KASILOF RIVERVIEW
ADEC SPILL #93230015402
UST FACILITY ID#384

CORRECTIVE ACTION REPORT

Prepared for:

Kasilof Riverview
P.O. Box 254
Kasilof, Alaska 99610

Prepared By:

Arne Tikka, P.E.
A.C.E. Engineering
P.O. Box 3411
Soldotna, Alaska 99669

December 2003
Project No. 23019

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December 20, 2003 Project No. 22132

Don Seagren
Project Manager
ADEC
43335 K Beach Road, Suite 11
Soldotna, Alaska 99669

Subject: Kasilof Riverview; ADEC Spill #93230015402; UST Facility ID #384
Corrective Action Report
Report of Environmental Investigation and Analytical Results

Don:

Introduction

A Corrective Action Plan was approved by ADEC December 28, 1999, for the Kasilof Riverview subject UST spill site. We have completed the tasks included in the corrective action plan prepared by Gilfilian Engineering & Environmental Testing, Inc. (GE^2T) dated September 7, 1999. Following is a report of the investigation and monitor well installations, analytical results from soil and ground water sampling, and discussion of testing of the SVE system in place at the site.

We have discussed the project investigation with you and provide the following report and summary of our findings.

Background

Contamination was identified at the site during a Phase I Release Investigation by GE^2T on April 29, 1998, with report dated May 15, 1998, and during the UST system upgrade conducted October 15, 1998, with report by GE^2T dated May 1999. A covered soil stockpile remains onsite from the UST upgrade. An SVE system is in place on the property, as shown on a site plan by GE2T in their Corrective Action Plan dated September 7, 1999, however details of the system installation including well depths and screened intervals was not available.

Field Investigation and Monitor Well Installations

A field investigation was completed on April 24-25, 2003. Three soil borings and monitor well installations were completed in approximate locations previously approved by ADEC, as shown on the attached Approximate Site Plan, Figure 1.

Drilling and monitor well installation was completed by Hughes Drilling, under our observation, using a CME 75 truck-mounted drill rig and 8" hollow-stem augers. All drilling and soil sampling equipment were decontaminated prior to drilling and split-spoon samplers were decontaminated between each sample using a mild anionic detergent and multiple distilled water rinses.

The borings were advanced into the surface of the upper most aquifer encountered at depths of 24 – 28 feet in the borings. Soil samples were taken at 5-foot intervals using a 2.5-inch diameter, 24" long, split-spoon sampler driven into undisturbed soils with a 340-pound hydraulic hammer. Monitor wells were completed using 10-feet of two inch PVC screen, PVC casing, silica sand pack, bentonite chips, Volclay grout, and a 6" steel security casing set in concrete. Well screens were placed with approximately 6-7 feet of the screen below, and 3-4 feet above, the observed water table. A silica sand pack was placed to approximately two feet above the screen, followed by two feet of bentonite chips and volclay grout to the surface. Soil boring logs, including monitor well depths and screened intervals, are attached as Sheets 1, 2, & 3.

Subsurface Geology and Groundwater Flow

The subsurface geology encountered in the borings appeared similar, however, an organic/coal layer was encountered near the bottom of SB's 1 & 3 but not in SB 2. The soils observed generally consisted of a gravelly fill layer on the surface underlain by silty soils with typically trace sands and gravels to depths of 12 – 15 feet below ground. Soils below this were sands and gravels with varying silt content extending to depths of over 25 feet deep in SB 1 and over 30 feet in SB's 2 & 3. An organic soil layer of apparent decomposed, relatively dry, coal was encountered in MW 1 from 26.5 feet to the total depth of 31.0 feet, and in MW 3 from 31.0 to the total depth of 32.0 feet. A water table was encountered in the soil borings at depths of 24-27 feet while drilling.

A survey of the monitor wells was completed by Johnson Surveying on June 24, 2003. Static water levels were taken from the wells on August 2 and November 20, 2003, using a Solinist water level indicator. Based on these static water levels, and corresponding groundwater elevations, apparent direction of groundwater flow is toward the east with a slight southerly trend in August. Groundwater levels fluctuated between the August and November measurements and probably fluctuate seasonally in this apparent perched shallow aquifer.

Soil Sampling and OVM Readings

Monitor Well Soil Sampling

Soil samples were taken from each soil boring at 5-foot intervals using a split-spoon sampler. Soil samples extracted from each split-spoon were screened for organic vapors using an onsite calibrated Mini-Rae 2000 photo ionization detector (PID). The samples were warmed, agitated and vapor readings taken. The soil samples taken from soil boring SB 1 samples S-3, 4, & 5 revealed a possible slight hydrocarbon odor but no visible sheen and samples from the other soil borings, SB 2 and SB 3, revealed no hydrocarbon odors or sheens.

PID vapor readings in the samples from SB 1 ranged from 0 – 20.7 ppm in samples taken at 15, 20, and 25 feet. Vapors were not-detected in other samples from SB 1, including the samples taken at 5, 10, 15 and 30 feet, or samples from SB 2 & SB 3.

Two samples were taken from each soil boring for laboratory analysis. One of these samples was taken from the approximate soil/water interface. Samples were taken using individual stainless steel hand trowel and placed in appropriate containers. Containers were labeled during sampling and soil samples for BTEX analysis were covered with methonal preservative provided

by the laboratory. Samples were taken for BTEX, GRO, DRO, and RRO analysis, and containers placed in a cooler with blue ice at 4^{O}C for lab delivery.

Former Diesel UST Soil Sampling

Samples were also taken from three borings at the approximate former diesel UST location site, and four locations from the onsite soil stockpile, using a hollow-stem stainless steel hand auger and individual stainless auger sample tubes. Samples were taken at the former diesel UST for GRO, DRO, and BTEX analysis. Sample screening from the diesel UST borings revealed vapor readings ranging from 1.2 – 32.2 ppm.

