



**LAW/CRANDALL, INC.**  
ENGINEERING AND ENVIRONMENTAL SERVICES

**ENVIRONMENTAL OPINION OF COSTS**

**SAN FERNANDO VALLEY**

**EAST-WEST RAIL TRANSIT PROJECT**

**SP BURBANK BRANCH ALTERNATIVE**

*for*

**LOS ANGELES COUNTY**

**METROPOLITAN TRANSPORTATION AUTHORITY**

**Los Angeles, California**

**September 13, 1994**

**Project 2701.30889**



**LAW/CRANDALL, INC.**

ENGINEERING AND ENVIRONMENTAL SERVICES

September 13, 1994

Los Angeles County  
Metropolitan Transportation Authority (MTA)  
818 West 7th Street  
Los Angeles, California 90017

Attention: Mr. Stan Barankiewicz  
Environmental Specialist

Dear Mr. Barankiewicz:

We are pleased to present our "Environmental Opinion of Cost, San Fernando Valley Segment, Metro Rail Project." The purpose of this project was to evaluate impacts due to known and suspected sources of contamination along the alignment and present opinion of costs associated with mitigation of the impacts.

This report was prepared for the exclusive use of the Rail Construction Corporation-MTA in accordance with the Letter Contract No. EN028 dated November 3, 1993 and executed November 9, 1993. The scope of this contract work order was approved by Mr. Stan Barankiewicz. This report has been prepared for MTA and their consultants to be used solely in evaluating potential environmental implications at the subject site. The report has not been prepared for use by other parties, and may not contain sufficient information for the purposes of other parties or other uses.

The findings and opinions are relevant to the dates of our work and should not be relied on to represent conditions at later dates.

We appreciate the opportunity to work with you on this project and look forward to our continuing relationship.

Respectfully submitted,

**LAW/CRANDALL, INC.**

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Senior Environmental Geologist

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Principal Engineer  
Vice President

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(3 copies submitted)

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## 1.0 INTRODUCTION

We understand that the MTA is assessing potential environmental impacts on construction costs for the proposed Metro Rail tunnel project in the San Fernando Valley. This line runs east-west along the San Fernando Valley and extends from Woodland Hills to North Hollywood. The objectives of this work order are to evaluate the existing data and develop an opinion of costs for environmental services for the proposed project. The MTA is particularly interested in assessing the possibility of encountering contaminated soil and groundwater during excavation activities for Alternatives A, B and C. In addition, they require that potential volume of contaminated wastes and associated disposal costs be estimated. We understand that the Regional Water Quality Control Board agreed the MTA need only be concerned with contaminated waste that is produced during construction activities. They will not be responsible for remediation of the remaining soil and groundwater in the vicinity.

We were requested to develop an opinion of cost for the three proposed alternative designs of the project (designated Alternatives A, B, and C), as well as an opinion of cost for asbestos removal, and for bridge demolition (including the cost if lead-based paint is present).

The Law/Crandall Team has performed an environmental opinion of cost for the San Fernando Valley East-West Rail Transit project, SP Burbank Branch Alternative. We gathered and analyzed limited data from readily available sources. We identified sites as having a potential for impacting the alignment and then developed opinion of costs for monitoring and mitigating these impacts. These opinions of costs include construction monitoring, and treatment and disposal alternatives for the contaminated soil and groundwater.

## 2.0 PURPOSE AND SCOPE

The purpose of the opinion of costs and waste disposal options analysis is to provide the Rail Construction Corporation (RCC) and Metropolitan Transportation Authority (MTA) with a basis for evaluating environmental costs associated with construction of the Chandler alignment (tunnel project) as a part of the planning process for this alignment. These costs involve the identification and handling of contaminated soil and groundwater encountered during construction, asbestos removal for the structures to be demolished during construction, and bridge demolition (including associated costs with lead-based paint, if present). A limited amount of data is available regarding known contamination along the route. As a result, the methodology and assumptions used in this analysis take on critical importance. Our methodology and assumptions used are discussed in Sections 3.0 and 4.0, respectively.

The scope of work is presented in four tasks: data review, characterization, data analysis, and opinion of costs development. These tasks are further described below:

### Task 1 - Data Review

- Review of MTA's Phase I and Phase II reports along the proposed San Fernando Valley Line (tunnel project).
- Review of Law/Crandall's environmental and geotechnical reports along the proposed San Fernando Valley Line.
- Review of updated environmental records report for sites along the alignment.
- Review of agency files regarding current remediation sites.
- Review of existing EIR reports.
- Development of a scope of work for additional Phase I/Phase II/Phase III assessments.

### Tasks 2 - Characterization

- Characterization of the geology and hydrogeology along the proposed line.
- Characterization of the capture zone resulting from potential dewatering activities during construction to assess the outer boundaries of the assessment.

- Characterization of potential contamination in the soil and groundwater that will likely be encountered during construction.

### **Task 3 - Data Analysis**

- Determination of what regulatory permitting is required for the construction task (i.e., NPDES permit for dewatering, South Coast Air Quality Management District [SCAQMD] permitting).
- Development of approximate quantities of waste, both soil and groundwater, that will be generated during construction.
- Analysis of waste disposal alternatives.

### **Task 4 - Opinion of Costs Development**

- Development of an opinion of costs for:
  - Regulatory permitting and construction monitoring of environmental issues.
  - Characterization and disposal of both soil and water (including transportation).
  - Asbestos removal for structures along the alignment.
  - Bridge demolition (including lead-based paint, if present)
- Preparation of a report which details the data review, characterization, data analysis and the opinion of costs.

### 3.0 METHODOLOGY

This section describes the methodology used to complete the environmental opinion of costs for waste disposal options analysis. We have organized this section into the following subsections:

- Identification of potential sites and analysis hydrogeology characteristics for area
- Estimation of potential contamination levels and volumes
- Identification of site monitoring and evaluation of activities needed during construction
- Determination of treatment options for individual sites
- Collection of preliminary data to render opinion of costs of waste treatment and disposal
- Development of opinion of costs

#### **IDENTIFICATION OF POTENTIAL SITES AND ANALYZING HYDROGEOLOGY CHARACTERISTICS FOR AREA**

We reviewed the following data sources:

- Phase I Environmental Assessment of the Burbank Branch of the Southern Pacific Transportation Company Railroad, San Fernando Valley, California, Contract Number T00-S0017, November 27, 1990, Holguin, Fahan & Associates, Inc.
- Phase II Environmental Assessment of the Burbank Branch of the Southern Pacific Transportation Company Railroad, San Fernando Valley, California, Contract Number T00-S0017, November 28, 1990, Holguin, Fahan & Associates, Inc.
- Geotechnical Investigation for Limited Preliminary Engineering Program, San Fernando Valley East-West Segment, Metro Red Line Project, Draft Report, Project No. 93-4955, November 1993, prepared for Engineering Management Consultant by Earth Technology Corporation.
- Environmental Record Search Reports, BBL, Inc., Metro Red Line, San Fernando Valley, January 6, 1994.
- Report of Foundation Investigation, Proposed Office Building and Parking Structure, Van Nuys Boulevard between Delano and Calvert Streets, Van Nuys District, Los Angeles, California for the Department of General Services, Office of the State Architect, Project No. A-79322, May 13, 1980, LeRoy Crandall and Associates.



- Report of Paving Studies, Proposed Parking Lot, Chandler Boulevard and Vantage Avenue, North Hollywood District, Los Angeles, California for the Gibraltar Savings and Loan Association, Project No. A-85105, April 16, 1985, LeRoy Crandall and Associates.
- Report of Foundation Investigation, Proposed Shop Buildings "A", "B", and "D", Victory Boulevard between Canoga and Owensmouth Avenues, Woodland Hills District, Los Angeles, California, for Pacific/Youngman-Woodland Hills, Project No. A-86009, February 11, 1991, LeRoy Crandall and Associates.
- Report of Phase I Environmental Site Assessment, Topanga Plaza, Warner Center, California for Prudential Realty Group, Project No. 2691-30647-0002, November 10, 1993, Law/Crandall, Inc.
- Draft Environmental Impact Report, San Fernando Valley East-West Rail Transit Project, State Clearinghouse #89050304, November 1989, Gruen Associates.
- Final Environmental Impact Report, San Fernando Valley East-West Rail Transit Project, State Clearinghouse #89050304, February 1990, Gruen Associates.
- Draft Subsequent Environmental Impact Report, San Fernando Valley East-West Rail Transit Project, Ventura Freeway Advanced Aerial Technology Alternative, State Clearinghouse #91061010, September 1991, Gruen Associates.
- Final Subsequent Environmental Impact Report, San Fernando Valley East-West Rail Transit Project, SP Burbank Branch Alignment, Ventura Freeway Advanced Aerial Technology Alternative, State Clearinghouse #91061010, July 1992, Gruen Associates.
- Quarterly Report, Second Quarter: April 1 - June 30, 1992, UNOCAL Service Station #4240, 6050 Tampa Avenue, Tarzana, California, prepared by Reidel Environmental Services, Inc, date July 28, 1992
- Pre-acquisition site characterization report, SPTCo - Burbank Line, Site B-17-b - Ritz Dry Cleaning, prepared by Geofon Environmental, Inc., dated August 6, 1991.
- Site Assessment Results of an underground tank excavation, Heetland Roofing Company, Inc., 14200 Bessemer Street, Van Nuys, California, prepared by Holguin, Fahan & Associates, Inc., dated December 10, 1990.
- Asbestos Survey of the Burbank Line, prepared by Holguin, Fahan & Associates, Inc., dated February 25, 1991.
- L.A. City Fire Department and Regional Water Quality Control Board files regarding sites with known and suspected contamination.

