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DRAFT

CITY OF ROCHESTER

EXHIBIT
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COURT STREET PARKING GARAGE

SOIL REMEDIATION
FEASIBILITY STUDY

Seeler Associates
ENVIRONMENTAL CONSULTANTS

FEBRUARY 1994

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CITY OF ROCHESTER

COURT STREET PARKING GARAGE

SOIL REMEDIATION FEASIBILITY STUDY

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1.0 - INTRODUCTION

1.1 Purpose

The purpose of this report is to present an analysis of remedial alternatives and to make recommendations for the selection of a remedial approach which addresses soils containing stoddard solvent found in the area between the planned Court Street Parking Garage and the Bausch & Lomb Corporate World Headquarters building currently under construction, see Figure 1. The objective of the remedial approach will be to minimize the migration of contaminants from soils at the site and/or to reduce the levels of contaminants within the soil to levels which will not adversely impact groundwater or human health. The report is also intended to serve as documentation of the level of effort undertaken by the City to select an appropriate remedial alternative in an effort to support cost recovery activities currently under way.

1.2 Background

The City of Rochester retained Seeler Associates to conduct a site characterization investigation of the area which will compose the east end of the Court Street Parking Garage, the current location of Speedy Cleaners, and to develop a work plan for the handling and disposal of soils containing stoddard solvent and perchloroethylene within the proposed construction area. The work is summarized in our report dated February 1994 and entitled "Investigation Report and Soil Removal Work Plan for the Court Street Parking Garage Site."

As a result of the site characterization investigation report prepared to support the construction of the City's parking garage project, the soil in this area of the parking garage has been found to be contaminated with volatile organic compounds and stoddard solvent. A portion of this soil will be removed, as defined in the above referenced February 1994 report. It is believed, however, that the contaminants identified by the site characterization investigation have effected an additional 3,000 to 4,000 cubic yards of soil, beneath the area of concern, which will not be removed in order to facilitate construction. In this area, field observations and soil sample results indicate that contaminants are present at elevated levels to a depth of at least eighteen feet below groundsurface. It is believed that both the contaminants and their concentrations vary through the volume of soil currently planned to remain on the site. The contaminants present consist of the same suite of compounds reported in the Investigation Report and Soil Removal Work Plan for the Court Street Parking Garage. This feasibility study has been prepared to address a remedial approach for this additional 3,000 to 4,000 cubic yards of soil.

1.3 Report Format

The remainder of this feasibility study will be presented in three sections. Section 2 will present the Project Constraints and the Selection Criteria used to select a recommended approach. Section 3 will present a discussion of the Potential Remedial Technologies selected for evaluation and will include the following sections:

- a technology description;
- a discussion of effectiveness;
- a discussion of implementability; and
- estimated costs.

Section 4 will present our recommendations including a discussion of the rationale for selection (selection process) and a presentation of the conceptual design.

2.0 - PROJECT CONSTRAINTS AND SELECTION CRITERIA

2.1 General

This section of the report first establishes the constraints which apply to the project. In addition, we discuss our selection criteria which will be utilized to judge each technology and used to select our final remedial alternative. The constraints and selection criteria are discussed in the following sections.

2.2 Project Constraints

First we present the project cleanup objectives. A description of the nature and extent of contamination follows. Project scheduling constraints and a potential beneficial use determination for the contaminated soil are then discussed.

2.2.1 Cleanup Objectives

Since stoddard solvent is a petroleum derived product, the NYSDEC STARS Memo #1 will be utilized to establish cleanup levels. In particular, Table 2 of the STARS Memo #1, entitled "Guidance Values for Fuel Oil Contaminated Soil" will serve as the basis for establishing cleanup criteria for the purpose of assessing remedial alternatives.

2.2.2 Nature and Extent of Contamination

The site to be addressed has been defined by the previous site characterization work and extends from the planned Court Street Parking Garage to the west wall of the Bausch & Lomb World Headquarters Building. From Court Street northward, the site will extend to the parking garage access tunnel which connects the Bausch & Lomb World Headquarters Building to the parking garage, see Figure 2. Beneath the site we have identified four units; fill, an undisturbed silt and sand, a dense silt and sand (glacial till), and bedrock. These units are shown on two cross-sections of the site as they relate to the existing buildings and the planned Court Street Parking Garage, see Figures 3 and 4. The fill layer consists of soil with varying amounts of brick and cinders and extends to a depth of approximately ten feet below groundsurface. The undisturbed layer of silt and sand has a variable consistency ranging from silt to sand with minor or trace amounts of silt. The dense silt and sand, identified at approximately 15 feet below groundsurface and extending to approximately 26 to 30 feet, is more uniform than the layer above and was very difficult to penetrate (dense). Bedrock was tentatively identified in several of our borings, but is believed to be at a depth of approximately 26 to 30 feet below groundsurface.

The zones of contamination were identified through analysis of soil samples and Hnu measurements. In general, the contaminants appeared to be restricted to the fill and the undisturbed silt and sand layer. Elevated contaminant concentrations and Hnu readings were found in soils directly below the concrete floor slabs within the Speedy building. Both contaminant concentrations and Hnu measurements were significantly lower or non-existent once the dense silt and sand was penetrated.

2.2.3 Area and Extent of Remediation Measures

The horizontal limits of contamination are represented in Figure 2. The vertical extent of the remediation efforts will be limited to the zone which extends from the dense silt and sand (glacial till). The actual depth of the remediation will be approximately 15 feet below groundsurface. The surface of the dense silt and sand was selected as the limit because its permeability is very low and its characteristics appears to serve as a confining layer. Further, the low contaminant concentrations found within the dense silt and sand are below clean up criteria established by the NYSDEC STARS Memo.

The contaminants of concern are Stoddard solvents and the anticipated concentrations are assumed to be consistent with the soil sample results collected by Seeler Associates. The volume of soil to be removed containing perchloroethylene is expected to be small and will be removed during work efforts outlined in the February 1994 work plan.

2.2.4 Scheduling Requirements

As a result of recent court decisions and timing requirements for utility relocations, the City's schedule for remediation and construction has been severely constrained. These constraints factor heavily into the selection of remedial approach and are outlined as follows:

- First, the court has delayed the vacancy of the Speedy building from February 15 to March 20, 1994. Asbestos abatement of the Speedy building will begin on March 21st and has a scheduled duration of three weeks completing on April 11, 1994, and demolition and excavation of the Speedy building will begin on April 11th and has a scheduled duration of eight weeks ending on June 6, 1994. Access to soils beneath the Speedy building can not occur until demolition is complete.