Stockpile Soil Sampling

Samples were taken from four separate locations of the soil stockpile for GRO, DRO, RRO, and BTEX analysis. Screening revealed vapor readings from 10 – 327 ppm in the samples taken.

The attached Soil Stockpile and Former Diesel UST Locations Map, Figure 2, shows the former diesel tank, and soil stockpile, sample locations and soil vapor readings, respectively.

Groundwater Sampling

Water samples were taken from the completed monitor wells, two days following installation and development, after purging each well over three casing water volumes. Water samples were taken, using individual disposable plastic bailers for each well, and transferred directly to containers provided by the laboratory. A sample was also taken from the onsite water supply well for volatile organic compounds. The water well samples were taken directly from the bathroom sink following a complete purge of the water system.

Laboratory Sample Results

Samples were stored and shipped to SGS/CT&E Environmental Services, Inc. for sample analysis under proper security and Chain-of-Custody. Soil samples were analyzed for gasoline range organics (GRO) by Alaska Method 101 (AK 101), diesel range organics (DRO) by AK 102, residual range organics (RRO) by AK 103, and BTEX by Method 8021B. Monitor well water samples were analyzed for GRO, BTEX, and DRO. The potable water well sample was analyzed for volatile organic compounds under EPA Method 524.2. The laboratory results are summarized on Tables 1-4 and the detailed Analytical Reports and Chain of Custody Records are included as Attachment A.

The soil samples from monitor well borings show all contamination levels at not-detected for GRO, DRO, RRO, and nearly all BTEX components. Soil boring SB 1/MW 1, sample S-3 at 15 feet deep showed the only contamination with a benzene level of 0.0889 mg/Kg, however, the sample at 25 feet showed ND for benzene . This is the only result above the allowable soil cleanup level of 0.02 mg/Kg for benzene migration to groundwater in 18 AAC 75.341. Soil Cleanup Levels; Table B1.

The laboratory results for the groundwater samples show ND for GRO, DRO, and BTEX with the exception of MW-1 which showed a benzene level of 0.00626 mg/L, slightly above the allowable State groundwater cleanup level of 0.005 mg/L. All other analytical results for soil boring and monitor well samples were below allowable State cleanup levels.

The water sample from the onsite drinking water well showed all ND values for volatile organic compounds.

Soil samples from the former diesel UST show ND for GRO, DRO, and BTEX with the exception of sample S1 which showed a level of 54.7 for DRO and ND for GRO and BTEX.

The stockpiled soil samples show contamination levels for GRO, DRO, and RRO, and most BTEX components below allowable State cleanup levels. The benzene level in samples S2 of 0.0418 mg/Kg, S3 of 0.0233, and S4 of 0.0227 slightly exceed the allowable cleanup level of 0.02 for migration to groundwater.

Spill Site Cleanup Levels

The Alaska Department of Environmental Conservation (ADEC), Oil and Hazardous Substances Pollution Control Regulations, 18 AAC 75, sets Soil Cleanup Levels, 18 AAC 75.340 and provides Soil Cleanup Levels; Tables 18 AAC 75.341. Groundwater and surface water cleanup levels are provided in 18 AAC 75.345.

Based on existing onsite conditions, under Method One, Table A1, the site appears to fall into Catagory A with cleanup levels of GRO - 50 mg/Kg, DRO - 100 mg/Kg, and RRO - 200 mg/Kg. Under Method 2, Table B1, acceptable soil cleanup levels are given for ingestion, inhalation, and migration to groundwater for GRO, DRO, RRO, and BTEX components. Table C provides groundwater cleanup levels.

Soil analytical results show most contamination levels from subsurface soil and groundwater samples taken are below ADEC's Method 1 & 2 allowable cleanup levels with the exception of benzene in SB 1, S 3 and the groundwater sample from MW-1 as discussed previously. Soil boring sample analytical results and ADEC cleanup levels are shown on Table 1. Diesel UST soil boring sample results are shown on Table 2. Stockpiled soil sample analytical results are shown on Table 3 and water sample analytical results and cleanup levels are shown on Table 4.

All samples show contamination levels below allowable State cleanup requirements for GRO, DRO, RRO, and most BTEX components, as noted previously.

Soil Vapor Extraction System Testing

The soil vapor extraction system was tested on July 15, 2003 with the assistance of David Brailey from Oil Risk Consultants. Mr. Brailey provided an intrinsically safe 1 ½ hp test blower, pressure gauge, and pressure manometer. Each well was connected to the blower at the building pipe termination point. The piping appeared to have water and the well heads were exposed, the blower was reversed, and the water was cleaned from the piping network. Testing revealed variable mostly uninterpretable results. Maximum air flows observed were approximately 6 cfm from extraction wells V-1 and V-2. Other wells showed minimum or no air flows and appear to

act as if the screens may be plugged or under water. Additionally, we could observe no true pressure/vacuum correspondence between wells during vapor extraction. The blower was left in operation in extraction mode for approximately one week on wells V-1 and V-2. Other wells were tested intermittently but showed no response.

The blower was connected to the pipe from the soil stockpile for approximately one week , however, did not appear to draw more than 4 cfm air volume.

Contaminated Soil Stockpile Analytical Results and Cleanup Plans

The soil stockpile storage cell consists of a prepared, bermed soil base covered with a 20-mil PE liner. An air vent piping network was placed during stockpile construction to accommodate air-venting of the stockpile and piping was run to the SVE piping termination point.

A total of approximately 125 cy of contaminated soil was reportedly placed in the stockpile (GE2T May 12, 1999). The stockpile is completely covered over with a 20-mil liner which is anchored in place with tires and ropes.