Based on the review of the above references, we selected the sites that, in our opinion, had a potential impact for soil and/or groundwater contamination along the alignment.

The geology and hydrogeology along the alignment is shown on Plate 1. The tunnel section in the western part of the alignment is predominantly fine-grained material. In addition, a majority of the tunnel in this section is below the groundwater surface. If dewatering of this section is conducted, the capture radius on the north side of the alignment is estimated to be 500 to 600 feet. The capture radius on the south side of the alignment is estimated to be ¼ mile. A computer model indicated that a total pumping rate of 300 gallons per minute will be necessary to lower the groundwater level below the bottom of the tunnel and station excavation.

#### **ESTIMATION OF POTENTIAL CONTAMINATION LEVELS AND VOLUMES**

Based on the data reviewed, we selected six sites as having a potential for environmental impact to the tunnel. Adequate laboratory analysis for soil and groundwater at these selected sites were not readily available. If data were available, they typically were for soil at shallower depths than the proposed tunnel. Using the soil types in the area and infiltration rates, we made assumptions on the size of the contaminant plume and its concentration. We applied known plume dimensions and concentrations from one site to another if geologic and hydrogeologic conditions were similar.

In addition, we assumed there would be two contingency sites with both soil and groundwater contamination. Data from sites with known contamination were used to estimate volumes of soil and groundwater that require treatment and disposal.

#### **IDENTIFICATION OF SITE MONITORING AND EVALUATION OF ACTIVITIES NEEDED DURING CONSTRUCTION**

An on-site staff professional will be required during tunnel and station excavation. The staff professional will monitor the tunnel boring and excavation cuttings with an organic vapor analyzer (OVA) and document the type of soil being excavated. Costs for this monitoring is based on a tunnel boring rate of 100 to 150 feet per day.

A mobile laboratory will be on call to perform analyses at the site when contamination is encountered. Our opinion of cost for laboratory services is based on the mobile lab being on site for approximately 50 days, not necessarily consecutive. The lab will test the soil and groundwater when contamination is first encountered. The lab will then perform confirmation sampling at the end of the contaminated section of tunnel. We also costed additional funds for miscellaneous testing.

We anticipate that contractors providing remediation services will have their treatment systems already permitted with the appropriate agencies. The exception to this is the NPDES permit for discharge of groundwater to the stormwater drain.

#### **DETERMINATION OF TREATMENT OPTIONS FOR INDIVIDUAL SITES**

Available soil and groundwater treatment technologies were screened to determine the leading options for the potential sites. The technologies were evaluated according to technical effectiveness, implementability, and cost. *Technical effectiveness* evaluates if a technology will reduce or destroy identified site contaminants. *Implementability* evaluates the deployment of processing equipment on the site and the suitability of conducting remedial activities at the site. *Cost* is an evaluation of candidate technology relative to one another. Costs for the leading technologies were then calculated in accordance to the methodology and assumptions described below. Appendix A, Site Ratings, includes our ratings for each site.

#### **COLLECTION OF PRELIMINARY DATA TO RENDER OPINION OF COSTS OF WASTE TREATMENT AND DISPOSAL**

In preparation for estimating the potential costs involved in the treatment and disposal of contaminated soil and groundwater, Williams & Vanino, Inc. researched waste treatment and disposal options for the identified sites. Once options were identified, we contacted appropriate vendors regarding their methodologies, requirements and costs. In addition, Williams & Vanino, Inc. contacted regulatory agencies with jurisdiction over waste treatment and disposal in Los Angeles County. In our conversations with agencies, we discussed permitting requirements and action levels.

The results of this research were used, in part, to estimate the waste treatment and disposal costs presented in the site profiles. Profiles are included in Appendix B, Site Profiles.

#### **DEVELOPMENT OF OPINION OF COSTS**

Williams & Vanino, Inc. coordinated the development of the opinion of costs methodology and prepared actual opinion of costs. To complete the opinion of costs, we used Williams & Vanino, Inc.'s waste treatment and disposal options research, site specific data provided by Law/Crandall, and our knowledge and experience in remediation and waste treatment systems.

#### 4.0 ASSUMPTIONS

We used the following assumptions as the basis for the opinion of costs:

##### Soils

- Tunnel bore yield 14.07 cubic yard per foot including soil expansion.
- Average unit mass of soil is 1.8 tons per cubic yard.
- RCC-MTA will provide a site for a mobile treatment system at no additional cost.
- RCC-MTA will provide space for conducting bioremediation at no additional cost.
- Contractors providing remediation services will have their treatment systems already permitted with the appropriate agencies.
- Preliminary information on disposal costs at BKK indicates that costs range from \$15 to \$31 per ton. For estimating purposes, a cost of \$27 per ton was assumed based on conversations with MTA personnel. A March 8, 1994 conversation with Mr. Ed Rogan of CH<sub>2</sub>M Hill which identified \$26 per ton as the unit costs for previous metro rail segments.
- Preliminary information indicates thermal desorption costs range from \$35 to \$125 per ton. If more than 100,000 tons are treated, the data indicates that unit costs can be reduced to approximately \$35 per ton. Because our estimated volume of potentially contaminated soil exceeds 100,000 tons, we used \$35 per ton in our opinion of cost estimate.
- Preliminary information received in a March 8, 1994 telephone call from Mr. Ed Rogan to Ms. Ann Vanino indicates that if an RCC Recycling Network (similar to that estimated by CH<sub>2</sub>M Hill for previous segments) cost per ton range from \$30 to \$35 per ton. A cost of \$32.50 per ton is used for estimating.
- Bioremediation costs are estimated at \$30 per cubic yard per ton.
- Site characterization information for one of the sites (the Chevron Van Nuys Terminal) was insufficient to estimate a potential impact to the alignment's soil and groundwater. It is our opinion, however, that the potential impact may be quite high.
- In the estimate for the volume of contaminated soil for the rail stations, we assumed that contaminated groundwater occurs over the entire area of the station, and has impacted approximately 8 feet of soil in contact with the groundwater table (for the Topanga and Tampa Stations). For the Reseda Station, we assumed that

only 4 feet of soil in contact with the groundwater has been impacted, because the soils are generally more coarse grained, and would tend to have a lesser capillary effect above the saturated zone.

- In the estimate for the volume of contaminated soil for the six sites, and the two contingency sites, we consider most likely to impact the soil, we assumed that contaminated groundwater was the source of a majority of the contamination. For Alternatives B and C, we assumed that eight feet of soil in contact with the groundwater would be impacted for the excavations near the Montgomery Ward/Rocketdyne, P.L. Porter, UNOCAL, and the L.A. County Public Works sites; we assumed that the L.T. Sawyer/Mobil Station and the Ritz Cleaners sites would involve soil contamination only, and we assumed that approximately half the excavation (about 20 feet), has been impacted near these sites.

#### Groundwater

- Capital costs for Carbon System = \$15,000/100 gallons per minute capacity (gpm).
- Adsorption Capacity for Liquid - Phase carbon = 5 percent.
- Carbon costs including purchase, and regeneration = \$2.50 per pound of carbon.
- Air stripping capital costs = \$30,000 (Flow Rate/100 gpm)<sup>0.7</sup>
- Vapor phase treatment for air stripping = one-third of carbon costs
- Free product recovery = \$15 per recovered gallon.
- EMC, the construction management company, has indicated that each station location for the MTA will have to be dewatered for approximately one year.
- The three stations with potential contamination will be constructed at the same time. Three groundwater remediation systems will be running simultaneously.

#### Asbestos Removal

- Structures on 16 parcels will be demolished after purchase of the parcels.
- Average disposal cost of asbestos-containing material (ACM) is \$12 to \$14 per square foot.
- Estimate of square footage of ACM is \$118,000.