- Rochester Gas and Electric (RG&E) must take control of the planned route of their 115 Kilo-volt service relocation on April 15th. The re-routing of the major electric service has a firm and fixed schedule. The RG&E work must be completed by June 1, 1994 to service the peak electric load season.

As a result of these limitations, the City must implement a two phase remedial approach. The first phase addresses soils along the proposed RG&E relocation. The second phase addresses soils beneath the existing Speedy Cleaners structures.

2.2.5 Applicability of Beneficial Use Determination

A letter report to Mr. Mitchell T. Williams, the attorney representing Speedy Cleaners, from the Sear-Brown Group, dated November 1, 1993, suggests that under New York State Solid Waste Regulations 6 NYCRR Part 360, leaving the contaminated soil on site is an acceptable alternative to landfilling of soil. Section 360-1.15 addresses beneficial use of solid waste. Specifically Paragraph 360-1.15 (b)(8) states that "beneficial use may be applied to non-hazardous, contaminated soil which has been excavated as part of a construction project, and which is used as backfill for the same excavations containing similar contaminants and the same site." The letter proceeds to assume that no further actions would be required. It is believed that this assumption is incorrect. A telephone conversation with Mr. Edward Kieda of NYSDEC on February 17, 1994 confirmed that additional remedial efforts may be required to prevent contaminants left on site from adversely impacting groundwater or human health. Paragraph 360-1.15(b)(9) gives the NYSDEC the opportunity to require further remediation of this soil, the paragraph states that "beneficial use may be applied to non-hazardous petroleum contaminated soil which has been decontaminated to the satisfaction of the department and is being used in a manner acceptable to the department." The Spill Technology and Remediation Series (STARS) document entitled "STARS Memo #1, Petroleum - Contaminated Soil Guidance Policy, August 1992" defines the criteria that determines satisfactory decontamination. Therefore, the STARS Memorandum will be applied at this site.

Beneficial reuse of the soil will be addressed where appropriate in the feasibility study to reduce potential soil disposal costs. It is our interpretation, however that the beneficial use clause of the state's solid waste management regulations only addresses excavated soil whose quality meets the state's clean up objective for the protection of groundwater quality, protection of human health, and nuisance characteristics. This determination is made by the NYSDEC after submission of appropriate documentation.

2.3 Selection Criteria

The selection of an appropriate remedial alternative will be developed using the following selection criteria. These criteria are shown in the order of their importance in the selection process:

2.3.1 Ability to Meet the Cleanup Objectives

The remedial alternative must have regulatory approval, and the soil quality must meet the NYSDEC clean up objectives after treatment or a suitable remediation system will be constructed that will either reduce the contaminant concentrations over time or immobilize the contaminants such that they are no longer a threat to water quality, human health or have nuisance characteristics.

2.3.2 Ability to Meet the Construction Schedule

The selected remedial alternative must be in place or completed in order not to delay the construction of the parking garage, the RG&E 115KV Power Line relocation or the Bausch & Lomb World Headquarters project.

2.3.3 Ability to be Implemented at the Site

This criterion focuses on the technical feasibility and availability of the technology being evaluated and the administrative feasibility of implementing the technology. Technologies that are technically or administratively infeasible or require specialized equipment or individuals not available within a reasonable time period may be eliminated from further consideration.

The site will be active with construction workers and equipment and as a result, space for on site treatment activity or stock piling of soil will be limited. In addition to the workers on site, the site is located within an active commercial and retail business area of the City, consequently considerations must be given to pedestrians, traffic and surrounding building occupants.

2.3.4 Cost Effectiveness

The cost of construction and any long term costs to operate and maintain the alternative will be considered. Costs that are grossly excessive compared to the overall alternative effectiveness may be considered a factor used to eliminate the alternatives. Alternatives providing effectiveness and implementability similar to that of another alternative, but at a greater cost, can be eliminated from consideration.

3.0 - POTENTIAL REMEDIAL TECHNOLOGIES

3.1 General

Four remedial approaches have been selected for evaluation and include:

- excavation;
- containment;
- in situ bioremediation; and
- soil bio-venting.

These technologies will be discussed in the following sections. If it can be determined that a technology is not feasible during one of the evaluation stages, the technology will be dropped from further evaluation.

3.2 Options

3.2.1 Excavation

The excavation of contaminated soil will be considered an applicable remedial technology. Excavation coupled with on site treatment and reuse and excavation coupled with disposal in an appropriate landfill will be discussed.

Description

This option will consider using conventional excavation practices to remove the contaminated soil, place it in trucks and haul to an appropriate landfill. To meet construction schedules this work must be sequenced to accommodate the installation of the RG&E electric service located beneath the re-routed of Stone Street (B&L Place) and the demolition of the Speedy building. To accomplish this sequencing, it will be required that the excavations be sheeted using soldier piles and lagging (see Figure 5), to prevent subsidence below existing structures while maximizing the volume of soil excavated. The use of this structure support system is common and is currently in use on the Bausch & Lomb site.

Two options are being evaluated for the disposal/treatment of the contaminated soil: disposal in an appropriate landfill and on site treatment using thermal stripping. An appropriate permitted landfill for soil disposal will be identified by the City and the material will be transported to the landfill for disposal. On site thermal stripping of the soil will consist of a thermal stripping unit. Depending upon the contractor each thermal unit can be slightly different in physical layout, but in essence the units are low temperature kilns which heat the soil to vaporize the contaminants from the soil. The contaminants then enter an after burner chamber which thermally destroys the contaminants and releases only water vapor and carbon dioxide.

Effectiveness

Excavation is an effective technology for removing contaminants and thereby meeting soil clean up objectives. Problems can arise if contaminants follow a small seam and large quantities of soil are required to be excavated to remove small quantities of contaminant mass. Since the site is underlain by a dense, a low permeability silt and sand unit that does not appear to be significantly contaminated, excavation would only be used to remove soil found in the upper 15 feet of the overburden. If soil contamination is found to extend outside the limits of the area of concern, for example south beneath Court Street, these soils would be left in place.

The effectiveness of the disposal options is dependent on the integrity of the landfill or the treatment equipment. The effectiveness of the landfill is, to a limited extent, ensured by the regulatory agency which permits the landfill operation. However this does not mean that it removes all long term liability. The effectiveness of the thermal stripping unit is based on the contaminants involved, their concentration, and the residence time the soil has in the unit. Verification samples will be required as the soil is processed to ensure the treatment is complete. These units have been permitted for work in New York and have been found effective on the contaminants in question.