The stockpiled soil samples show contamination levels for GRO, DRO, and RRO, and most BTEX components below allowable State cleanup levels. The benzene level in samples S2 of 0.0418 mg/Kg, S3 of 0.0233, and S4 of 0.0227 slightly exceed the allowable cleanup level of 0.02 mg/Kg for migration to groundwater.

The owner was hoping to dispose of the soil onsite since costs for hauling, thermal remediation, and disposal in Anchorage are estimated at $15,000-$20,000 per 100CY of soil. Benzene was the only contaminant observed in the soils samples exceeding allowable ADEC cleanup standards and the levels, as noted above, were quite low. Simple aeration would be expected to reduce benzene levels to allowable cleanup standards.

Conclusions

Soil samples collected from the monitor well soil borings and former diesel tank location, and water samples from the monitor wells, show nearly all levels below ADEC's allowable cleanup levels for GRO, DRO, RRO, and BTEX. Benzene was the only contaminate detected in soil boring and monitor well SB-1/MW-1, however, the low level only slightly exceeds groundwater cleanup levels provided in Table C, 18 AAC 75.345. The soil samples from the borings show all contamination levels at not-detected for GRO, DRO, RRO, and nearly all BTEX components. Soil boring SB 1, sample S-3 at 15 feet deep showed the only contamination with a benzene level of 0.0889 mg/Kg. This is the only result above the allowable soil cleanup level of 0.02 mg/Kg for benzene migration to groundwater in 18 AAC 75.341. Soil Cleanup Levels; Table B1.

The laboratory results for the groundwater samples show ND for GRO, DRO, and BTEX with the exception of MW-1 which showed a benzene level of 0.00626 mg/L, slightly above the allowable State groundwater cleanup level of 0.005 mg/L (this cleanup level is for groundwater expected to have a potential future use as a drinking water source, which may not be applicable for this shallow apparent perched water table aquifer).

Based on review of the data, onsite soil and groundwater sampling, and sample analytical results, observed soil and groundwater contamination appears to be at levels mostly below allowable ADEC cleanup standards, however, some minor amounts of Benzene contamination appears in the soil and groundwater at MW 1.

Based on the above investigation and analytical results, and previous reports by GE2T, it appears the contamination may have been mostly removed from the ground and remaining contamination, based on previous investigation by GE2T, may be difficult to extract without substantial efforts. The soils are fairly tight and most of the SVE wells appear non-functional.

Recommendations

Monitor Well MW 1 should be sampled for BTEX on at least an annual basis, for three years, to determine Benzene levels and to evaluate any potential increase in levels toward the Kasilof River in this shallow aquifer.

Groundwater levels in the monitor wells indicate groundwater flow appears to be mostly toward the east and shows some seasonal fluctuation. This water table may show additional fluctuation during seasonal periods and periods of heavy rain. Static water levels should be monitored, on at least a quarterly basis, for one year to evaluate if additional monitor well placement is needed and to evaluate optimal location.

Several options are available for the soil stockpile. Based on the low contamination levels observed in the samples with only Benzene slightly exceeding allowable cleanup levels the soil stockpile could probably be further aerated, by the placement of additional aeration pipes and lifting or venting the cover to allow air flow or, by landfarming the soil onsite. The owner plans to evaluate options and determine a plan for final remediation and disposal of the contaminated soil stockpile. The preferable option may be to landfarm the soils onsite in smaller quantities aerating to reduce benzene levels. After evaluating the options the owner will provide information to ADEC for review and approval of the preferred plan.

This corrective action report is provided to ADEC, at the request of the owners, Joe and Joann Browning. Please review this report and attached information and evaluate the recommendations provided for future site action/activities.

Please call with any questions or if you need additional information.

