special features also need to be made.

Notwithstanding the above, based on the information gathered during the Phase I RI, a simple qualitative approach can be made to establish a relative hierarchy of habitat value of the vegetative covertypes found at the Union Road Site. It should be noted that this approach is a very subjective process. Those functions assumed to be high in relative efficiency or importance are ranked as a 3 - high, 2 - moderate, and 1 - low. Specific factors and brief descriptions which were utilized in the habitat value analysis of the Union Road Site qualitative evaluation are as follows:

- o Food Chain Production - This factor determines the growth of vegetation in a habitat and influences the populations and secondary productivity of animals that feed on the plants, or that feed at high trophic levels in the community.
- o Primary Productivity - Primary productivity is a measure of the stored food potential of the vegetation in excess of that used by the plants in metabolism. This determination provides an overall measure of the energy input directly available to the consumer species. It should be noted that the possible range of productivity values, both within and between particular environments, is extremely variable and dependent on a number of local conditions. For the present analysis literature values for primary productivity as a function of biomass was utilized.
- o Nutrient Transport Function - Transport of nutrients in detrital-based food chains is strongly dependent on the hydrologic characteristics of the particular ecosystem. For example, wetlands located in lower lying areas export more detrital material than do the higher marsh areas infrequently affected by creek/river overflow. Similarly, detrital transport in riverine systems is dependent on the river flow regime, especially during periods of peak discharge. In contrast, very little detrital material is exported from isolated ponds and marshes, except during periods of episodic overflow resulting from exceptionally high precipitation.

- o Food Chain Support - This function refers to the secondary productivity values of consumer species that a particular ecosystem can support. Secondary productivity is an overall measure of the efficiency of the habitat in terms of available nutrients to higher trophic levels.
- o Hydroperiod - This factor refers to the frequency of inundation either by river flow runoff or direct precipitation. Areas of good hydrologic linkage helps to maintain a regular interchange of nutrients and other materials necessary to support diverse flora and fauna.
- o Elevational Location - From the above, it is apparent that hydrologic relationships will progressively deteriorate as the depth of flooding decreases. The weakest hydrologic linkages exist in those areas physically isolated from other areas in the system.
- o Vegetative Characteristics - The effectiveness of wetland vegetation to abate erosion depends in part on the width of the vegetated area and its buffering affect in reducing water energy. However, it must be emphasized that this factor is extremely variable and dependent upon location and width of the buffer zone and vegetation type.
- o Cultural Evaluation - This particular factor is difficult to assess in specific detail because of the number of socio-economic considerations which may be involved. Hence, the evaluation in relation to local residential, commercial or industrial development is largely left to the professional judgement of the field personnel on a specific case-by-case basis.
- o Recreation - Recreation is a vital personal and social need which provides opportunity for self expression, physical exercise and a change of pace from normal or routine activities. Outdoor recreation is a major leisure activity and is growing in national importance with a trend towards a higher standard of living. A significant portion of the total recreational output is water-based or water-related. As such, greater weight is given to those types of habitats.
- o Socio - Economic - This factor pertains to benefits which can directly pertain to renewable resources, recreational enjoyment or other features associated with a particular habitat.

- o Aesthetics - Selected types of habitats are distinctive landscape features which can please the aesthetic sense through the intrinsic appreciation of natural beauty. Wetlands, or any other type of natural landscape, can also be offensive if their features have been adversely modified by incompatible human activities. Aesthetic value can be largely determined by the degree of visual diversity and contrast between the physical elements, such as landforms, waterbodies, vegetation types and land use types.

- o Water Purification Factor - Through a variety of physical, biological and chemical processes, some habitats function to naturally purify water by removing organic and mineral particulate matter from runoff and/or rivers and streams. For example, wetlands may be significant in minimizing some of the harmful effects of pollutants introduced into natural ecological systems by the activities of man. Thus, the presence of wetlands, especially those part of riverine or estuarine systems, can be an integral part of water quality and pollution control objectives.

Based upon the above factors, an attempt to provide a qualitative analysis of the habitat value of the vegetative communities at the Union Road Site is presented in Table No. 3-12. Based upon these results, those habitats in descending order from high to low value are as follows:

- o Emergent wetland;

- o Flowing water habitats and open shoreline;

- o Palustrine forested wetland;

- o Upland forested areas;

- o Ponded water habitats;

- o Vacant and disturbed lands.

Table No. 3-12

QUALITATIVE HABITAT VALUES*
UNION ROAD SITE

<u>Evaluation Factors</u>	<u>Ponded Water</u>	<u>Flowing Water</u>	<u>Emergent Wetland</u>	<u>Palustrine Forested Wetland</u>	<u>Vacant Lands</u>	<u>Disturbed* Lands</u>	<u>Upland Forested</u>	<u>Open Shoreline</u>
Food Chain Production								
Primary Productivity	3	1	3	2	1	1	2	2
Nutrient Transport	1	2	3	2	1	1	1	2
Food Chain Support (i.e., Nesting, etc.)	2	2	3	2	1	1	2	2
Hydroperiod	1	2	2	2	1	1	1	2
Elevational Location	1	2	2	2	1	1	1	1
Vegetative Characteristics	2	1	2	3	1	1	2	1
Cultural Evaluation								
Recreation	1	3	2	2	1	1	2	3
Socio - Economic	1	3	1	1	1	1	2	3
Aesthetics	1	3	2	2	1	1	2	3
Water Purification Factor	<u>1</u>	<u>1</u>	<u>2</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>
TOTALS	14	20	22	19	10	10	16	20

*Scoring is as follows: 3 - high value
2 - moderate value
1 - low value

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