Implementation

Excavation of the soil can be implemented successfully. As previously mentioned, depending on the sequencing of the work the use of support systems may be required to ensure the stability of the existing buildings. In addition, during the excavation planning, allowances will have to be made for the collection water in the excavation from snow or rain, decontamination areas will be required, and room on site must be made available for the purposes of stock piling soil prior to disposal.

The disposal of contaminated soil in an appropriate landfill is straight forward, however the waste will have be loaded onto trucks which will take some coordination between the excavation contractor, the trucker, and the landfill. In addition, the waste will have to be transported with a bill of lading and the truck properly placarded. As mentioned above, the site will have to be organized with decontamination areas and areas for soil stockpiling.

The treatment of contaminated soil in the thermal stripping unit will require additional considerations for implementation. Many of these considerations will involve the sampling of the treated soil and logistics of the site operation. A sampling plan for the treated soil will be prepared and carried out to ensure that the soil has successfully been treated. In addition, the state may also require air monitoring and sampling of the unit's off gas discharge. These considerations in themselves are not insurmountable but will require planning, as will the logistics of the thermal unit operation. The operation of a thermal stripping unit requires an area of approximately 50 feet by 80 feet. This does not include areas required for stock piling of soil. The thermal stripping process can treat approximately 18 to 25 tons of soil per hour and the operation typically runs continuously with shut-downs only for repair. It is apparent that the excavation of contaminated soil will progress faster than the treatment capacity of the thermal stripping process.

Estimated Cost

The estimated cost for excavation and disposal in an appropriate landfill is shown on Table 1. The costs are based on the excavation and disposal of approximately 3,700 cubic yards of soil which will be classified as non-hazardous special waste. For the purposes of costing transportation and disposal, we assumed using truck trailers holding approximately 22 tons of soil, having a 30 mile round trip to the landfill, and having a tipping fee of $27.50/ton. The estimated capital cost, which includes construction and supervision and site monitoring is $633,000.00. The detailed cost breakdown for this review is provided in the appendices.

The estimated cost for excavation and thermal treatment of soil has many of the same costs associated with landfilling the soil. The costs differ in that instead of a landfill cost, there will be an on-site treatment cost. The thermal treatment carries a unit price 8 to 21 dollars per ton greater than landfilling. After treating the soil, it could be replaced in the excavation providing some cost benefit. However, given the space requirements of the thermal unit and the production rate of the process (18 to 20 tons per hour), which is significantly slower than the production rate of the excavation, and space requirements to stockpile soil, it appears that the technology is not logistically feasible nor is there a cost benefit in using the technology.

3.2.2 Soil Stabilization

In situ soil stabilization was evaluated as a soil remedial option. There would not be any excavation or disposal associated with this process.

Description

In situ soil stabilization is generally conducted with a shallow soil mixing rig when contaminants exist up to 40 feet below ground surface. A hydraulic mechanical mixing auger would be mounted on a crane or backhoe. As the auger is progressing down through the soil, a grout mixture combined with chemical reagents, is injected into the soil, and the soil and grout is mechanically mixed by the rotation and/or withdrawal of the auger. From the mixing process, the grout additive(s) chemically bond with, and immobilize, thus stabilizing, the existing soil contaminants. The process produces an encapsulated solid block of the contaminated soil, which is designed to have high structural integrity and a low permeability.

The size, type, and number of augers utilized per rig, vary between contractors, however, at the anticipated 15' depth of contamination, a single 8 foot diameter auger is typical. The additives or reagents added to the grout mixture also can vary. A treatability study is required to successfully design and develop the appropriate reagent mix to achieve the desired stabilization effect of the soil.

Effectiveness

Soil stabilization has shown to be successful in immobilizing stoddard solvent contaminants in soil similar in nature to the existing conditions at the subject site. Data from previous applications shows that the process would meet the current clean up criteria, however, a treatability study is required, to ensure that the correct quantities and types of reagents are utilized. Verification sampling of the treated and stabilized soil would also be necessary, to ensure that leaching of contaminants would not occur.

The benefits of soil stabilization include eliminating the need for excavation and thus ex-situ soil treatment and/or landfilling. The potential emission of volatile organic compounds is also reduced, as the process is performed with a wet slurry mixture, which eliminates ideal conditions for volatilization. The finished stabilized product generally has a high unconfined compressive strength, which should facilitate construction requirements on top of the remediated area.

Any future excavation which might be required in the treated area would be difficult, and the risk of releasing immobilized contaminants would exist, should the stabilized soil be disturbed. Also, if excavation is required, the excavated material would probably have to be landfilled as a regulated special waste.

Implementation

The implementation of soil stabilization can be successfully achieved at the subject site. A sample of the contaminated soil would have to be sent to the selected contractor to facilitate the treatability study. A standard time frame for this portion of the process is forty-five to sixty days, as curing time is required. Provided that the treatability study produces positive results, contractor mobilization may begin. This schedule would not be compatible with the current schedule of site activities. Therefore, stabilization will not be considered further.

3.2.3 Containment Structures

There a number of different types of containment structures that can be constructed to contain or restrict the movement of contaminants. The majority of containment structures are used to restrict a mobile contaminant. The structures could be used at this site to limit the infiltration of precipitation. By eliminating water infiltration into the soil, contaminated leachates can no longer be produced and the mechanism for contaminant migration is stopped. In addition, the zone of contamination is above the saturated, therefore contaminated groundwater migration will not be a significant issue. The following types of containment systems will be addressed; high density polyethylene (HDPE) sheeting, and geosynthetic clay liners (GCL). To reduce the amount of duplication, HDPE and GCL will be discussed together because they differ little in concept except for their anticipated performance under the discussion of synthetic liners.

Other containment systems involving sheet piles and slurry walls are not being considered. Sheet piles are not being considered because the soil is too dense too successfully to drive the piles to a depth of 15 feet throughout the site. Slurry walls are not being considered because of anticipated constructibility problems associated with planned and existing buildings and performance problems associated road vibrations.

Synthetic Liners (Description)

Synthetic liners are made of impermeable materials. These liners are typically manufactured in long sheets that are overlapped or chemically welded together to produce the desired area. The sheets are used to eliminate liquid infiltration, collected liquids, or to stop the horizontal movement of liquids. Liners, either composed of natural or synthetic materials, are required for landfills and are also commonly used as primary or secondary containment structures. For the purposes of this evaluation we are examining their use as capping systems and vertical barriers.