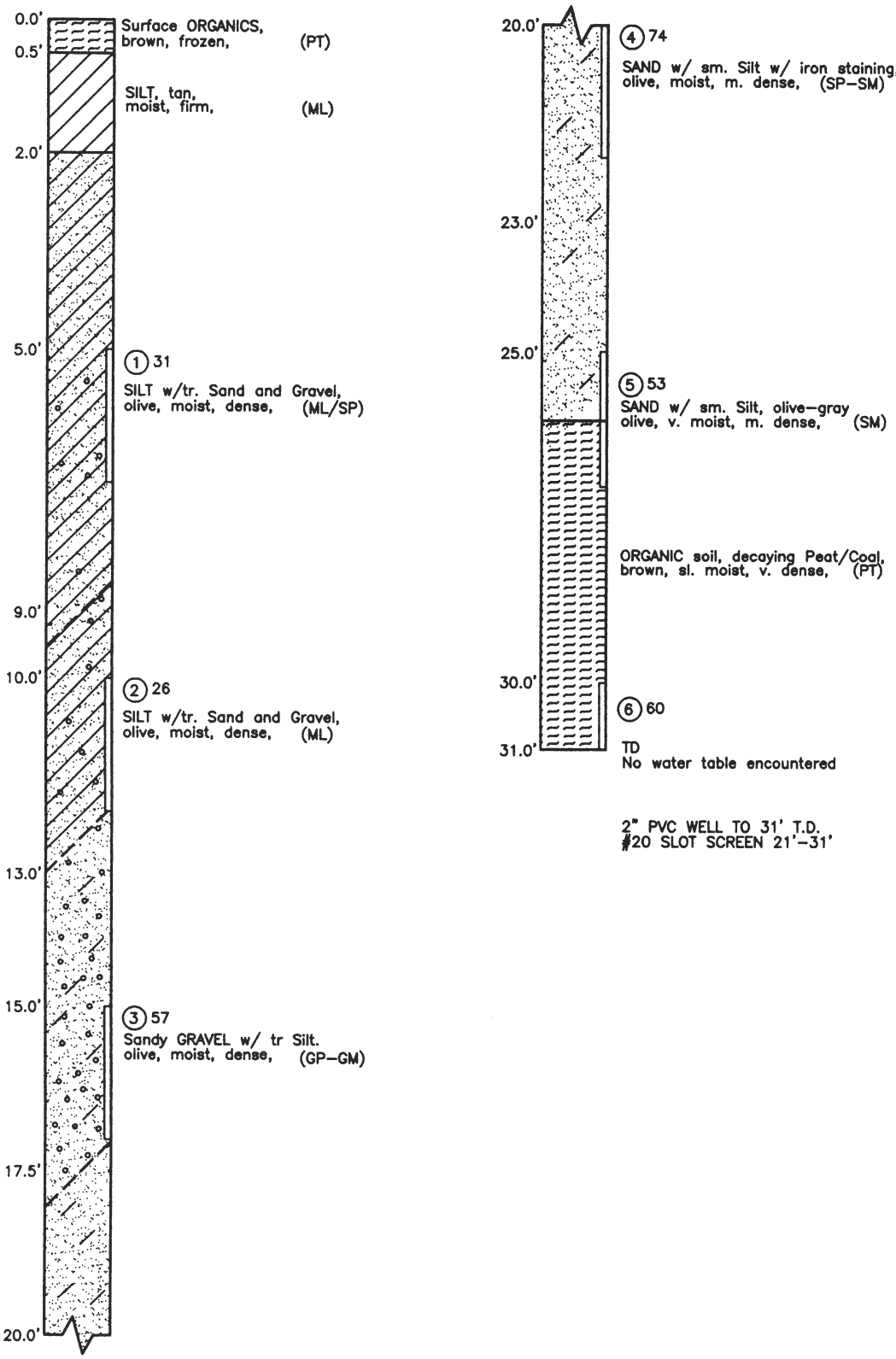
Sincerely,

Arne Tikka, P.E.
c:\msw\myfiles\reports\oldsawmillroadfinalsa.rpt

Attachments

Soil Boring Logs, Sheets 1-3
Approximate Site Plan, Figure 1 of 3
Soil Stockpile and Former Diesel UST Sample Locations, Figure 2 of 3
Monitor Well Water Level and Groundwater Flow Diagram, Figure 3 of 3
Laboratory Analytical Results Summaries, Tables 1-4
Laboratory Detailed Analytical Report, Attachment A

SB–1
(MW 1)
04/24/03



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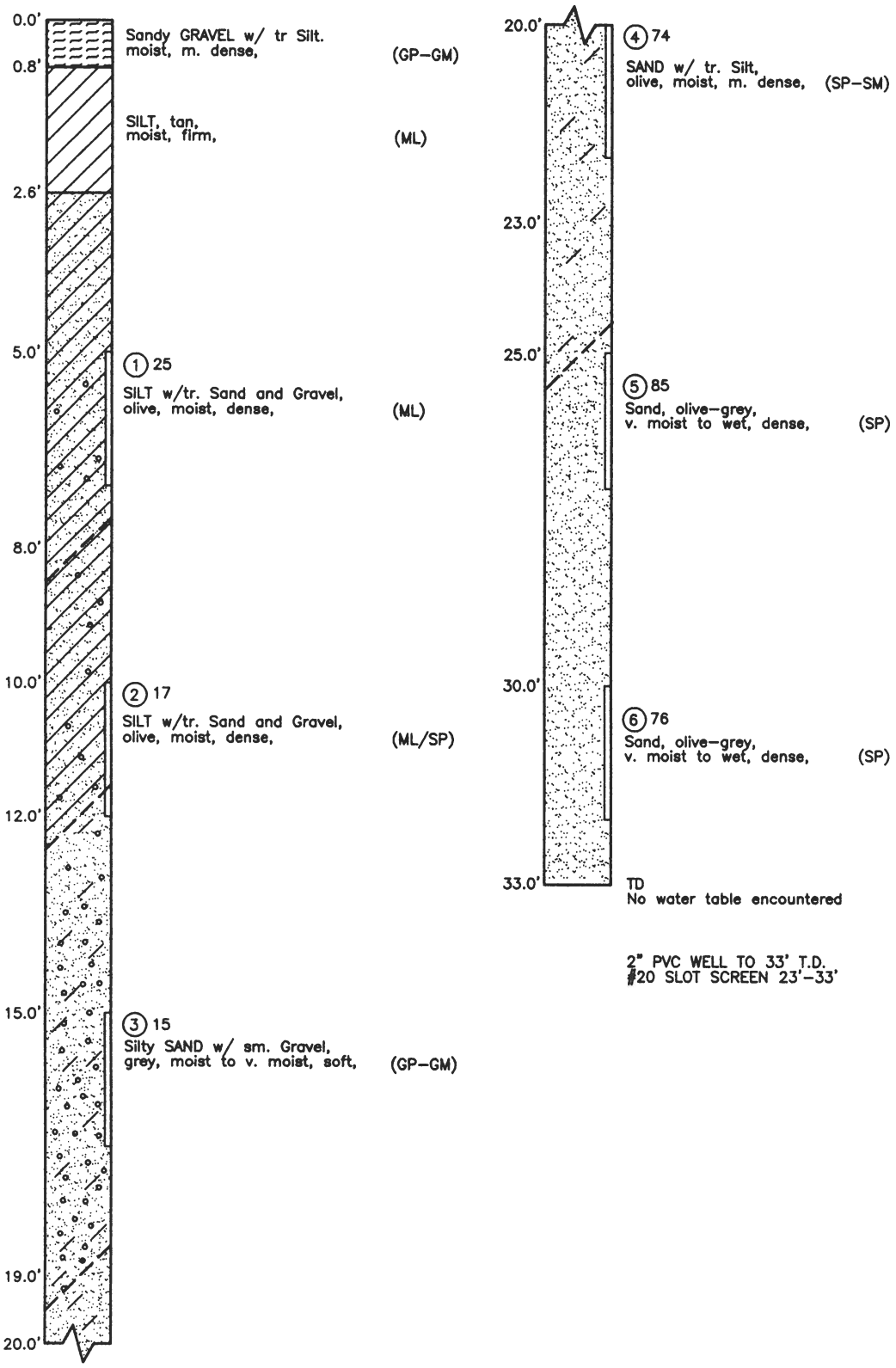
SB–2
(MW–2)
04/24/03