#### Bridge Removal

- The bridge spanning the Los Angeles River will be demolished and removed from the site.
- The Los Angeles River bridge is painted with lead-based paint.

### 5.0 OPINION OF COSTS

The following table summarized the opinion of costs. A detailed table of opinion of costs is included in Appendix C, Opinion of Costs.

Task	Opinion of Costs Alternate A	Opinion of Costs Alternates B and C
Soil remediation costs for the six potential sites, two contingency sites, and three rail stations.	\$2,940,000 to \$5,375,000	\$3,878,000 to \$7,060,000
Groundwater treatment for four sites plus two contingency sites	\$2,498,000 to \$4,881,000	\$2,498,000 to \$4,881,000
Groundwater Treatment System (3) units	\$300,000	\$300,000
Transportation of soil <sup>1</sup>	\$1,900,000 to \$4,340,000	\$2,500,000 to \$5,600,000
Construction monitoring <sup>2</sup>	\$750,000 to \$1,000,000	\$750,000 to \$1,000,000
Laboratory analysis	Approximately \$125,000	Approximately \$125,000
Additional EIR/EIS monitoring <sup>3</sup>	Approximately \$90,000	Approximately \$90,000
Asbestos Removal <sup>4</sup> - (16 sites)	\$1,523,000	\$1,523,000
Bridge Removal <sup>5</sup> - (LA River Bridge)	\$1,100,000	\$1,100,000
<b>TOTAL OPINION OF COSTS</b>	<b>\$11,226,000 to \$18,734,000</b>	<b>\$12,764,000 to \$21,679,000</b>
<sup>1</sup> Range will vary dependent on the disposal site. <sup>2</sup> Dependent on the tunneling rate. <sup>3</sup> Includes the noise, biological, and cultural monitoring. <sup>4</sup> Based on MTA disposal costs of \$12-14 per square foot ACM. <sup>5</sup> Dependent on quantity of lead-based paint used on bridge surface.		

## 6.0 LIMITATIONS

The opinion of costs include six potential sites and two contingency sites. Assuming an average lineal footage of 150 feet per site, these sites represent approximately 2 percent of the total route. Consequently, there is a high degree of uncertainty in developing this opinion of costs.

In this environmental opinion of cost, some capital costs associated with remediation are included for each potential site. If construction schedules will allow reuse of either carbon or air stripping equipment on different sites, this will significantly reduce the overall costs for groundwater treatment.

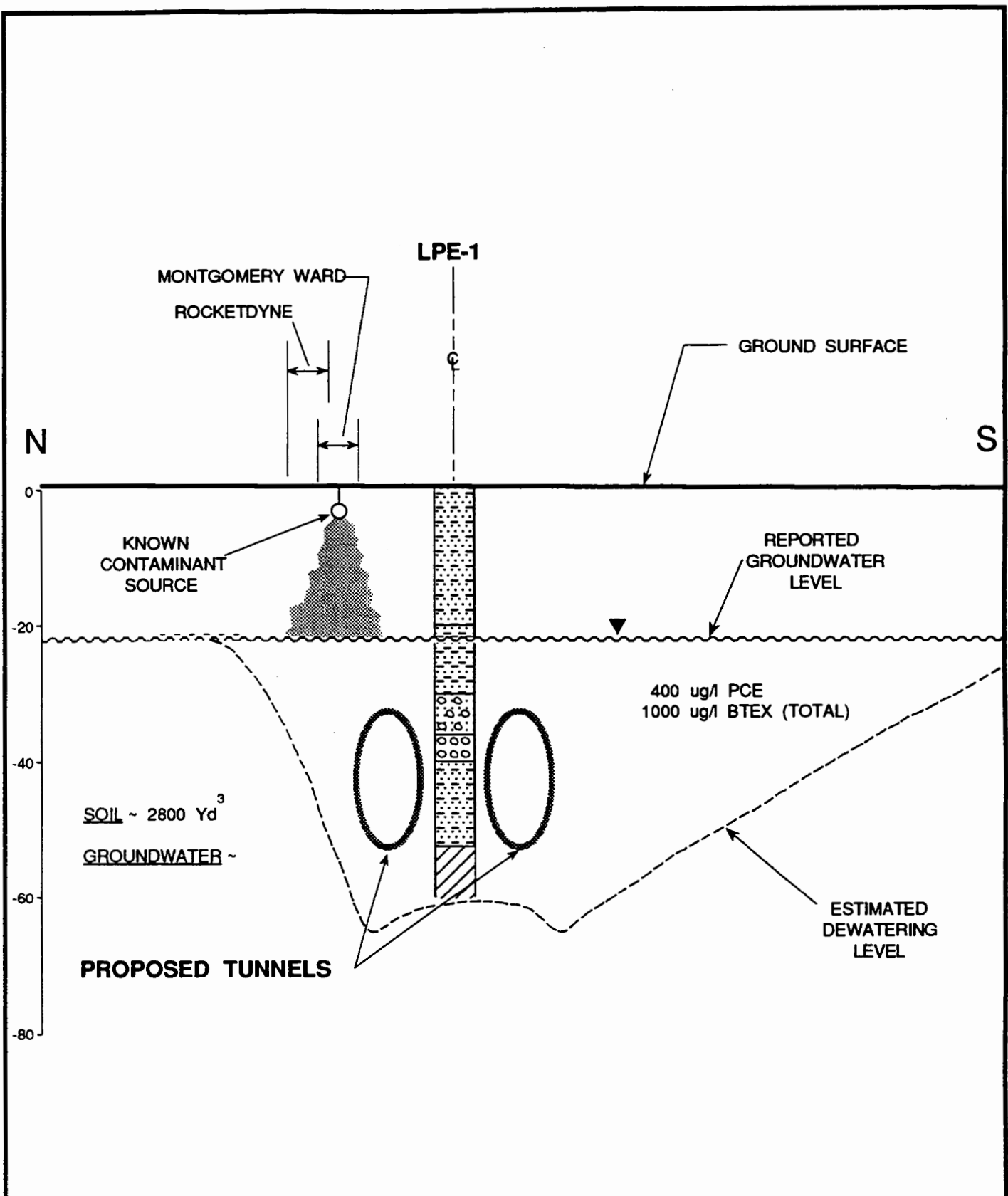
Groundwater opinion of costs for individual sites are based on regional hydrogeological data. Deviations in pumping rates at individual sites can effect actual costs.

The data used to determine impacted areas and concentrations of contaminants were from sites adjacent or nearby the alignment. These data were not necessarily from the depths of the proposed tunnel excavation or station areas. Ranges of depths and ranges of concentrations were often used to describe impacted soil and groundwater. Without the benefits of analytical data from specific areas of the proposed tunnel and station excavations, our estimates yield conservative costs with a low confidence level.

The opinion of costs were estimated based on remedial, disposal, laboratory, transportation, and monitoring costs at the time this document was prepared. It should be expected that these costs will increase, and may need to be re-evaluated if a significant amount of time passes before the onset of this project.