Effectiveness

Liners make very effective containment systems, but are not capable of reducing contaminant concentrations. As a result, the use of containment systems alone does not satisfy the objects of the feasibility study. This review is being presented to provide a cost comparison and for potential use with other technologies.

Liner limitations can usually be attributed to their installation or their incompatibility with the chemicals they are containing. Limitations attributed to their installation fall into several categories: improper site preparation which can lead to punctures and settlements of the liner; poorly constructed seams which mate two or more sheets of material and can cause leaks; and chemical incompatibility.

These limitations can be overcome by proper planning and good construction oversight. Chemical incompatibility should not be a concern because the liner will require a layer of sand be placed to provide a cushion and therefore contaminants will not be in direct contact with the liner material. There is a slight potential that contaminated groundwater could come in contact with the liner, but the concentrations of the chemicals in the groundwater are expected to be low based on the groundwater analyses conducted by LaBella Associates for the Phase II investigation. If this technology is selected the liner thickness and composition can be specified to be resistant to chemical attack.

The use of liner containment structures, however, do not reduce or eliminate contamination and as a result, does not meet the objective of the feasibility study. Since the contaminants appear to be well absorbed onto the soil, placing an impermeable barrier between the soil and infiltrating water would effectively contain the contaminants. This concept is an attractive alternative. However, there still will remain a liability which will require long term management and periodic monitoring.

Implementation

Implementation or construction of the liner containment system can be done with conventional construction equipment. Some special instruction may be required for welding of the HDPE material, but this technology is fairly well established in the construction industry and appropriately trained contractors are available.

The site will also required some additional preparation to eliminate sources of punctures, to reduce vertical loads on the material, and to key the liner into the underlying dense silt and sand. The amount of site preparation required will be dependent on the material selected for use, either HDPE or GCL. In each case, site preparation will include grading and compaction of the existing surface, placement of a good quality fill, typically sand, to prevent punctures, and excavation required to key the liner into the dense silt and sand. If GCL are selected additional fill may be required beneath the planned route of Stone Street. Since the GCL is composed of clay it will be susceptible to failure or settlement caused by the road traffic load. GCL requires some additional site preparation, but is fairly easy to install and can heal itself if punctured. HDPE is generally more difficult to install because it is more rigid than GCL and will require chemically welded seams or joints to join sheets. If punctures occur in the HDPE, individual patches will have to be cut and welded over the puncture. In summation, the construction of the liner containment system is compatible with the site and should not impede construction.

Estimated Cost

Costing for the liner containment system is based on the area to be covered and the site preparation required. The technology cost summary is provided in Table 1.

A detailed cost breakdown for each technology assessment is provided in the appendices.

3.2.4 Soil Bio-Venting

Soil bio-venting is a technology which utilizes soil vapor extraction and biodegradation to reduce contaminant concentrations within the unsaturated zone.

Air flow in the subsurface is created by installing a series of air supply vents placed into the contaminated zone along with vacuum extraction point(s). The air flow provides a mechanism to remove the highly volatile component of a complex organic mixture such as stoddard solvent, but also provides an oxygen supply which facilitates in-situ biodegradation.

This technology is relatively experimental, yet has been proven successful for the remediation of petroleum based contaminants in several limited applications. Bio-venting conducted in the unsaturated zone is sensitive to climatic conditions (air and soil temperatures) and the air permeability of the soil. Consequently, the technology has been most successful when applied to homogeneous soils with relatively high conductivity and relatively uniform grain size.

Effectiveness

The effectiveness of the technology is dependent on several factors that can limit the success of the treatment; the chemical compounds present, the concentrations of the chemical compounds, the homogeneous of the soil and therefore the ability to uniformly transport oxygen to the micro-organisms and transport volatile components from the soil, and the temperature of the soil/air mixture. Some of these parameters can be enhanced to provide improved treatment conditions. For example, the soil can be "turned over" to break up the soil matrix which would result in better air flow conditions, or the soil/air mixture can also be heated or covered to increase the soil temperature. These enhancement options were not considered feasible at the Speedy Cleaners site because of project timing constraints, cost, and the fine grained soil is not suitable for vapor extraction. As a result, the use of soil bio-venting does not appear feasible without the use of enhancement technologies and was not considered for further evaluation.

4.0 - SUMMARY CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary

The purpose of the feasibility study is to analyze potential remedial alternatives and make recommendation for the selection of a remedial approach that addresses soil contaminated with Stoddard solvent. The objective of any remedial approach considered to minimize the migration of contaminants from the on site soil and/or reduce the contaminant concentrations to levels which would not adversely impact groundwater or human health.

4.2 Conclusions

The area to be remediated was been defined by the previous site characterization work and extends from the east wall of the planned Court Street Parking Garage to the west wall of the Winter Garden building of the Bausch & Lomb World Headquarters Building. The site also extends southward to Court Street and north to the tunnel which connects the Bausch & Lomb World Headquarters Building to the parking garage, see Figure 2. The chemical compounds detected in the zone of contamination are consistent with petroleum based Stoddard solvent. The source of these compounds is believed to be the Speedy Cleaners building where Stoddard solvent is used and stored. Based on the presence of Stoddard solvent the NYSDEC's STARS Memo #1 (STARS) was applied when establishing cleanup objectives.

The zone of contamination consists of miscellaneous fill material, soil, brick, and cinders, and an undisturbed silt and sand layer. The zone of contamination is vertically limited to the approximate top of the dense silt and sand layer (glacial till). We have defined the zone in this way since chemical concentrations below the dense silt and sand meet guidance clean up levels provided in STARS . We believe that the dense silt and sand layer has limited the migration of contaminants and will provide a barrier to nuisance odor migration because of its apparent low permeability. We have made this assessment based on the soil density and soil grain size analysis, which indicates that this layer is composed of greater than 50-percent silt and clay sized particles.

After evaluating excavation, containment, and bio-venting technologies as potential remedial candidates, we have selected excavation and landfill disposal of contaminated waste for our recommended remedial technology. Excavation and landfilling of waste soil significantly reduces the amount of contamination on site and is cost effective in comparison to bio-venting. The other technologies were eliminated from consideration for the following reasons:

Excavation and On Site Thermal Soil Treatment

Excavation and on site thermal soil treatment was eliminated from consideration because it did not fit into the logistical plan for the site or the construction schedule. The processing of soil would proceed at a slower rate than the excavation of the soil. Further, insufficient space was available for the thermal unit itself. As a result, contaminated soil would need to be stockpiled on site while waiting for treatment. The stockpiling of soil would restrict access to the site and may cause delays in the construction schedule. In addition, on site treatment of the soil was slightly more expensive than direct landfilling of the contaminated soil.