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KASILOF RIVERVIEW
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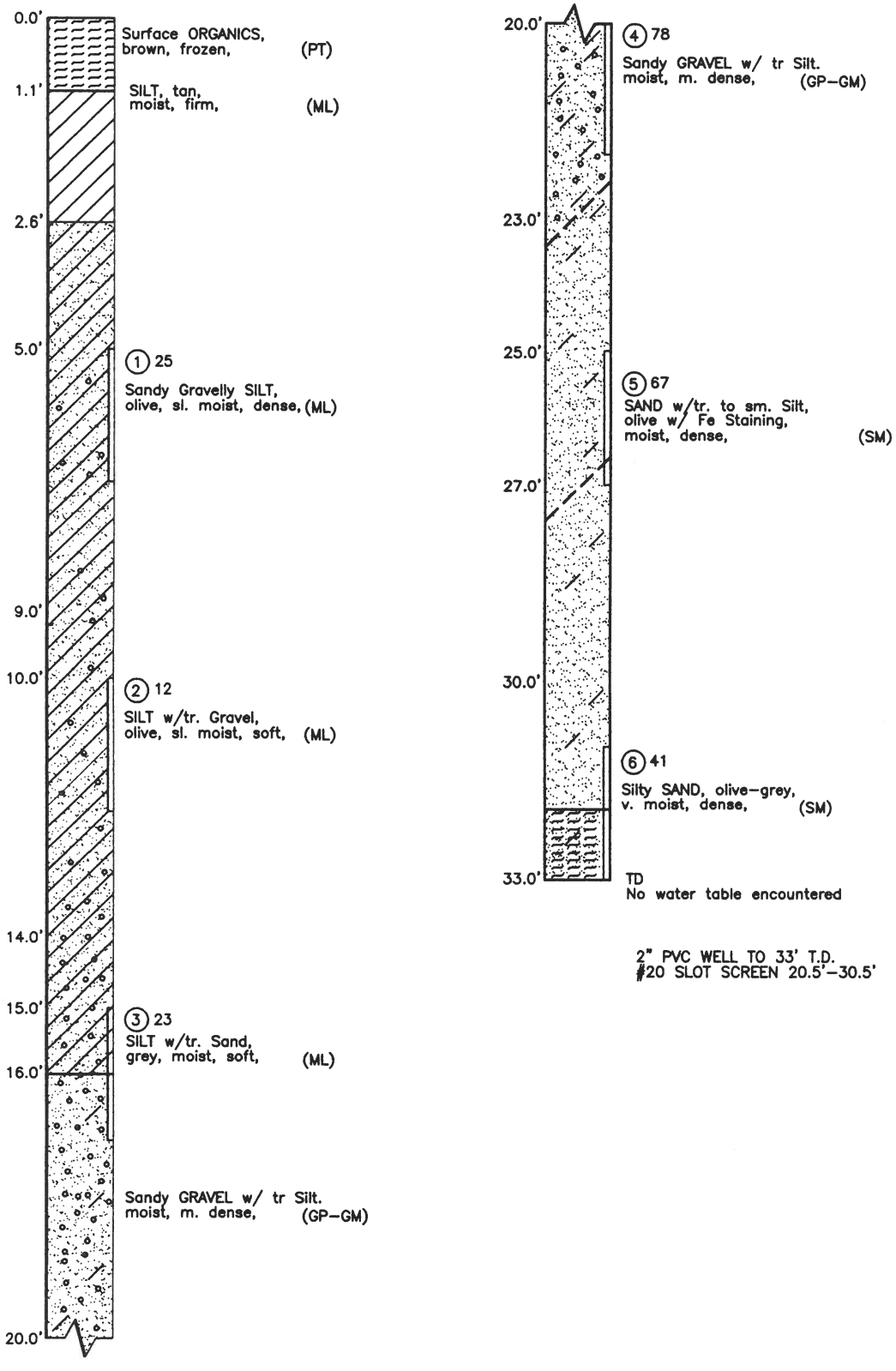
SOIL BORING LOGS

SB–3
(MW–3)
04/24/03



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KASILOF RIVERVIEW
CAP REPORT
SOIL BORING LOGS

Table 1: Soil Analytical Results Summary
Kasilof Riverview
Soil Boring Soil Sample Results

Well	Sample	Gasoline Range Organics (mg/Kg)[1]	Diesel Range Organics (mg/Kg)[2]	Residual Range Organics (mg/Kg)[3]
MW-1	S-3	ND	ND	ND
MW-1	S-5	ND	ND	ND
MW-2	S-3	ND	ND	ND
MW-2	S-5	ND	ND	ND
MW-3	S-5	ND	ND	ND
MW-3	S-6	ND	ND	ND
Method 1 Cleanup Levels		50*	100*	200*
Method 2 Cleanup Levels	Ingestion	1400	10250	10000
	Inhalation	1400	10250	22000
	Migration to GW	300	250	11000

* These Method 1 Cleanup Levels are typical Category A levels from Matrix Score, Table A1, 18 AAC 75.341.