JOB 2701.30889.0004 DATE 6/9/94 F.T. DR. JULIANA O.E. BM W.P. CHKD BM

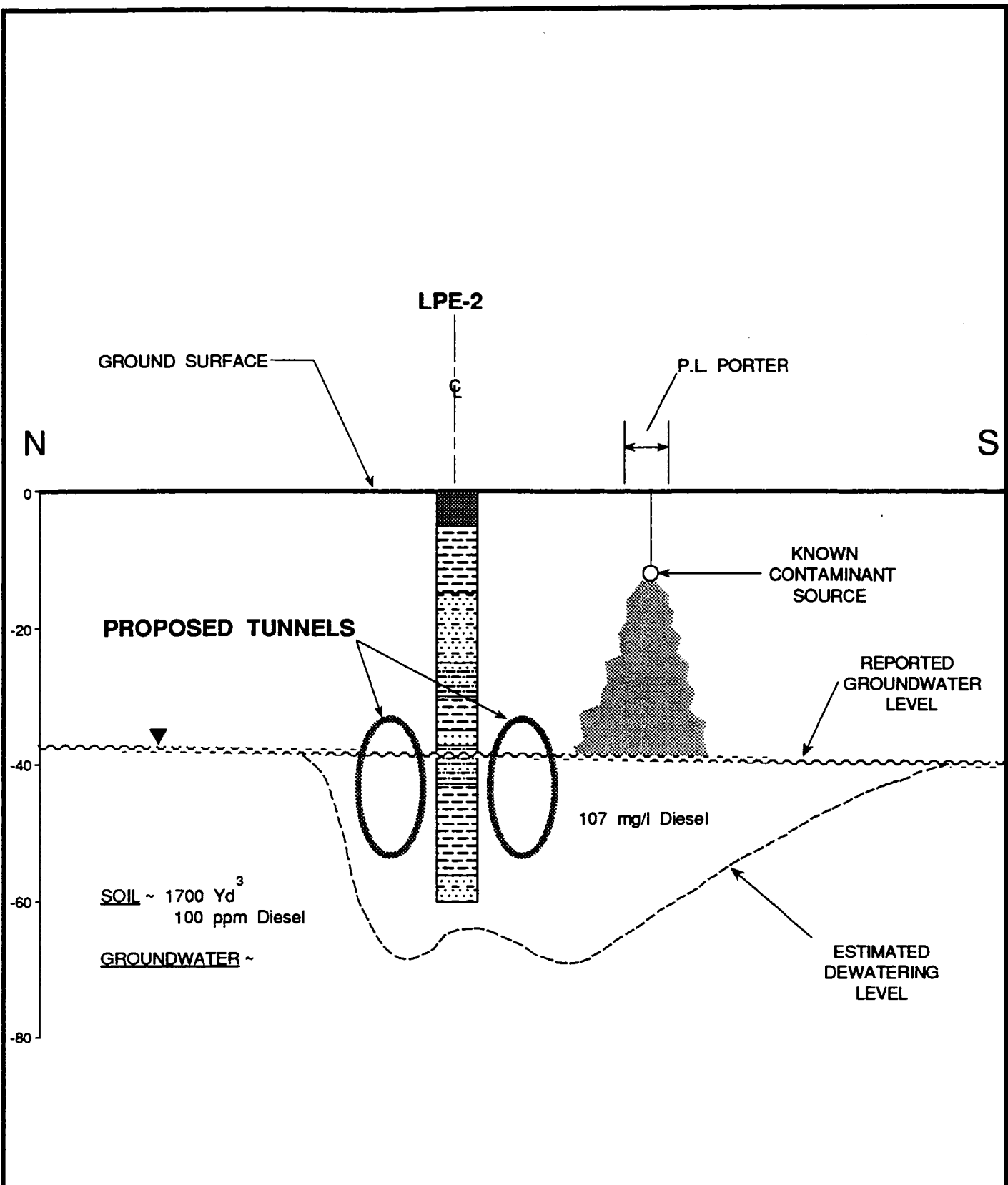


# CROSS SECTION

STATION 10+00  
VERTICAL SCALE: AS SHOWN  
HORIZONTAL SCALE: NOT TO SCALE

LAW/CRANDALL, INC. 

JOB 2701.30889.0004 DATE 3/9/94 F.T. DR. JULIANA O.E. J.O. W.P. CHKD *DM*

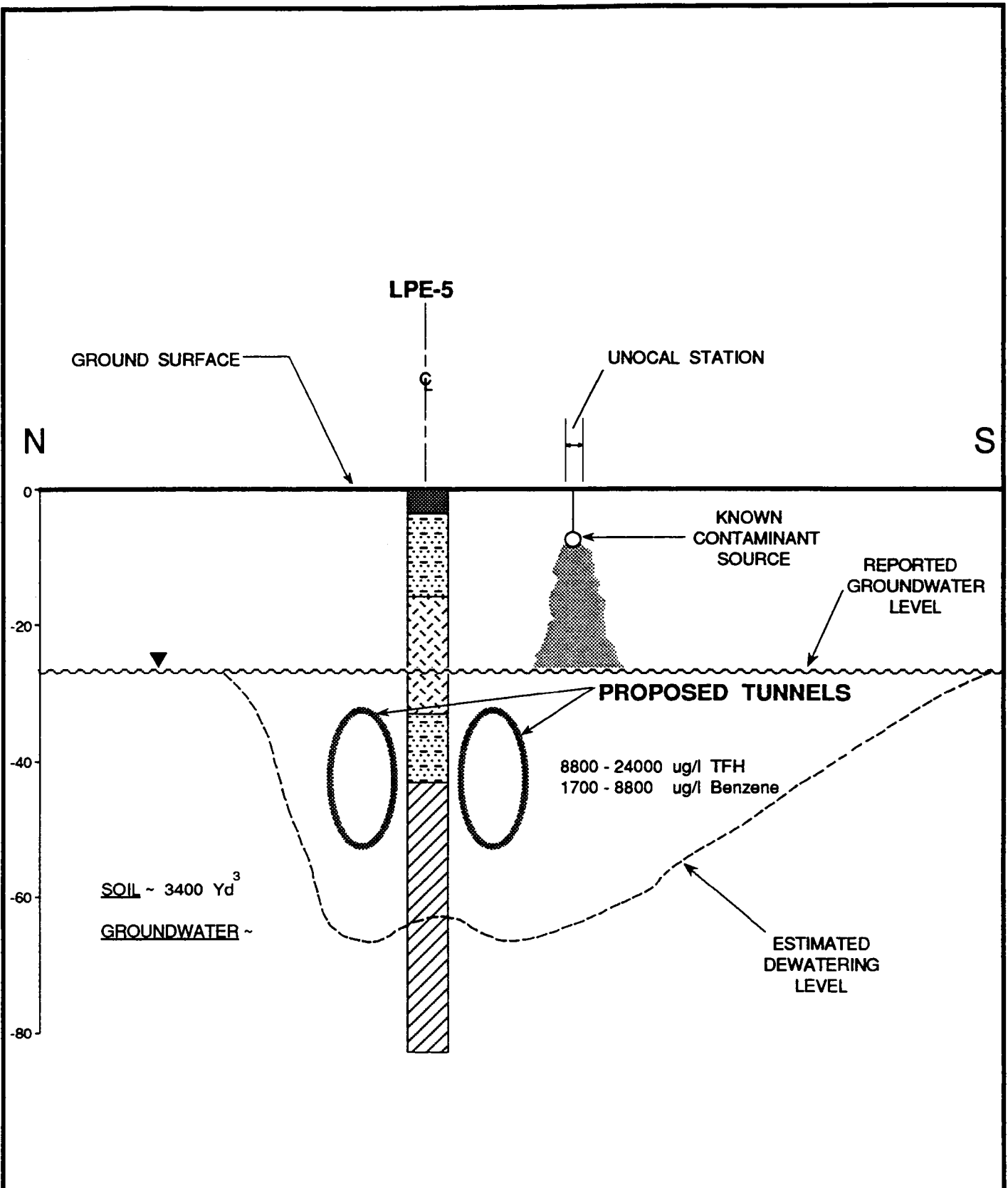


# CROSS SECTION

STATION 56+00  
VERTICAL SCALE: AS SHOWN  
HORIZONTAL SCALE: NOT TO SCALE

LAW/CRANDALL, INC. 

