EARTH BURNERS
INCORPORATED

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March 20, 1997

Mary Bell Pratt
Environmental Enforcement Specialist
WDNR NWD Headquarters
810 West Maple
Spooner, WI 54801

RE: Project Update - Moose Junction Lounge LUST Investigation
Dairyland, WI Wisconsin Unique ID# 0301.

Ms. Pratt:

Earth Burners, Inc. (EBI) has reached a juncture regarding the above referenced site. A settlement was reached with PECFA regarding disputed costs. The settlement satisfied the requirements for EBI to continue with conducting the necessary steps in completing the remediation of this site. There remain a number of points that need to be addressed at this time. In order to complete the remedial action plan (RAP) as required by Administrative Order No. NWD-92-023 bank financing has to be secured. EBI is working on obtaining financing, from a local lending institution, on behalf of the claimant, Mr. Dale Schultz. However, before the loan can be approved, the lender, Norwest Bank, Duluth,Minnesota, request a RAP having the approval of both the WDNR and PECFA be furnished. Without this approval there will be no loan and EBI cannot proceed without a guarantee of payment for any additional work completed at the site.

As stated in the letter dated July 22, 1996, from Chris Saari, a recommendation was made to reconsider the implementation of the original pump and treat RAP as described in the Annual Report dated December 8, 1994. I have provided a copy of this RAP for your review and have provided copies to those listed below. Also I am including a copy of the letter dated January 4, 1994 to John Prohaska detailing the the specifications of the pump and treat system. If the 'pump and treat' RAP is deemed appropriate for the site, upon receiving approval from both the WDNR and PECFA, EBI will provide this to the bank for the procurement of financing. If this method does not satisfy the requirements, then EBI will research, as stated in the Remedial Alternative Cost Response of May 30, 1996, the feasibility of overexcavation at the site.

EBI recognizes the need to proceed with the remedial action at this site to remain in compliance with the Administrative Order. EBI also realizes, as a company, the economics of performing any additional work without some kind of financial guarantee of payment is not acceptable. Please review this information and if you have any questions please call me at (218) 628-0454.

Sincerely,

EARTH BURNERS, INC.

James R Warren

James R. Warren,
Office Manager/Hydrologist

Attachments

cc: Dale Schultz, Moose Junction Lounge
Christopher A. Saari, WDNR Hydrogeologist
Michael C. Thompson, PECFA Representative

FILE COPY

EARTH REMEDIATION SERVICES

a division of Earth Burners, Inc.
P.O. Box 16083
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January 4, 1994

John Prohaska
Waste Management Specialist
Wisconsin Department of Natural Resources
Brule Area Headquarters
P.O. Box 125
Brule, WI 54820

RE: Amendment to the Remedial Action Plan at Moose Junction, Wisconsin. WDNR Site # 0301

Dear Mr. Prohaska:

Earth Remediation Services (ERS), in conjunction with the Wisconsin Department of Natural Resources (WDNR), has decided to amend the Remedial Action Plan (RAP) for the former Underground Storage Tank (UST) site at the Moose Junction Lounge.

The relatively high concentrations of GRO (Gasoline Range Organics) found in the groundwater at MW-2, which is within 60 feet of the potable well at the residence of Margaret Dickman, is of concern. ERS proposes MW-2 be incorporated into a recovery well. The pumping rate will be relatively minimal. The most optimum pumping rate will be established in the field. Two 1,000 gallon tanks will, temporarily, be placed near MW-2. If the well can sustain a 1.3 gallon per minute pumping rate, the tanks would be filled daily. The collected groundwater will be transported to the facility of Earth Burners, Inc. on Hallett Dock #7 in Duluth, Minnesota, for treatment. The water will be sparged in air diffusion tanks until the water meets the disposal criteria for the Western Lake Superior Sanitary District (WLSSD). The water will be sampled after 24 hours of diffusion. If the water remains above the disposal criteria, it will be sparged and sampled a second time. After withdrawing water for one week (approximately 10,000 gallons), the groundwater in MW-2 will be sampled for GRO and BTEX (Benzene, Toluene, Ethylbenzene, and Xylene. After the groundwater samples are analyzed, ERS will determine the effectiveness of the pump and treat method. If this pilot test proves effective at significantly reducing the level of contamination, then a continuation of the method may be warranted to further reduce the contamination to a predetermined level.