Well	Sample	Aromatic Volatile Organics (BTEX) mg/Kg[4]			
		Benzene	Toluene	Ethyl-Benzene	Xylenes
15'-17.5' bgs MW-1	S-3	0.0889	ND	ND	ND
MW-1	S-5	ND	ND	ND	ND
MW-2	S-3	ND	ND	ND	ND
MW-2	S-5	ND	ND	ND	ND
MW-3	S-5	ND	ND	ND	ND
MW-3	S-6	ND	ND	ND	ND
Method 2 Cleanup Levels	Ingestion	290	20300	10000	203000
	Inhalation	9	180	89	81
	Migration to GW	0.02	5.4	5.5	78

[1]Gasoline Range Organics (GRO) by Alaska Method 101
[2] Diesel Range Organics (DRO) by Alaska Method 102
[3] Residual Range Organics (RRO) by Alaska Method 103
[4] Aromatic Volatile Organics (BTEX) by 8021B in Solid Matrix

Table 2: Soil Analytical Results Summary
Kasilof Riverview
Diesel UST Soil Sample Results

	Sample	Gasoline Range Organics (mg/Kg)[1]	Diesel Range Organics (mg/Kg)[2]
	S-1	ND	54.7
	S-2	ND	ND
	S-3	ND	ND
Method 1 Cleanup Levels		50*	100*
Method 2 Cleanup Levels	Ingestion	1400	10250
	Inhalation	1400	10250
	Migration to GW	300	250

* These Method 1 Cleanup Levels are typical Category A levels from Matrix Score, Table A1, 18 AAC 75.341.

	Sample	Aromatic Volatile Organics (BTEX) mg/Kg[4]			
		Benzene	Toluene	Ethyl-Benzene	Xylenes
	S-1	ND	ND	ND	ND
	S-2	ND	ND	ND	ND
	S-3	ND	ND	ND	ND
Method 2 Cleanup Levels	Ingestion	290	20300	10000	203000
	Inhalation	9	180	89	81
	Migration to GW	0.02	5.4	5.5	78

[1] Gasoline Range Organics (GRO) by Alaska Method 101
[2] Diesel Range Organics (DRO) by Alaska Method 102
[3] Residual Range Organics (RRO) by Alaska Method 103
[4] Aromatic Volatile Organics (BTEX) by 8021B in Solid Matrix

Table 3: Soil Analytical Results Summary
Kasilof Riverview
Stockpile Soil Sample Results

	Sample	Gasoline Range Organics (mg/Kg)[1]	Diesel Range Organics (mg/Kg)[2]	Residual Range Organics (mg/Kg)[3]
	S-1	3.94	100	85.4
	S-2	7.36	ND	29.6
	S-3	4.69	ND	ND
	S-4	3.94	30.2	56.6
Method 1 Cleanup Levels		50*	100*	200*
Method 2 Cleanup Levels	Ingestion	1400	10250	10000
	Inhalation	1400	10250	22000
	Migration to GW	300	250	11000

* These Method 1 Cleanup Levels are typical Category A levels from Matrix Score, Table A1, 18 AAC 75.341.

	Sample	Aromatic Volatile Organics (BTEX) mg/Kg[4]			
		Benzene	Toluene	Ethyl-Benzene	Xylenes
	S-1	ND	ND	ND	ND
	S-2	0.0418	0.0999	ND	0.31
	S-3	0.0233	0.0844	ND	ND
	S-4	0.0227	0.0645	ND	ND
Method 2 Cleanup Levels	Ingestion	290	20300	10000	203000
	Inhalation	9	180	89	81
	Migration to GW	0.02	5.4	5.5	78

[1] Gasoline Range Organics (GRO) by Alaska Method 101
[2] Diesel Range Organics (DRO) by Alaska Method 102
[3] Residual Range Organics (RRO) by Alaska Method 103
[4] Aromatic Volatile Organics (BTEX) by 8021B in Solid Matrix

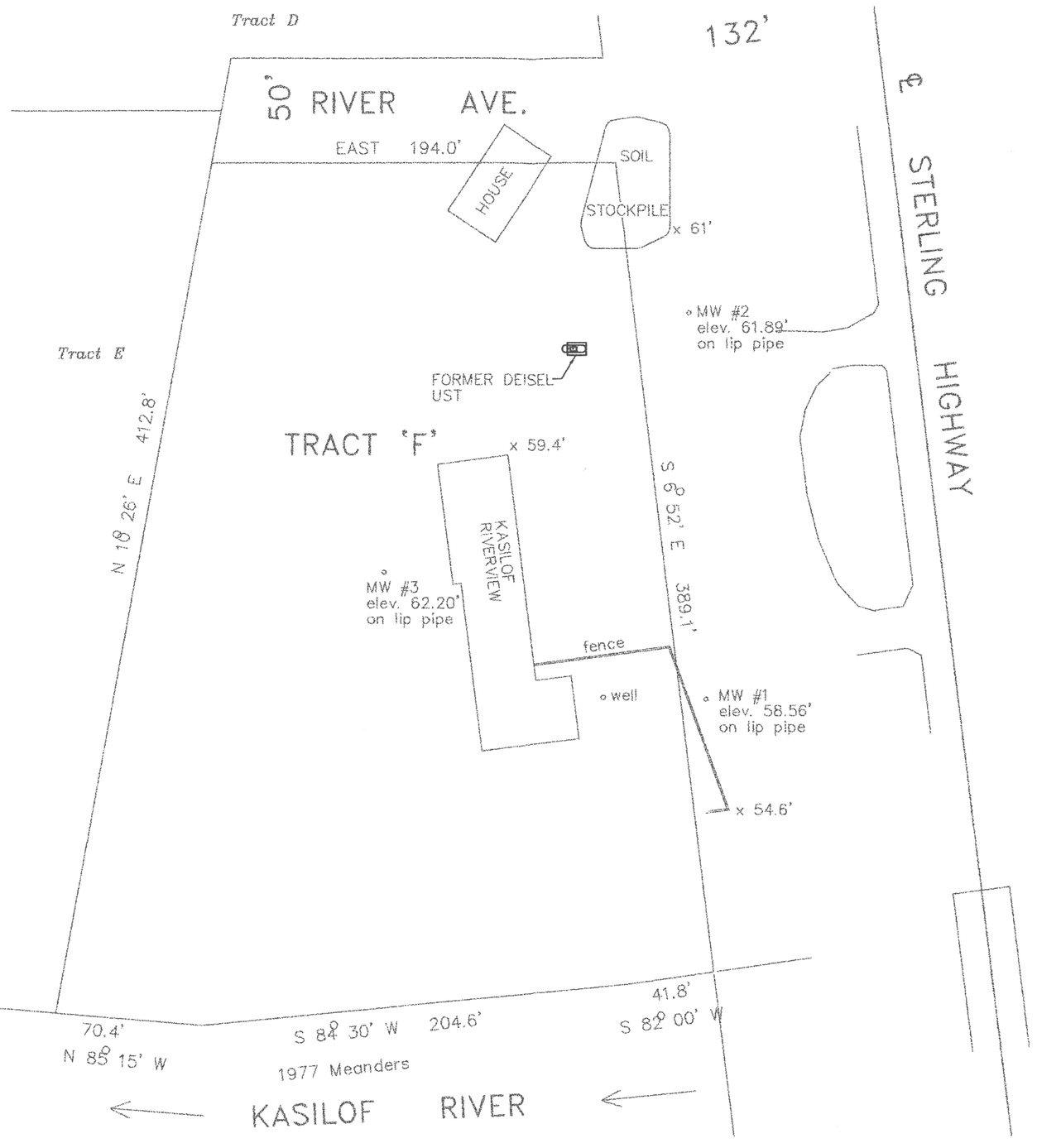
Table 4: Water Analytical Results Summary
Kasilof Riverview
Water Sampe Results