JOB 2701.30889.0004 DATE 6/9/94 F.T. DR. JULIANA O.E. BM W.P. CHKD BA



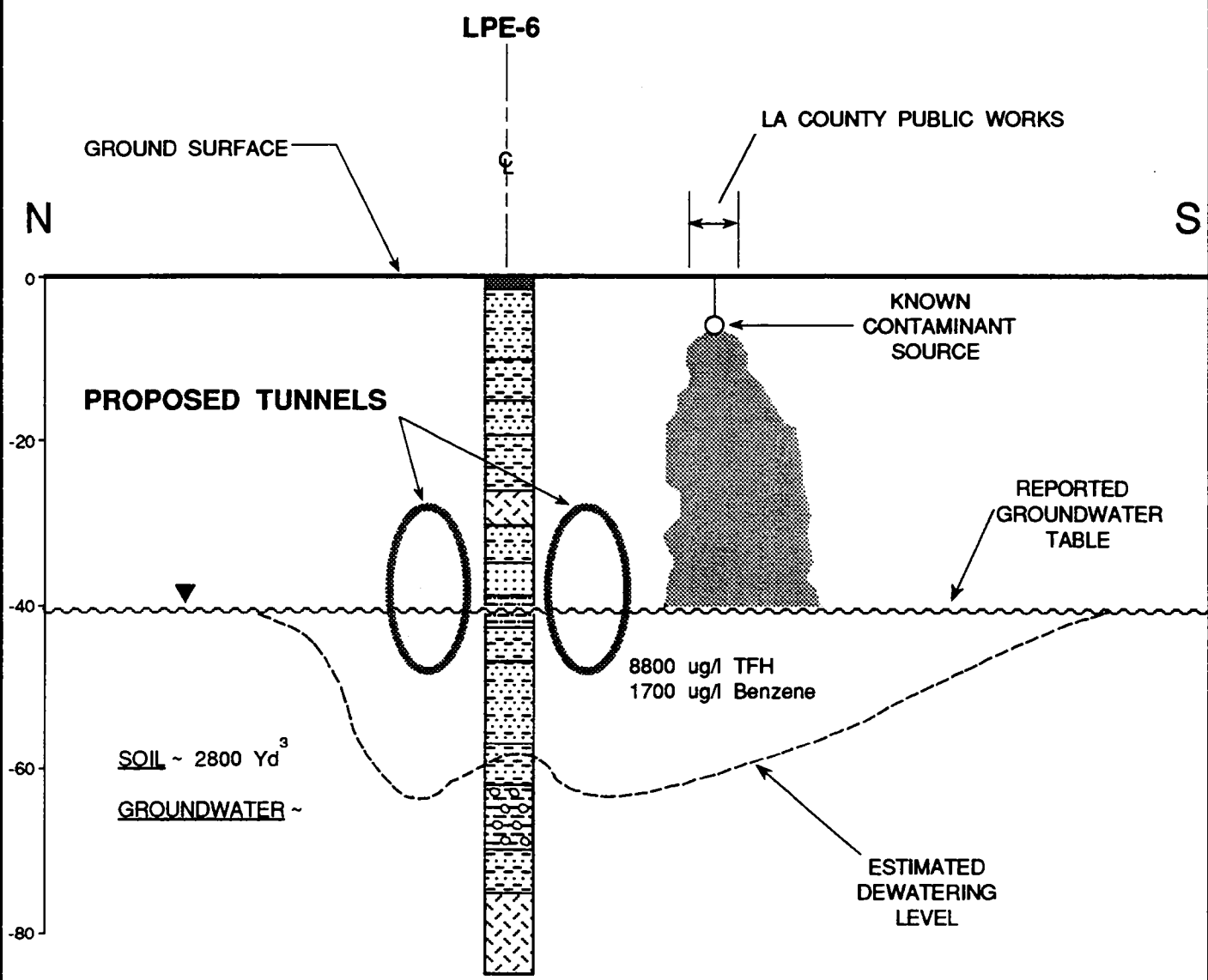
# CROSS SECTION

STATION 68+00  
VERTICAL SCALE: AS SHOWN  
HORIZONTAL SCALE: NOT TO SCALE

LAW/CRANDALL, INC.



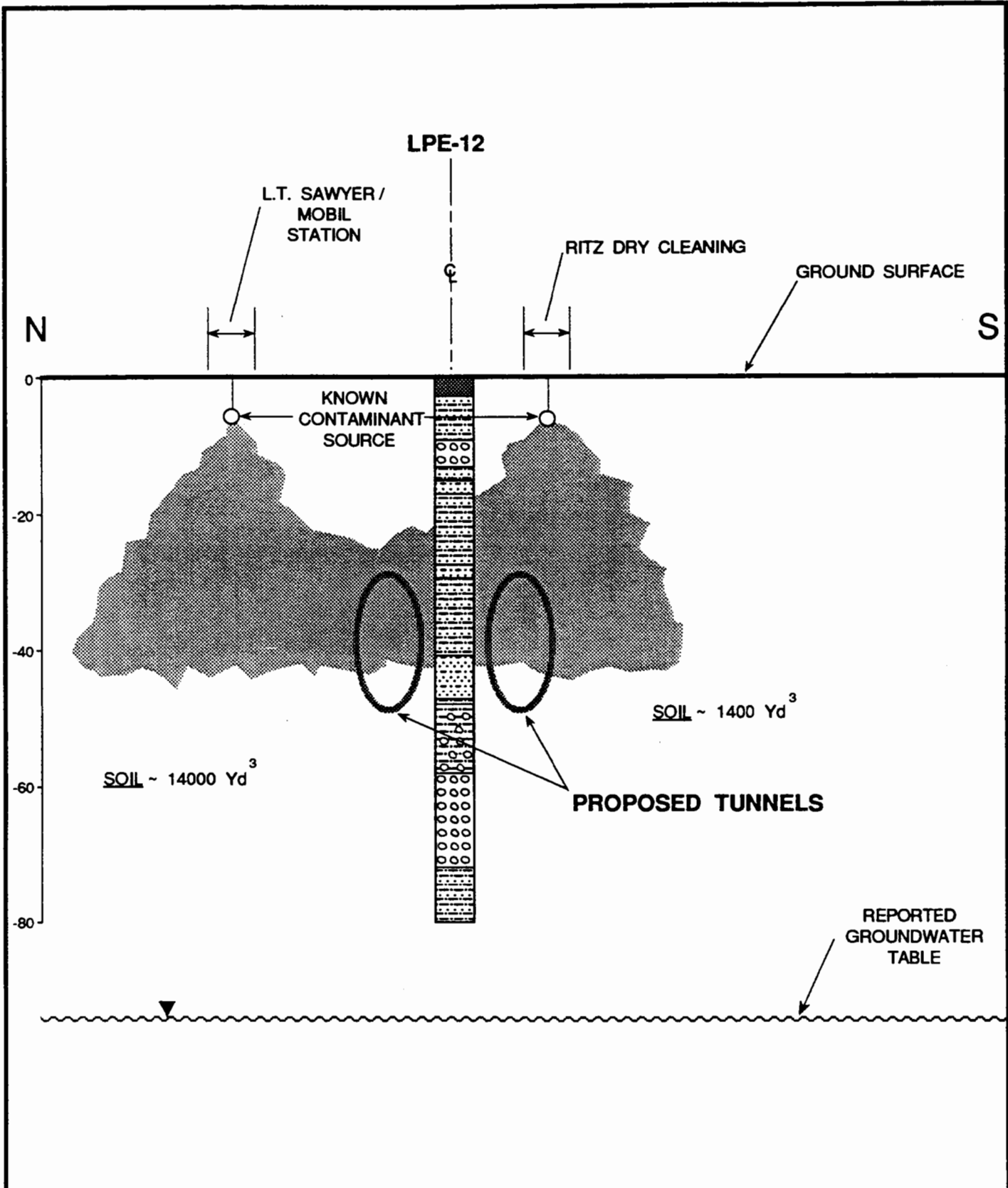
JOB 2701.30889.0004 DATE 6/9/94 F.T. DR. JULIANA O.E. BM W.P. CHKD. BA



# CROSS SECTION

STATION 220+00  
VERTICAL SCALE: AS SHOWN  
HORIZONTAL SCALE: NOT TO SCALE

JOB 2701.30889.0004 DATE 6/9/94 F.T. 60 DR. JULIANA O.E. 20 BM W.P. 0 CHKD Bm



# CROSS SECTION

STATION 581+00  
VERTICAL SCALE: AS SHOWN  
HORIZONTAL SCALE: NOT TO SCALE

LAW/CRANDALL, INC. 



Site/Activity	Soil					Groundwater				
	Disposal	Thermal Desorption	Recycling	Biotreatment	Fixation	Carbon	Air Stripping	Biological Treatment	UV - Oxidizing	Membrane
<b>Montgomery Ward/Rocketdyne<sup>1</sup></b>										
Treatment Effectiveness	H	H	H	L	L	H	H	L	H	L
Implementability	H	M	M	L	L	H	M	M	L	L
Permitting	2	—	2	—	—	—	—	—	—	—
Cost	L	L	L			M	M	H	H	H
<b>PL Porter</b>										
Treatment Effectiveness	H	H	H	H	L	H	H	H	H	H
Implementability	H	M	M	M	L	H	M	L	M	M
Cost	L	L	L	L	L	M	L-M	M	H	H
<b>Unocal, Tarzana<sup>3</sup></b>										
Treatment Effectiveness	H	H	H	H	L	H	H	H	H	H
Implementability	H	M	M	M-L	L	H	M	L	M	M
Permitting	—	—	—	—	—	—	Air permit	—	—	—
Cost	L	L	L	L	H	M	L-M	M	H	H
<b>Los Angeles Department of Public Works</b>										
Treatment Effectiveness	H	H	H	H	L	H	H	H	H	H
Implementability	H	M	M	M	L	H	M	L	M	M
Cost	L	L	L	L	H	M	L-M	M	H	H

Site/Activity	Soil					Groundwater				
	Disposal	Thermal Desorption	Recycling	Biotreatment	Fixation	Carbon	Air Stripping	Biological Treatment	UV - Oxidizing	Membrane
<b>L.T. Sawyer</b>										
Treatment Effectiveness	H	H	H	H	L	—	—	—	—	—
Implementability	M	M	H	M-L	L	—	—	—	—	—
Permitting	2	—	—	—	—	—	—	—	—	—
Cost	L	L	L	L	H	—	—	—	—	—
<b>Ritz Dry Cleaning</b>										
Treatment Effectiveness	H	H	H	L	L	—	—	—	—	—
Implementability	H	M	H	L	L	—	—	—	—	—
Permitting	W.A. 8240 <sup>5</sup>	Air	—	—	—	—	—	—	—	—
Cost	L	L	L	H	H	—	—	—	—	—

Prepared/Date: MAE 06/10/94  
 Checked/Date: \_\_\_\_\_

Notes: W.A. Waste Analysis

H High

L Low

1 Note that soils may originate from CERCLA site.

2 Presence of TCE in soil may make disposal unacceptable.

3 Potentially high concentrations of fuel hydrocarbons in soil.

4 Waste must be verified as acceptable at landfill due to PCE in potentially high levels.

5 Assumption was made that soil contains approximately 200 parts per billion (ppb) PCE and 700 cubic yards of soil are impacted.