Containment

Two containment options were evaluated, steel sheet piles and synthetic liners. Steel sheet piles were eliminated because they would not penetrate the dense silt and sand layer. Synthetic liners were eliminated from consideration because they do not reduce or eliminate the level of contamination present in the soil. The liner cost was estimated for comparison purposes. However, the long term monitoring costs and potential liabilities associated with leaving the contaminated soil on site out weighed the cost benefit.

Bio-Venting

Bio-venting was eliminated from consideration because the soil and climatic conditions on site made success of the technology only marginally possible. The soil density and grain size were not conducive to effective ventilation (aeration) of the soil. As a result, it was possible that some of the soil would contain contaminants a level above cleanup objectives.

4.3 Recommendations

To remediate the contaminated soil within the area of concern we recommend excavation and placement of the soil in an appropriate landfill. We have selected this option for the following reasons:

- it reduces the mass of contaminant on site; and
- it can be implemented without impacting other planned construction activities.

The soil excavation process would be completed in two phases as described below and illustrated in the east-west cross-section shown in Figure 6.

Phase 1

Phase 1 of the excavation process would be completed in the area between the east building wall of the Speedy Cleaners building and the west building wall of the Bausch & Lomb World Headquarters building. The excavation should begin as soon as possible in order to remove the contaminated soil beneath the proposed route of RG&E's 115 kilovolt electric service and before backfilling of the west wall of the Bausch & Lomb World Headquarters building. The placement of soldier piles would begin first to provide structural support to the Speedy Cleaners building and potentially to Court Street side walk and road surface. Soldier piles and lagging would be placed as needed to support the excavation to depth need for waste soil removal. The soldier piles and lagging would be off-set from the Speedy Cleaners building by a distance of approximately six feet. On the east side of the excavation along the Bausch & Lomb World Headquarters building, the base of the excavation would be off-set from by a distance of twelve feet and the excavation's slope would be maintained at one foot rise over a one horizontal distance. No soldier piling and lagging system is proposed. The excavation would proceed using the same procedures as presented in the Investigation Report and Soil Removal Work Plan, prepared by Seeler Associates and dated January 1994. This work plan was developed for soil removal with the proposed limits of the Court Street Parking Garage. Since this area is adjacent to the Speedy Cleaner's building where soil containing perchloroethylene has been found, the excavation will proceed in the following manner; the fill material (brick, cinder, ash) will be removed and the undisturbed stoddard contaminated soil exposed. This surface will be sampled garage, a perforated plastic pipe should be placed approximately three feet off the foundation footing of each building. The pipe should be backfilled with clean washed gravel. The perforated pipe should be run continuously along the structures from Court Street to the parking garage tunnel. Where the pipe terminates, a riser should be placed and extended five feet above the groundsurface and capped until completion of the planned structures.

TABLES

TABLE 1

COST SUMMARY OF REMEDIAL ALTERNATIVES

	Excavation	Capping
Capital Cost	$633,000	$175,145
Present Worth Operation and Maintenance Cost	- 0 -	32,396
Project Present Worth	$633,000	$207,541

FIGURES

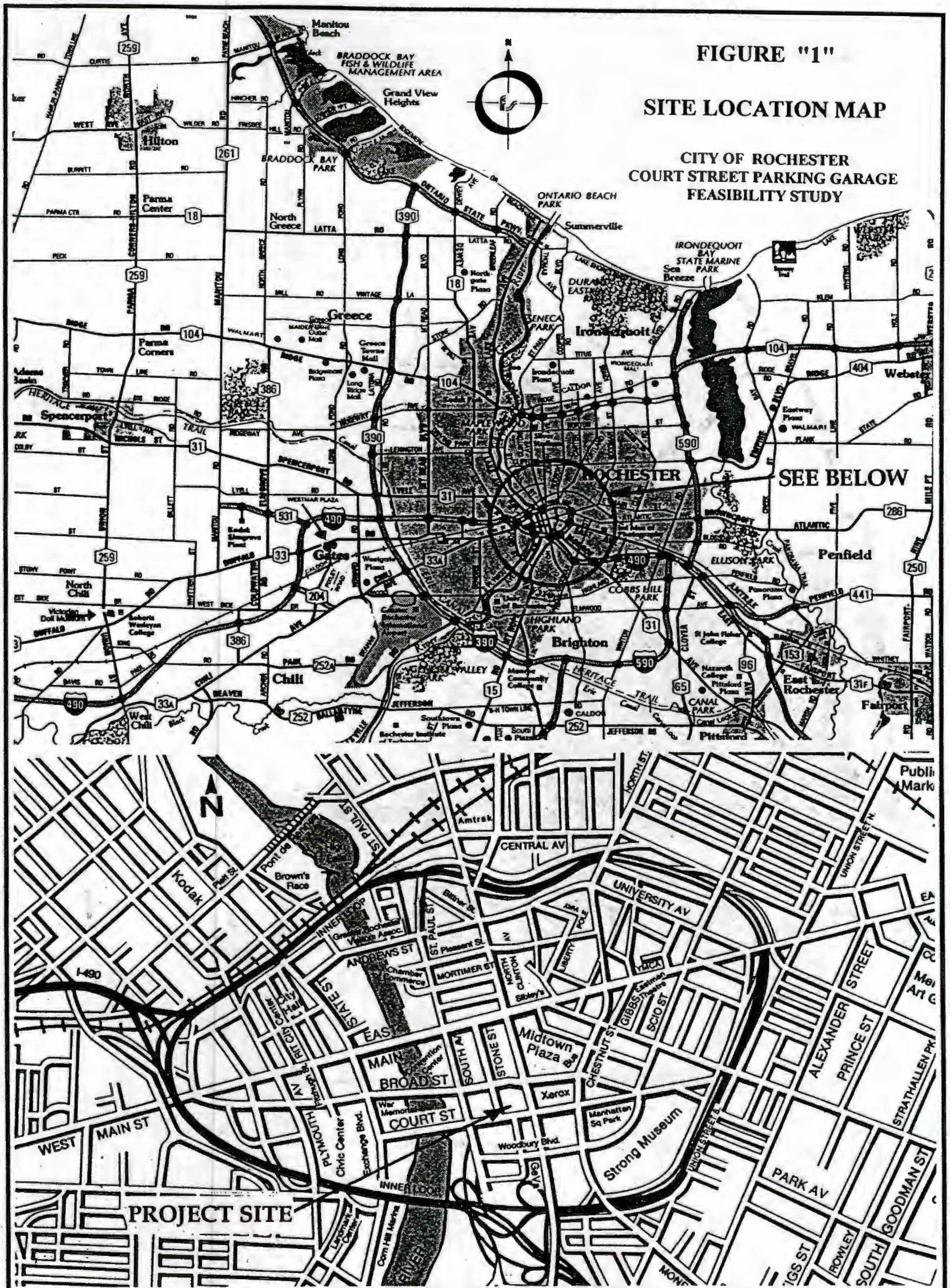


FIGURE "1"