	Well	Gasoline Range Organics (mg/Kg)[1]	Diesel Range Organics (mg/Kg)[2]
	MW-1	ND	ND
	MW-2	ND	ND
	MW-3	ND	ND
Method 1 Cleanup Levels		50*	100*
Method 2 Cleanup Levels	Ingestion	1400	10250
	Inhalation	1400	10250
	Migration to GW	300	250

* These Method 1 Cleanup Levels are typical Category A levels from Matrix Score, Table A1, 18 AAC 75.341.

	Well	Aromatic Volatile Organics (BTEX) mg/Kg[4]			
		Benzene	Toluene	Ethyl-Benzene	Xylenes
	MW-1	0.00626	ND	ND	ND
	MW-2	ND	ND	ND	ND
	MW-3	ND	ND	ND	ND
	Potable Well	ND	ND	ND	ND
Method 2 Cleanup Levels	Ingestion	290	20300	10000	203000
	Inhalation	9	180	89	81
	Migration to GW	0.02	5.4	5.5	78

[1] Gasoline Range Organics (GRO) by Alaska Method 101
[2] Diesel Range Organics (DRO) by Alaska Method 102
[3] Residual Range Organics (RRO) by Alaska Method 103
[4] Aromatic Volatile Organics (BTEX) by 8021B in Solid Matrix



APPROXIMATE SITE PLAN

SCALE: 1"=60'

PRELIMINARY DRAWING FOR REVIEW ONLY

APPROXIMATE SITE PLAN

KASILOF RIVERVIEW CAP REPORT

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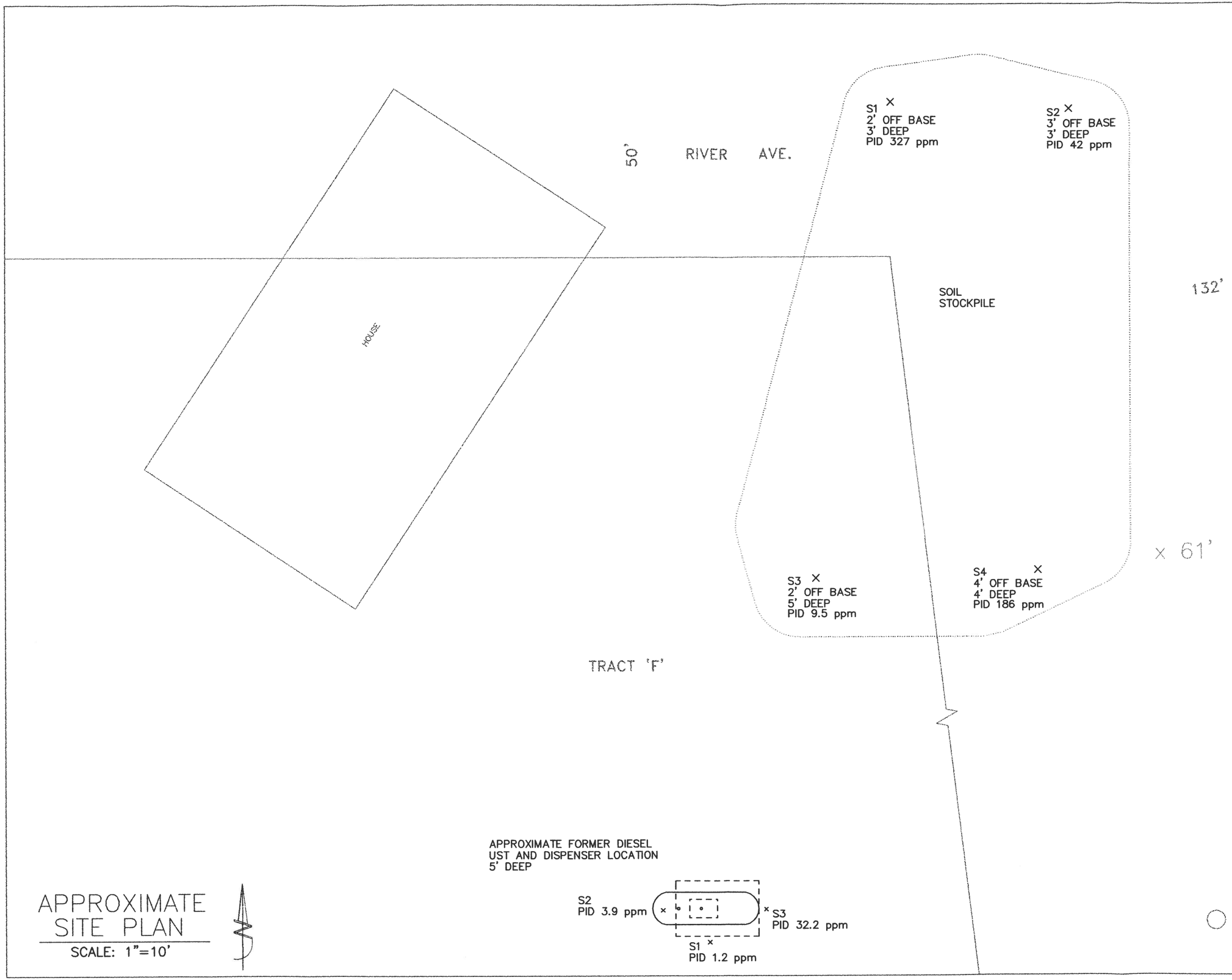
FIGURE 1