ERS has calculated the total volume of groundwater to be remediated based on a 30 foot diameter capture zone surrounding the recovery well. If a concentration level of 0.1 ppm benzene was established

as the cleanup standard, ERS estimates a total of 4,400 gallons of impacted water should be retrieved by the recovery well (MW-2). This well does not address all of the groundwater greater than one ppm GRO, however, the most impacted water should be removed, thereby, eliminating the concentrated source. ERS believes the remaining low level contamination will slowly remediate through advection, dispersion, diffusion, and to some degree, biodegradation.

The following calculations assume a linear 'batch flush' model and set the number of pore volumes to lower the initial concentration of Benzene, 10.85 ppm to the proposed final concentration of 0.1 ppm. The initial concentration of Benzene is an average calculated from the two sampling events. The following equations were used in calculating the volume of water required to flush the contaminants from the silt/sand grains.

$$PV = -R \left[\ln \left(C_s / C_i\right)\right]$$

where PV is the number of pore volumes of clean water which must be circulated through the contaminated zone to reduce the concentration of a given constituent from an initial value, C_i, to a cleanup standard value, Cs; and R is the retardation coefficient for the target constituent, estimated using the following equation:

$$R = 1 + K_{oc} f_{oc} \left(P_b/n\right)$$

where K_{oc} is the organic carbon partition coefficient; f_{oc} is the fraction organic carbon in the aquifer; P_b is the bulk density of the aquifer material; and n is the aquifer porosity.

The K_{oc} for Benzene is 97. The f_{oc} for a aquifer in glacial deposits is 0.001, with P_b at 1.8 g/cm^3. The aquifer is expected to have an average porosity of 0.25. Using this parameters the resultant retardation factor and pore volumes are calculated in the following equations.

$$R = 1 + (97)\ (0.001)\ (1.8\ g/cm^3 / 0.25) \quad \text{or} \quad R = 1.7$$

then,

$$PV = (-1.7)\ (\ln\ 10.85/0.10) \quad \text{or} \quad 7.97$$

ERS estimates the zone of influence volume equivalent of contaminated groundwater pore space at 4,400 gallons. To reduce the concentration of Benzene to defined levels, 8 pore volumes are required to be removed. The total water volume removed would be approximately 35,000 gallons.

If the groundwater analytics show a marked improvement, pumping could continue until a specified final concentration can be

established for two consecutive sampling events. If the groundwater analytics show no change, the volume of contaminated groundwater may have been underestimated. ERS and the WDNR could look for a more economical solution for groundwater remediation at this site.

The following is an estimated cost for groundwater remediation. These costs are in addition to the annual groundwater fees reported in the previously provided RAP. Because the exact amount of groundwater is not exactly known, ERS will use the proposed remediation of 10,000 gallons and give a range of costs obtained locally.

SYSTEM INSTALLATION	COST RANGE($)
Recovery well(s)	0 - 0
Groundwater remedial diffusion	5,000 - 10,000
Pumps and plumbing	1,500 - 3,000
System installation	2,800 - 4,500
System maintenance	1,000 - 2,000
Analytical samples	500 - 750
Annual progress and site abandonment report	1,500 - 2,000
Water transportation and WLSSD fees	1,500 - 2,500
ERS professional services/management	1,700 - 2,300
Site abandonment	400 - 800
Total	17,600 - 27,850

If you have any questions concerning any aspect of this report, please call either of us at (218) 628-0248.

Sincerely,

EARTH REMEDIATION SERVICES

Roger W. Biebl
Project Hydrogeologist

James R. Warren
Staff Hydrologist

RWB:jrw

3.2 Groundwater Analytical Results

Since the RAP report was published in October of 1993, four groundwater sampling events have been accomplished. Groundwater quality was comparable to the first event except the significant increase in the benzene level in MW-4. This could reflect a continued migration of groundwater contaminants southward or a lowered water table caused groundwater to encounter increased concentrations of benzene. Contamination levels of GRO and benzene can be viewed in Figure 3-2. Groundwater analytical results can be viewed in Tables 3-2A and 3-2B. A trend in showing contaminant concentrations and water levels could not be established. A groundwater hydrograph depicting water levels and groundwater quality can be seen in Figure 3-3. Groundwater stabilization forms are located in Appendix A and laboratory analysis reports can be viewed in Appendix B.