**TABLE C-4: ALTERNATIVES B AND C, OPINION OF COSTS, STATIONS**

SITE	BASIS	OPINIONS OF COST
Reseda	<u>Soil</u> 9,778 yd <sup>3</sup> x 1.8 = 17,600	\$475,000 - D \$616,000 - T \$572,000 - R \$330,000 - B
	<u>Groundwater</u> 158,000,000 gallons	<u>Carbon</u> Capital \$1,330,000 Operating \$ 96,000 Total \$1,426,000  <u>Air Stripping</u> Capital \$650,000 Operating \$32,000 Total \$682,000

Prepared/Date: MAE 06/10/94

Checked/Date: SWB 09/12/94

- Notes:
- D - Disposal \$26/ton
  - T - Thermal Desorption \$50/ton
  - R - Recycling \$32.50/ton
  - B - Bioremediation \$18.75/ton



TABLE B-1: SITE ASSUMPTIONS AND OPINION OF COSTS

Profile	Type of Contamination	Assumptions Regarding Extent of Contamination and Volumes				Cost of Remediation Methods Alternative A		Cost of Remediation Methods Alternative B and C	
		Data Available	Regarding Soil	Regarding Groundwater	Volume	Soil	Groundwater	Soil	Groundwater
1. Montgomery Ward/ Rocketdyne	BTEX PCE Solvents	<ul style="list-style-type: none"> <li>&gt; 1,000 µg/kg BTEX - soil</li> <li>&gt; 1,000 µg/l BTEX - groundwater</li> <li>Site with a NPL site due to solvent contamination.</li> <li>400 µg/l PCE - groundwater.</li> <li>Groundwater is encountered at 18 ft.</li> <li>L/C has data indicating 6.5 µg/l PCE in the groundwater sample collected from the monitoring well installed during the geotechnical investigation.</li> </ul>	<ul style="list-style-type: none"> <li>Plume of soil contamination is approx. 200 feet across alignment.</li> <li>Soils in the bottom half of the tunnel in this area are fine-grained.</li> <li>90% retention of contamination from groundwater.</li> <li>Finer grained material will retain contamination; coarse-grained material will not.</li> </ul>	<ul style="list-style-type: none"> <li>Tunnel construction rate at 100 feet/day.</li> <li>Dewater for 30 days.</li> <li>Plume is approximately 200 feet across the alignment.</li> <li>Transmissivity = 55,000 gpd/ft = pumping rate of 300 gpm.</li> <li>Porosity is approximately 30%.</li> <li>Capture radius on the north side of alignment is approximately 500 feet.</li> <li>Contamination is approximately 1,000 µg/L BTEX and 400 µg/l PCE.</li> </ul>	<p>Approximately 4,000 yd<sup>3</sup> of soil cuttings.</p> <p>Approximately 13 million gallons of groundwater.</p>	<p>\$194,000 - D \$252,000 - T \$234,000 - R \$135,000 - B</p>	<p><u>Carbon</u> \$53,000</p> <p><u>Air Stripping</u> \$68,000</p>	<p>\$115,000 - D \$150,000 - T \$139,000 - R \$ 80,000 - B</p>	<p><u>Carbon</u> \$53,000</p> <p><u>Air Stripping</u> \$68,000</p>
2. P.L. Porter*	Cutting oil Diesel	<ul style="list-style-type: none"> <li>9 USTs removed March, 1988.</li> <li>Tank leak discovered June 18, 1990.</li> <li>Total volume of contaminated soil was excavated was 1,800 yd<sup>3</sup>.</li> <li>LA Fire Dept. referred this case to the RWQCB.</li> <li>Groundwater is encountered 17.6 ft below ground surface.</li> <li>The lateral extent of groundwater contamination is unknown.</li> <li>Approximately 1,700 gallons of diesel in soil.</li> <li>Approximately 1,180 gallons of diesel in groundwater.</li> <li>Preliminary site assessment workplan has been completed.</li> </ul>	<ul style="list-style-type: none"> <li>The soils in the bottom half of the tunnel in this area are fine-grained, upper portion are coarse-grained.</li> <li>Tight material will retain; sand &amp; gravel will not retain contamination.</li> <li>Diesel fuel will not volatilize.</li> <li>Close to 100% retention in the fine-grained material.</li> <li>Plume is approximately 120 feet wide across the alignment.</li> <li>Anticipate approx. concentrations of 100 mg/kg diesel.</li> </ul>	<ul style="list-style-type: none"> <li>50% of the estimated 1,180 gallons diesel has migrated to the groundwater and it is evenly distributed.</li> <li>Tunnel construction rate at 100 feet/day.</li> <li>Dewater for 30 days.</li> <li>Plume is approximately 180 feet wide across the alignment.</li> <li>Transmissivity = 55,000 gpd/ft = pumping rate of 300 gpm.</li> <li>Porosity is approximately 30%.</li> <li>Capture radius on south side of alignment &gt; 500 feet.</li> <li>Thickness of water zone contaminated with diesel = 40 feet.</li> <li>Volume of impacted groundwater = 5,526,991 gallons.</li> <li>Contamination is approx. 200 mg/l diesel.</li> <li>No floating product.</li> </ul>	<p>Approximately 1,700 yd<sup>3</sup> of soil cuttings.</p> <p>Approximately 13 million gallons of groundwater.</p>	<p>\$ 83,000 - D \$107,000 - T \$100,000 - R \$ 58,000 - B</p>	<p><u>Carbon</u> \$99,000</p> <p><u>Air Stripping</u> \$84,000</p>	<p>\$70,000 - D \$90,000 - T \$84,000 - R \$48,000 - B</p>	<p><u>Carbon</u> \$99,000</p> <p><u>Air Stripping</u> \$84,000</p>