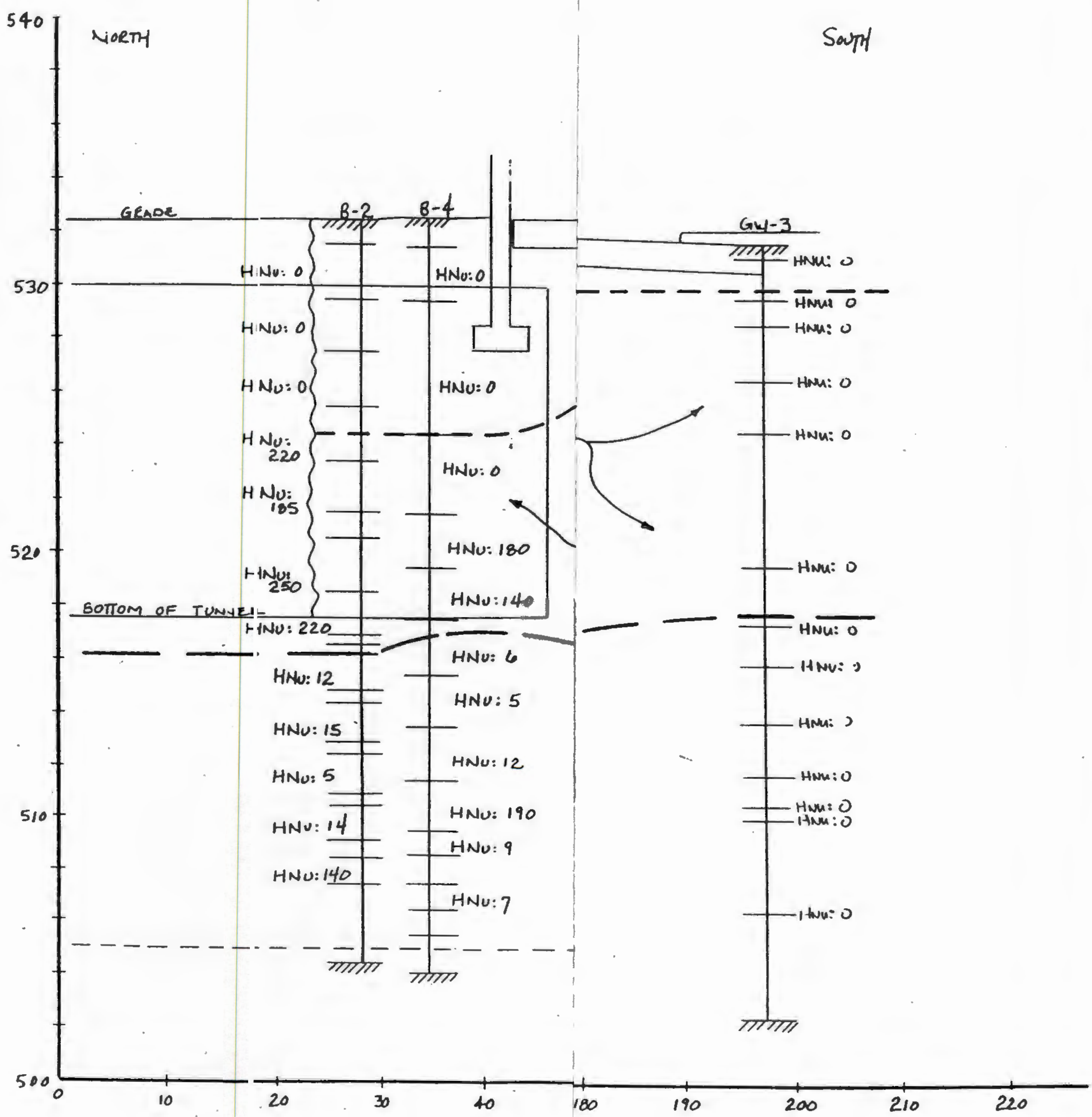
SITE LOCATION MAP

CITY OF ROCHESTER
COURT STREET PARKING GARAGE
FEASIBILITY STUDY

Seeler Associates
ENVIRONMENTAL CONSULTANTS

FIGURE 3

NORTH-SOUTH CROSS SECTION OF THE PROJECT SITE AREA



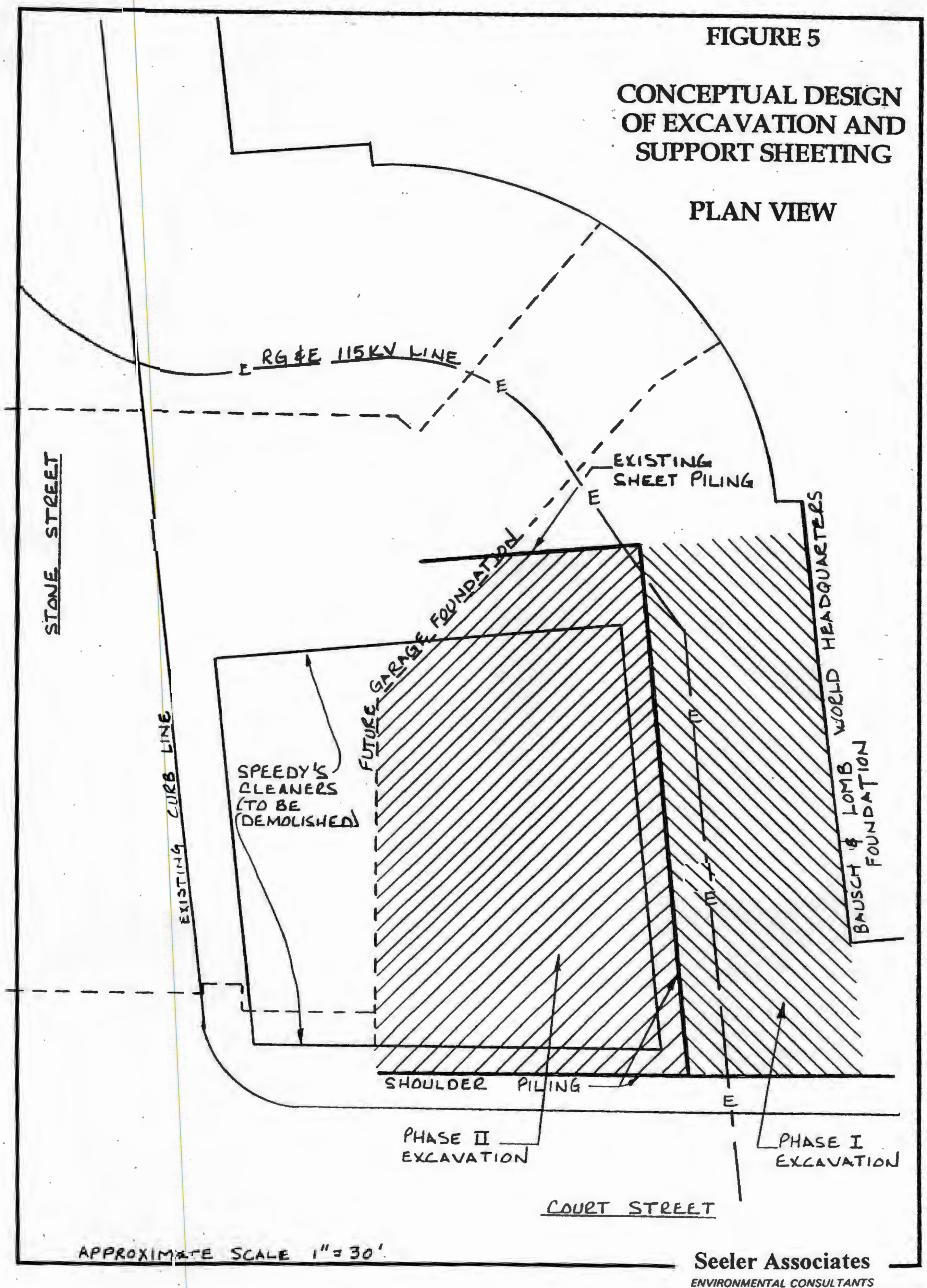


FIGURE 5
CONCEPTUAL DESIGN OF EXCAVATION AND SUPPORT SHEETING
PLAN VIEW
RG&E 115KV LINE
EXISTING SHEET PILING
STONE STREET
FUTURE GARAGE FOUNDATION
BAUSCH & LOMB WORLD HEADQUARTERS FOUNDATION
SPEEDY'S CLEANERS (TO BE DEMOLISHED)
EXISTING CURB LINE
SHOULDER PILING
PHASE II EXCAVATION
PHASE I EXCAVATION
COURT STREET
APPROXIMATE SCALE 1" = 30'
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FIGURE 4