4.0 REMEDIAL ACTION PLAN AMENDMENT

4.1 Remedial Action Plan Alternatives

ERS previously considered several options in proposing the RAP. A review of them are as follows:

- Air Sparging/Soil venting system. - This option would probably offer the most comprehensive soil and groundwater remediation system, it would also be the most expensive and labor intensive. In this scenario, many sparge/vent points would probably be needed for the residual contamination in the soils.

  ERS estimates the system would need horizontal components to address the majority of the contaminated soils which are believed to be under the county and state roads. System maintenance and monitoring could be very costly with no guarantee that the system will be compatible with decontamination of the glacial till, even with enhanced bioremediation assisting the venting/sparging. Other possible problems with this alternative are: 1) the elimination of petroleum hydrocarbons, which are typically very concentrated during the first stage of operation, from entering the atmosphere may require a separate air remedial system and associated permits which will increase costs further and 2) the actual remedial period is difficult to predict.

- Excavation of contaminated soils and remediation through thermal incineration. This method quickly eliminates the remaining source of contaminants. This option does not directly address contaminated groundwater, although elimination of the source should induce less contaminated groundwater samples in the future. However, EBI believes the expense of excavating the road base, and the inconvenience to travelers using the throughway, makes this alternative economically unfeasible.

- Passive bioremediation/Long-term groundwater monitoring. Although this remedial method is the most economical, it does not address groundwater contamination which could eventually impact the Dickman potable well. Water samples collected by EBI from the Dickman and Moose Junction Lounge potable wells have not detected any contaminants to date.

- Convert MW-2 into a low volume pump system and remediate the groundwater with air diffusion tanks. The well would be monitored weekly for GRO and PVOC to ensure the batch flush model is decreasing the contaminant concentrations. Although this does not fully address soil contamination, EBI expects vapors and contaminants in the soils will lessen as the strongest source of the contamination is believed to be in the groundwater. Advection, dispersion, diffusion, biodegradation, and chemical adsorption will further lower concentration levels in the soils.

All of the RAP alternatives include provisions for long term groundwater sampling of the monitoring and potable wells at both the Moose Junction Lounge and the Margaret Dickman residence. Groundwater samples will be analyzed for GRO, PVOC, and total lead. The monitoring and sampling will continue until two consecutive sampling events indicate groundwater analytics are under the following levels:

benzene 5 ppb	ethylbenzene 1360 ppb
toluene 343 ppb	xylene 620 ppb
lead 50 ppb	

If the potable well samples at either the Moose Junction Lounge or the Margaret Dickman residence show any contaminants above the WDNR groundwater quality standards as listed above, the WDNR will be notified immediately.

4.2 Estimated Costs

A range of costs is estimated to cover possible problems encountered during the RAP implementation. Costs are not broken down for each RAP alternative. After EBI and the WDNR agree on the most suitable action plan, a detailed cost estimate could be formulated. Costs are as follows:

o Air Sparging/ Soil Venting	$60,000 - 80,000
o Soil Excavation/ Thermal Treatment	$40,000 - 60,000
o Passive Remediation/ Groundwater Monitoring	$ 8,000 - 10,000
o Batch Flush/ Pump and Treat	$18,000 - 28,000

4.3 Schedule/Permits

Groundwater will continue to be sampled on a quarterly basis. The Moose Junction Lounge potable well will be sampled on a biannual basis. The Dickman potable well will not be sampled at the request of Margaret Dickman. Since the sampling of this well is part of Administrative Order NWD-92-023, EBI requests help from the WDNR in convincing Mrs. Dickman that sampling her potable well is in her best interest.

Because winter frost and cold conditions cause escalated costs, EBI recommends the remedial action be postponed to late spring, possibly after road restrictions have been lifted from Highway 35.

ERS does not foresee any special permits needed for the remedial action unless air sparging/ soil venting is employed. In this case an air quality permit will be needed for the vented vapors and a variance will be required to place remedial equipment on WDOT property . Access agreements between EBI, Mary McKelvey, and Margaret Dickman will have to be renewed for access to MW-4 and MW-2 which are located on their properties, respectively. Figure 5-1 estimates the horizontal zone of influence of the recovery well. Figure 5-2 shows the approximate vertical zone of influence.