TABLE B-1: SITE ASSUMPTIONS AND OPINION OF COSTS

Profile	Type of Contamination	Assumptions Regarding Extent of Contamination and Volumes				Cost of Remediation Methods Alternative A		Cost of Remediation Methods Alternative B and C	
		Data Available	Regarding Soil	Regarding Groundwater	Volume	Soil	Groundwater	Soil	Groundwater
3. Unocal	TPH as gasoline - soil TFH/BTEX - groundwater	<ul style="list-style-type: none"> <li>• 130 ppm TPH in soil at 20 feet.</li> <li>• Soil gas survey showed possibility of soil contamination in areas adjacent to the railroad right-of-way.</li> <li>• Groundwater is encountered at 22 feet.</li> <li>• TFH - 15,000 µg/l</li> <li>• Benzene - 6,600 µg/l</li> <li>• Toluene - 510 µg/l</li> <li>• Total Xylenes - 1,100 µg/l</li> <li>• Areas with floating product</li> </ul>	<ul style="list-style-type: none"> <li>• Soils in this tunnel section are fine grained.</li> <li>• 90% retention of contaminants in groundwater.</li> <li>• Plume is approx. 140 feet wide across the alignment.</li> <li>• Anticipate concentrations of 8,000—20,000 µg/kg TFH and 1,500—1,600 µg/kg Benzene.</li> </ul>	<ul style="list-style-type: none"> <li>• Contaminant concentrations in groundwater reported in file are consistent with what will be encountered during tunneling.</li> <li>• Tunnel rate at 100 feet/day.</li> <li>• Dewater for 30 days.</li> <li>• Plume is approximately 200 feet wide.</li> <li>• Transmissivity = 55,000 gpd/ft. = pumping rate of 300 gpm.</li> <li>• Porosity is approximately 25%.</li> <li>• Capture radius on north side of alignment = 500 feet.</li> <li>• Contamination is assumed at ranges of 8,800—24,000 µg/l TFH and 1,700—1,800 µg/l Benzene.</li> <li>• Three inches of floating product is consistent throughout the plume.</li> <li>• Plume is approximately 62,000 square feet.</li> </ul>	<p>Approximately 4,000 yd<sup>3</sup> of soil.</p> <p>Approximately 13 million gallons of groundwater.</p> <p>Approximately 29,000 gallons of fuel.</p>	<p>\$194,000 - D \$252,000 - T \$234,000 - R \$135,000 - B</p>	<p><u>Carbon</u> \$154,000</p> <p><u>Air Stripping</u> \$101,000</p> <p><u>Free Product Recovery</u> \$30,000</p>	<p>\$ 81,000 - D \$105,000 - T \$ 97,000 - R \$ 56,000 - B</p>	<p><u>Carbon</u> \$154,000</p> <p><u>Air Stripping</u> \$101,000</p> <p><u>Free Product Recovery</u> \$30,000</p>
4. L.A. County Public Works*	Diesel Gasoline Waste Oil	<ul style="list-style-type: none"> <li>• 10,000-gallon diesel tank, 10,000-gallon gasoline tank, 550-gallon waste oil tank.</li> <li>• RWQCB file had little information and said LA Fire Dept. is lead agency.</li> <li>• LA Fire Dept. had no file available.</li> <li>• Release caused by corrosion as stated in BBL report.</li> <li>• Potential of groundwater contamination at 20—25 feet, based on information in the BBL report.</li> <li>• Both saturated and unsaturated soil are impacted.</li> </ul>	<ul style="list-style-type: none"> <li>• Coarse grained sediments will retain 1%.</li> <li>• Soils in this tunnel section are coarse grained and will retain approx. 1% of the contamination in groundwater.</li> <li>• Plume is approximately 100 feet wide across the alignment.</li> <li>• Anticipate concentrations of 100—240 µg/kg TFH and 20 µg/kg benzene.</li> </ul>	<ul style="list-style-type: none"> <li>• Data and assumptions from Unocal Station were used to prepare this profile due to lack of file data.</li> <li>• Contamination concentration are consistent with what will be encountered during tunneling.</li> <li>• Tunnel rate at 100 feet/day.</li> <li>• Dewater for 30 days.</li> <li>• Plume is approximately 200 feet wide.</li> <li>• Transmissivity = 55,000 gpd/ft = pumping rate of 300 gpm.</li> <li>• Porosity is approximately 30%.</li> <li>• Capture radius on south side of alignment is &gt; 500 feet.</li> <li>• Contamination is assumed at ranges of 8,800—24,000 µg/l TFH and 1,700—1,800 µg/l benzene.</li> </ul>	<p>Approximately 4,000 yd<sup>3</sup> of soil cuttings.</p> <p>Approximately 13 million gallons.</p>	<p>\$194,000 - D \$252,000 - T \$234,000 - R \$135,000 - B</p>	<p><u>Carbon</u> \$154,000</p> <p><u>Air Stripping</u> \$101,000</p>	<p>\$58,000 - D \$75,000 - T \$70,000 - R \$40,000 - B</p>	<p><u>Carbon</u> \$154,000</p> <p><u>Air Stripping</u> \$101,000</p>





TABLE B-1: SITE ASSUMPTIONS AND OPINION OF COSTS

Profile	Type of Contamination	Assumptions Regarding Extent of Contamination and Volumes				Cost of Remediation Methods Alternative A		Cost of Remediation Methods Alternative B and C	
		Data Available	Regarding Soil	Regarding Groundwater	Volume	Soil	Groundwater	Soil	Groundwater
5. L.T. Sawyer/Mobil Station*	Gasoline BTEX Diesel Solvents	<p>L. T. Sawyer</p> <ul style="list-style-type: none"> <li>60 yrs. in operation as fuel facility.</li> <li>12 USTs; 7 above ground on-site since 1966.</li> <li>4 soil samples indicate gasoline, BTEX, diesel &amp; solvents to 45 feet.</li> <li>Soil vapor study indicated elevated levels of hydrocarbons.</li> </ul> <p>Mobile Oil Service Station</p> <ul style="list-style-type: none"> <li>Elevated levels of TPH (&gt;100 mg/kg) to a depth of 65 feet.</li> <li>Reported high level of BTEX.</li> </ul>	<ul style="list-style-type: none"> <li>Medium to high infiltration of sandy, silty sand and sandy silt.</li> <li>No clay layers to prevent downward migration.</li> <li>Contamination from the site impacts the soil in tunnel (&gt;100 ppm TPH and high BTEX).</li> <li>500 feet of tunnel is affected.</li> </ul>		Approximately 14,000 yd <sup>3</sup> of soil cuttings.	\$680,000 - D \$882,000 - T \$819,000 - R \$473,000 - B	N/A	\$720,000 - T \$934,000 - T \$867,000 - R \$500,000 - B	N/A
6. Ritz Cleaners*	PCE VOCs	<ul style="list-style-type: none"> <li>One sample at 5', PCE 36 ppb<sup>+</sup>.</li> <li>Soil gas survey indicated VOCs above background levels.</li> </ul>	<ul style="list-style-type: none"> <li>Area of high infiltration, silty sand and sandy silt.</li> <li>PCE has migrated down 30'.</li> <li>50' of tunnel with affected soil.</li> <li>About 50% of concentration has migrated into the tunnel area.</li> </ul>		Approximately 1,400 yd <sup>3</sup> of soil cuttings.	\$68,000 - D \$88,000 - T \$82,000 - R \$48,000 - B		\$72,000 - D \$94,000 - T \$87,000 - R \$50,000 - B	
8. 2 Contingency Sites	PCE TFH BTEX	--	<ul style="list-style-type: none"> <li>Each site has approx. 4,000 yd<sup>3</sup> of soil with the following concentrations:</li> <li>300 ppb PCE</li> <li>900 ppb benzene</li> <li>900 ppb TFH</li> </ul>	<ul style="list-style-type: none"> <li>Each site has approximately 13 million gallons of groundwater with the following conditions:</li> <li>400 µg/l PCE</li> <li>1,000 µg/l BTEX</li> </ul>	Volumes are based on conditions that are similar to the Unocal site (Point 2) (4,000 yd <sup>3</sup> of soil cuttings).	\$194,000 - D \$252,000 - T \$234,000 - R \$235,000 - B	<u>Carbon</u> \$53,000  <u>Air Stripping</u> \$68,000	\$194,000 - D \$252,000 - T \$234,000 - R \$235,000 - B	<u>Carbon</u> \$53,000  <u>Air Stripping</u> \$68,000

Prepared/Date: 06/10/94  
Checked/Date: \_\_\_\_\_

- Notes: D Disposal (\$26/ton)  
 T Thermal Desorption (\$50/ton)  
 R Recycling (\$32.50/ton)  
 B Bioremediation (\$18.75/ton)  
 ppb Parts per billion  
 µg/l microgram per liter  
 + A low potential exists that soils could be classified as California or RCRA Hazardous Waste. If this is the case, costs could significantly increase.  
 \* An estimate would be \$100 per cubic yard plus transportation assumed that analytical testing done on the site will be sufficient for landfill acceptance.





**TABLE C-1: ALTERNATIVE A, OPINION OF COSTS, SITES**

SITE	BASIS	OPINIONS OF COST
Montgomery Ward/Rocketdyne	<u>Soil</u> 4,000 yd <sup>3</sup> x 1.8 = 7,200 tons	\$194,000 - D \$252,000 - T \$234,000 - R \$135,000 - B
	<u>Groundwater</u> 13 million gallons	<u>Carbon</u> Capital \$45,000 Operating <u>\$ 8,000</u> Total \$53,000  <u>Air Stripping</u> Capital \$65,000 Operating <u>\$ 3,000</u> Total \$68,000
P.L. Porter	<u>Soil</u> 1,700 yd <sup>3</sup> x 1.8 = 3,060 tons	\$ 83,000 - D \$107,000 - T \$100,000 - R \$ 58,000 - B
	<u>Groundwater</u> 13 million gallons	<u>Carbon</u> Capital \$45,000 Operating <u>\$54,000</u> Total \$99,000  <u>Air Stripping</u> Capital \$65,000 Operating <u>\$19,000</u> Total \$84,000