EAST-WEST CROSS SECTION OF THE PROJECT SITE AREA

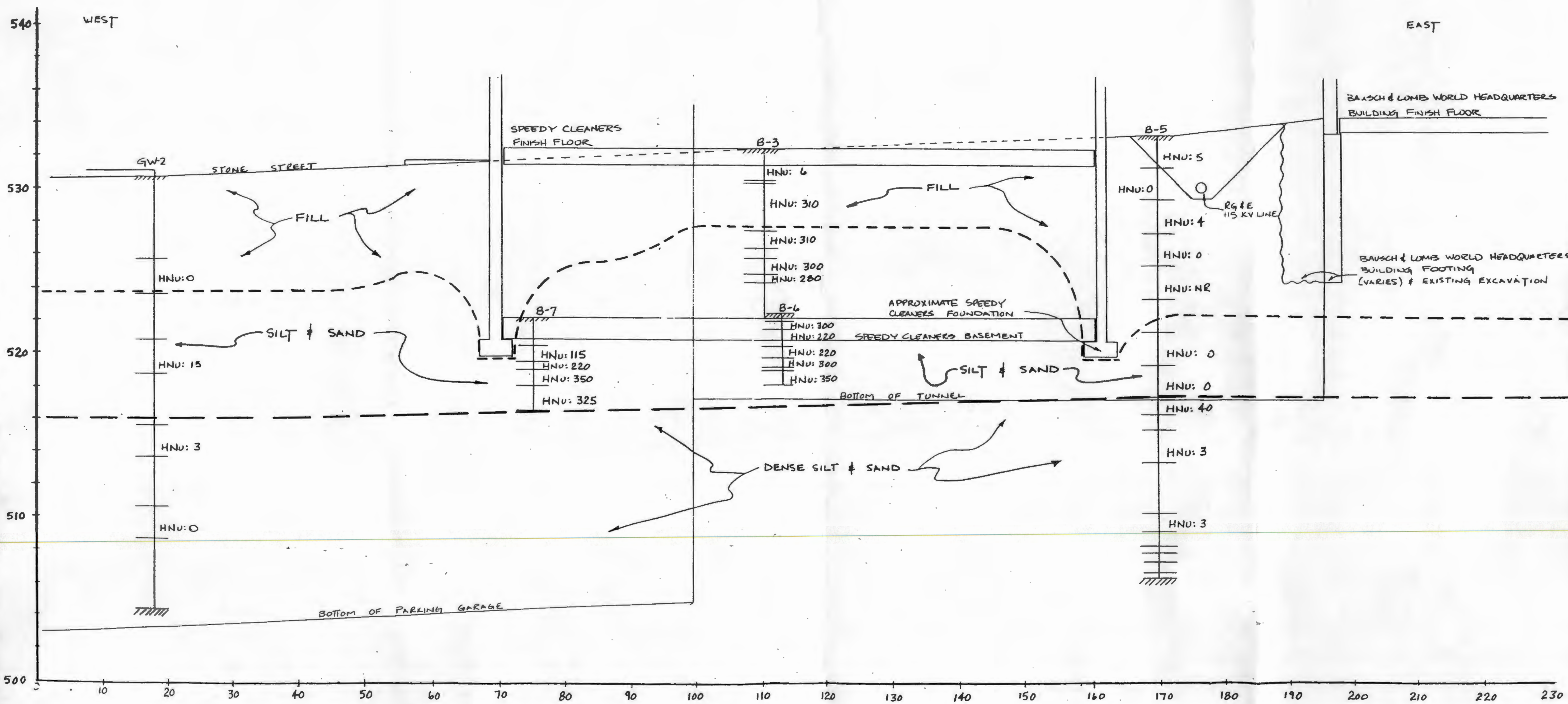

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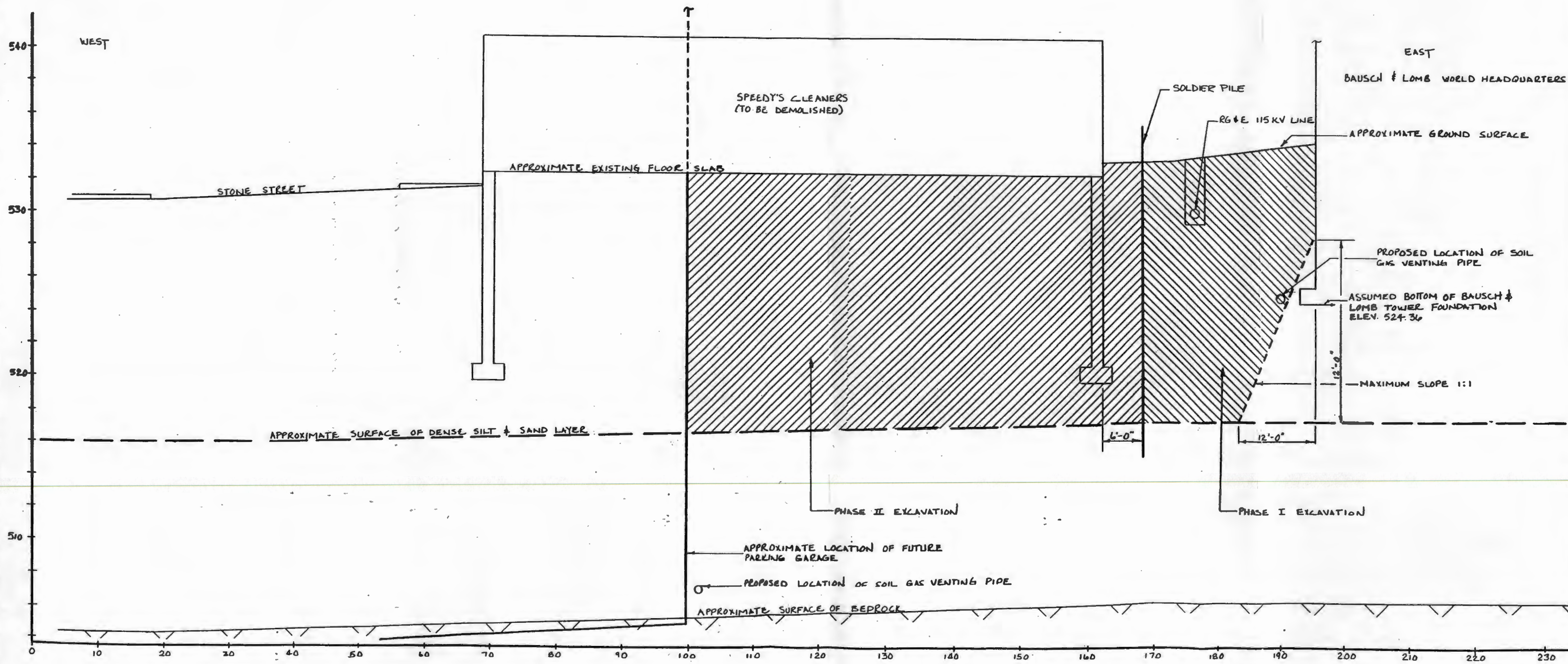
FIGURE 6

CONCEPTUAL DESIGN OF EXCAVATION AND SUPPORT SHEETING

EAST-WEST CROSS SECTION



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APPENDICES

APPENDIX A
SYNTHETIC LINER CAP

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SYNTHETIC LINER CAP

Capital Costs

Item #	Item Description	Quantity	Unit	Unit Price	Extended Cost
1	Excavate 5′ depth soil	1,790	CY	$ 1.90	$3,400.00
2	Slotted 4" PVC Foundation Pipe	355	LF	18.65	6,620.00
3	Backfill and Compact in Speedy's basement	620	CY	1.10	690.00
4	Backfill and Compact Sand Subbase (1′ depth), Drainage above Liner (1′ depth)	1,120	CY	11.55	12,940.00
5	Backfill and Compact Select Fill (2′ depth) above sand	1,115	CY	7.55	8,420.00
6	Synthetic Liner	30,000	SF	1.25	37,500.00
7	Geogrid	13,000	SF	0.50	6,500.00
8	Monitoring Well Installation	4	EA	4200	16,800.00
9	Haul Excess Excavated Soil	2,745	T	7.00	19,220.00
				Subtotal:	$112,090.00
				Contingency 25%:	28,025.00
				Total Capital Cost:	$140,115.00
				Engineering 25%:	35,030.00
				Total Project Cost:	$175,145.00