5.0 RECOMMENDATIONS

ERS recommends a pilot study to pump and treat 10,000 gallons from MW-2. After removal, the groundwater will be sampled. After removal of 10,000 gallons and analytical samples indicate no significant reduction in contaminant concentrations, EBI will stop the operation and report results to the WDNR so another remedial alternative pilot study can be initiated. If the batch flush system lowers concentrations, a time curve could determine the duration of the flush system based on lowering contaminants to prescribed WDNR levels.

6.0 STANDARD OF CARE

The conclusions contained in this report represent our professional opinion. These opinions were arrived at in accordance with currently accepted environmental practices. No warranty is implied or intended.

Prepared By:

Roger W. Biebl

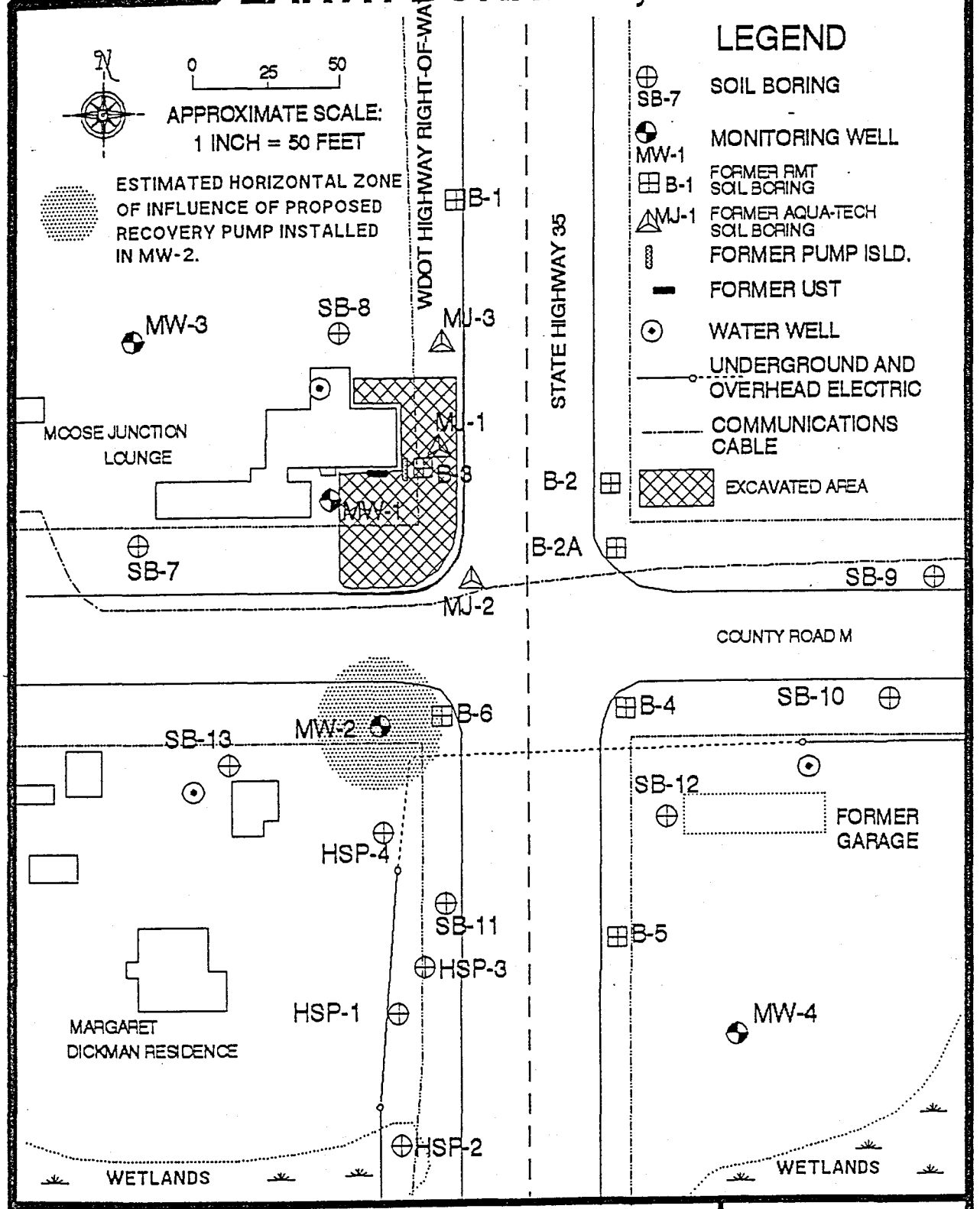
Roger W. Biebl
Project Hydrologist

Reviewed By:

Les Conway

Les Conway, PE
Consulting Engineer

EARTH BURNERS, INC.