APPROXIMATE SITE PLAN

SCALE: 1"=10'

SOIL STOCKPILE AND FORMER DIESEL UST SAMPLE LOCATIONS

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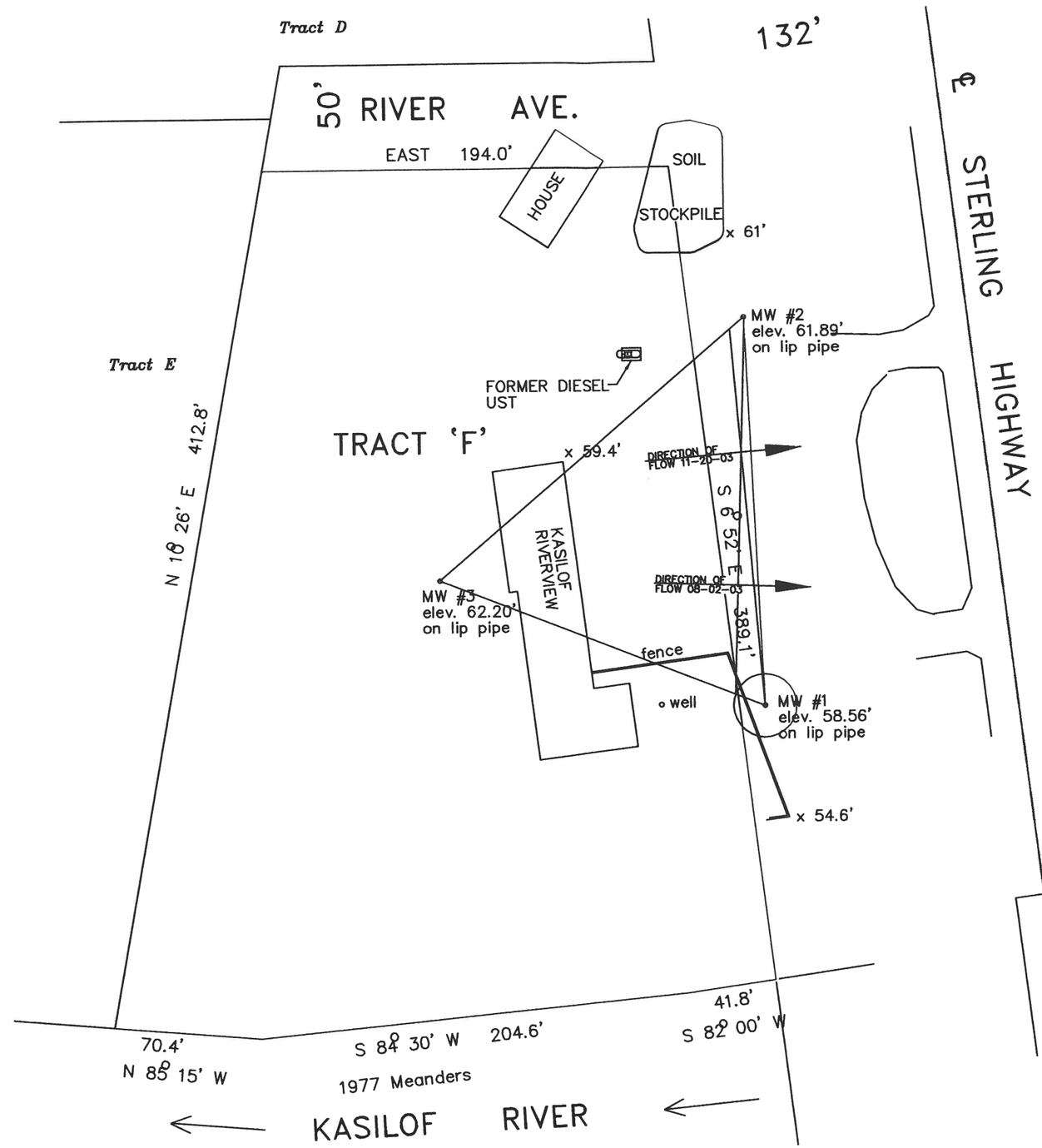
FIGURE 2



APPROXIMATE
SITE PLAN

SCALE: 1"=60'

GROUND WATER
FLOW DIAGRAM

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FIGURE
3
OF 3