Annual Operational and Maintenance Costs

Item #	Item Description	Quantity	Unit	Unit Price	Extended Cost
1	Analytical	4	EA	$ 225.00	$ 900.00
2	Monitoring & Reporting	20	Hrs.	75.00	1,500.00
	Annual Operation and Maintenance Cost:				$2,400.00
	Present Worth Annual Operation and Maintenance (6%, 30 years):				$32,396.00

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2/28/94
1394PVS

APPENDIX B
EXCAVATION AND LANDFILL DISPOSAL

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EXCAVATION AND LANDFILL DISPOSAL

Capital Costs

Item #	Item Description	Quantity	Unit	Unit Price	Extended Cost
1	Sheeting	3,900	SQ FT	$ 40.00	$160,000.00
2	Excavate Uncontaminated Soil	1,700	CY	1.90	$3,230.00
3	Excavate and Load Contaminated Soil	3,665	CY	2.20	8,060.00
4	Backfill and Compact Uncontaminated Soil	1,700	CY	1.10	1,870.00
5	Backfill & Compact Select Fill	1,965	CY	7.55	14,835.00
6	Haul Contaminated Soil	6,235	T	7.00	43,645.00
7	Landfill Cost	6,235	T	27.50	171,465.00
8	Analytical Costs	2	EA	1,000	2,000.00
				Subtotal:	$405,105.00
				Contingency 25%:	101,276.00
				Total Capital Cost:	$506,381.00
				Engineering 25%:	126,595.00
				Total Project Cost:	$633,000.00

Annual Operation and Maintenance Cost

Not Applicable