MOOSE JUNCTION LOUNGE
HORIZONTAL EXTENT OF INFLUENCE

FIGURE 5-1

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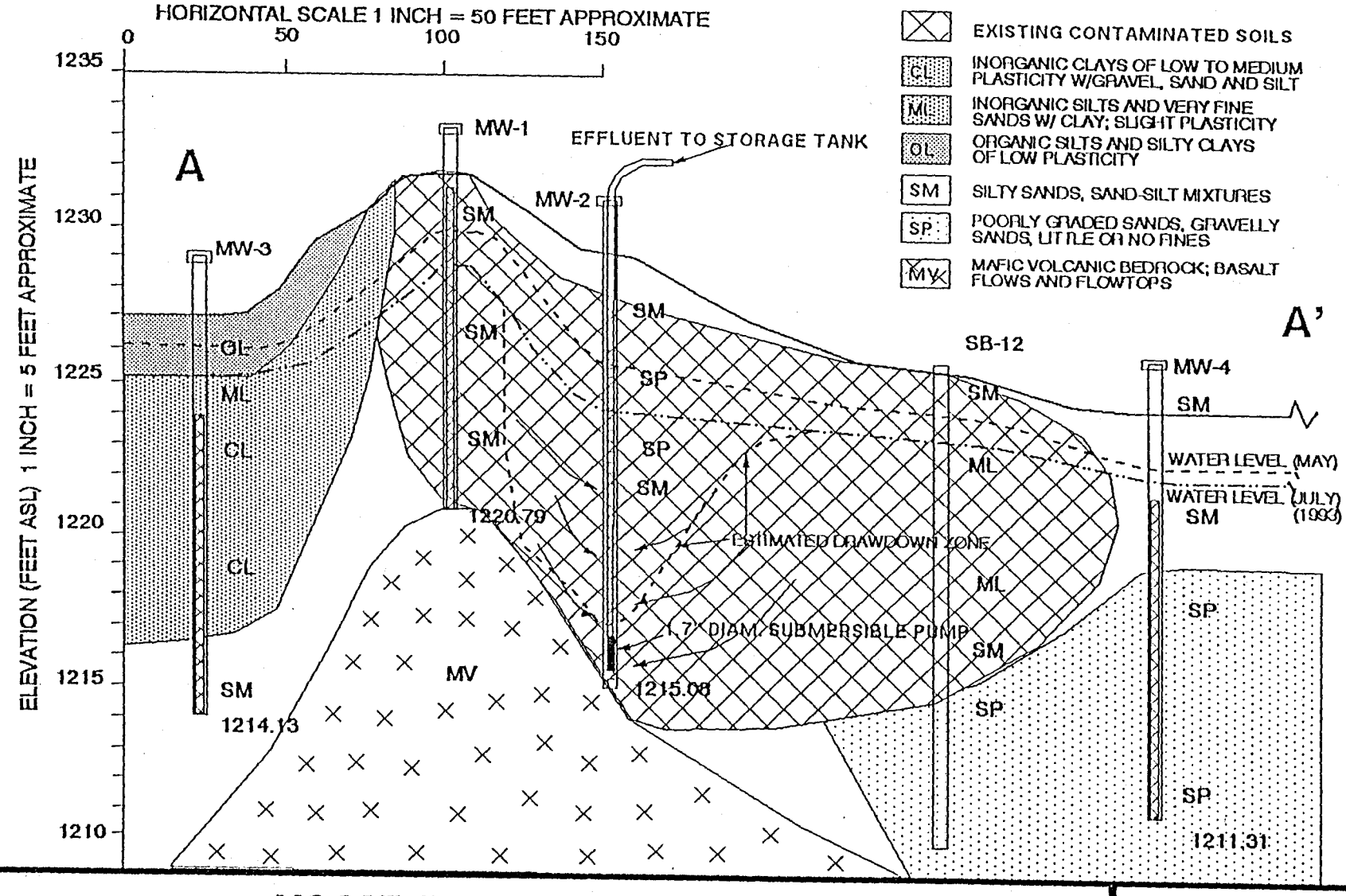

MOOSE JUNCTION LOUNGE
VERTICAL EXTENT OF RECOVERY WELL CONE OF DEPRESSION

FIGURE 5-2