**TABLE C-1: ALTERNATIVE A, OPINION OF COSTS, SITES**

SITE	BASIS	OPINIONS OF COST
Unocal Station	<u>Soil</u> 4,000 yd <sup>3</sup> x 1.8 = 7,200 tons	\$194,000 - D \$252,000 - T \$234,000 - R \$135,000 - B
	<u>Groundwater</u> 13 million gallons	<u>Carbon</u> Capital \$45,000 Operating <u>\$109,000</u> Total \$154,000  <u>Air Stripping</u> Capital \$65,000 Operating <u>\$36,000</u> Total \$101,000
	<u>Free Product</u>	Recovery \$30,000
Los Angeles County Public Works	<u>Soil</u> 4,000 yd <sup>3</sup> x 1.8 = 7,200 tons	\$194,000 - D \$252,000 - T \$234,000 - R \$135,000 - B
	<u>Groundwater</u> 13 million gallons	<u>Carbon</u> Capital \$45,000 Operating <u>\$109,000</u> Total \$154,000  <u>Air Stripping</u> Capital \$65,000 Operating <u>\$ 36,000</u> Total \$101,000

**TABLE C-1: ALTERNATIVE A, OPINION OF COSTS, SITES**

SITE	BASIS	OPINIONS OF COST
LT Sawyer/Mobil Station	<u>Soil</u> 14,000 yd <sup>3</sup> x 1.8 = 25,200 tons	\$680,000 - D \$882,000 - T \$819,000 - R \$473,000 - B
Ritz Cleaners	<u>Soil</u> 1,400 yd <sup>3</sup> x 1.8 = 2,520 tons	\$68,000 - D \$88,000 - T \$82,000 - R \$48,000 - B
Contingency Sites (2)	<u>Soil</u> 4,000 yd <sup>3</sup> x 1.8 = 7,200 tons	\$194,000 - D \$252,000 - T \$234,000 - R \$235,000 - B
	<u>Groundwater</u> 13 million gallons	<u>Carbon</u>  Capital \$45,000 Operating <u>\$ 8,000</u>  Total \$53,000  <u>Air Stripping</u>  Capital \$65,000 Operating <u>\$ 3,000</u>  Total \$68,000

Prepared/Date: MAE 06/10/94

Checked/Date: SWB 08/12/94

Notes: D - Disposal \$26/ton  
 T - Thermal Desorption \$50/ton  
 R - Recycling \$32.50/ton  
 B - Bioremediation \$18.75/ton

**TABLE C-2: ALTERNATIVE B & C, OPINION OF COSTS, SITES**

SITE	BASIS	OPINIONS OF COST
Montgomery Ward/Rocketdyne	<u>Soil</u> 2,307 yd <sup>3</sup> x 1.8 = 4,200 tons	\$115,000 - D \$150,000 - T \$139,000 - R \$ 80,000 - B
	<u>Groundwater</u> 13 million gallons	<u>Carbon</u>  Capital           \$45,000 Operating <u>\$ 8,000</u>  Total               \$53,000  <u>Air Stripping</u>  Capital           \$65,000 Operating <u>\$ 3,000</u>  Total               \$68,000
P.L. Porter	<u>Soil</u> 1,422 yd <sup>3</sup> x 1.8 = 2,560 tons	\$70,000 - D \$90,000 - T \$84,000 - R \$48,000 - B
	<u>Groundwater</u> 13 million gallons	<u>Carbon</u>  Capital           \$45,000 Operating <u>\$54,000</u>  Total               \$99,000  <u>Air Stripping</u>  Capital           \$65,000 Operating <u>\$19,000</u>  Total               \$84,000

**TABLE C-2: ALTERNATIVE B & C, OPINION OF COSTS, SITES**

SITE	BASIS	OPINIONS OF COST
Unocal Station	<u>Soil</u> 1,659 yd <sup>3</sup> x 1.8 = 2,986 tons	\$ 81,000 - D \$105,000 - T \$ 97,000 - R \$ 56,000 - B
	<u>Groundwater</u> 13 million gallons	<u>Carbon</u> Capital \$ 45,000 Operating <u>\$109,000</u> Total \$154,000  <u>Air Stripping</u> Capital \$65,000 Operating <u>\$36,000</u> Total \$101,000
	<u>Free Product</u>	Recovery \$30,000
Los Angeles County Public Works	<u>Soil</u> 1,185 yd <sup>3</sup> x 1.8 = 2,133 tons	\$58,000 - D \$75,000 - T \$70,000 - R \$40,000 - B
	<u>Groundwater</u> 13 million gallons	<u>Carbon</u> Capital \$ 45,000 Operating <u>\$109,000</u> Total \$154,000  <u>Air Stripping</u> Capital \$ 65,000 Operating <u>\$ 36,000</u> Total \$101,000



**TABLE C-2: ALTERNATIVE B & C, OPINION OF COSTS, SITES**

SITE	BASIS	OPINIONS OF COST
LT Sawyer/Mobil Station	<u>Soil</u> 14,815 yd <sup>3</sup> x 1.8 = 26,667 tons	\$720,000 - D \$934,000 - T \$867,000 - R \$500,000 - B
Ritz Cleaners	<u>Soil</u> 1,481 yd <sup>3</sup> x 1.8 = 2,666 tons	\$72,000 - D \$94,000 - T \$87,000 - R \$50,000 - B
Contingency Sites (2)	<u>Soil</u> 4,000 yd <sup>3</sup> x 1.8 = 7,200 tons	\$194,000 - D \$252,000 - T \$234,000 - R \$235,000 - B
	<u>Groundwater</u> 13 million gallons	<u>Carbon</u>  Capital \$45,000 Operating <u>\$ 8,000</u>  Total \$53,000  <u>Air Stripping</u>  Capital \$65,000 Operating <u>\$ 3,000</u>  Total \$68,000

Prepared/Date: MAE 06/10/94  
 Checked/Date: SWB 09/12/94

Notes: D - Disposal \$26/ton  
 T - Thermal Desorption \$50/ton  
 R - Recycling \$32.50/ton  
 B - Bioremediation \$18.75/ton

**TABLE C-3: ALTERNATIVE A, OPINION OF COSTS, STATIONS**

SITE	BASIS	OPINIONS OF COST
Topanga	<u>Soil</u> 26,222 yd <sup>3</sup> x 1.8 = 47,000 tons	\$1,274,000 - D \$1,652,000 - T \$1,534,000 - R \$ 885,000 - B
	<u>Groundwater</u> 158,000,000 gallons	<u>Carbon</u>  Capital           \$1,330,000 Operating         \$ 96,000  Total               \$1,426,000  <u>Air Stripping</u>  Capital           \$650,000 Operating         \$32,000  Total               \$682,000
Tampa	<u>Soil</u> 19,111 yd <sup>3</sup> x 1.8 = 34,400 tons	\$ 929,000 - D \$1,204,000 - T \$1,118,000 - R \$ 645,000 - B
	<u>Groundwater</u> 158,000,000 gallons	<u>Carbon</u>  Capital           \$1,330,000 Operating         \$ 96,000  Total               \$1,426,000  <u>Air Stripping</u>  Capital           \$650,000 Operating         \$32,000  Total               \$682,000

**TABLE C-3: ALTERNATIVE A, OPINION OF COSTS, STATIONS**

SITE	BASIS	OPINIONS OF COST
Reseda	<u>Soil</u> 6,889 yd <sup>3</sup> x 1.8 = 12,400 tons	\$335,000 - D \$434,000 - T \$403,000 - R \$232,000 - B
	<u>Groundwater</u> 158,000,000 gallons	<u>Carbon</u> Capital           \$1,330,000 Operating         \$ 96,000 Total               \$1,426,000  <u>Air Stripping</u> Capital           \$650,000 Operating         \$32,000 Total               \$682,000

Prepared/Date: MAE 06/10/94  
 Checked/Date: SWB 09/12/94

- Notes:
- D - Disposal                   \$26/ton
  - T - Thermal Desorption     \$50/ton
  - R - Recycling               \$32.50/ton
  - B - Bioremediation         \$18.75/ton

**TABLE C-4: ALTERNATIVES B AND C, OPINION OF COSTS, STATIONS**

SITE	BASIS	OPINIONS OF COST
Topanga	<u>Soil</u> 53,926 yd <sup>3</sup> x 1.8 = 97,067 tons	\$2,261,000 - D \$3,400,000 - T \$3,154,000 - R \$1,820,000 - B
	<u>Groundwater</u> 158,000,000 gallons	<u>Carbon</u>  Capital           \$1,330,000 Operating         \$ 96,000  Total               \$1,426,000  <u>Air Stripping</u>  Capital           \$650,000 Operating         \$32,000  Total               \$682,000
Tampa	<u>Soil</u> 21,333 yd <sup>3</sup> x 1.8 = 38,399 tons	\$1,037,000 - D \$1,344,000 - T \$1,248,000 - R \$ 720,000 - B
	<u>Groundwater</u> 158,000,000 gallons	<u>Carbon</u>  Capital           \$1,330,000 Operating         \$ 96,000  Total               \$1,426,000  <u>Air Stripping</u>  Capital           \$650,000 Operating         \$32,000  Total               \$682,000