

From MPCA LEAK File 2094
Former Food Service of America site

Hydrogeology

The property is located in the St. Louis River watershed. The property is located on the harbor of the St. Louis River, surface drainage from the property flows into the harbor. The regional groundwater flow direction is to the south-southeast. Based on site reconnaissance, it appears as though the local groundwater flow direction is also to the south-southeast. The depth to the groundwater table at the site is between 3.0 and 5.0 feet. Information about the groundwater flow direction is based on the USGS Hydrogeologic Atlas HA-586 (1979), the Duluth Quadrangle, and from information collected from geotechnical drilling for the City of Duluth.

REVIEW OF PREVIOUS WORK

Tank Excavation

In July 1989, J & D completed a tank excavation at the Food Services of America property. Approximately 457 cubic yards of contaminated soil was removed during the excavation of a 1000 gallon gasoline tank. The soil was thermally treated. AET does not have any other information about the excavation of the contaminated soil. AET requested information regarding the UST removal from Mr. Wilson of the Development Corporation of America, however, legal complications have interfered with the transfer of that information. A diagram of the site showing the UST location and any additional information about the tank removal was requested from the MPCA project manager. That information has been included in Appendix B. The information indicates that the UST excavation was 39 feet wide by 36 feet long by 5 feet deep. Headspace analyses were completed by Twin Ports Testing, Inc.

REMEDIAL INVESTIGATION RESULTS

Soil Borings

The fieldwork for the remedial investigation on the site was completed August 30, 1993 and January 7, 1994. Soil borings SB-1 through SB-3 were drilled by a CME-550C and soil borings SB-4 and SB-5 were drilled by a truck mounted CME-55. The soil boring locations can be found in Figure 3. The environmental soil borings, designated SB-1 through SB-5, were drilled

to depths ranging from 9.0 to 15.0 feet (5.0 feet below the contamination or 5.0 feet below the water table if the soil was contaminated). The soils were sampled every 2.5 feet by the split barrel method (ASTM:D1586). The split barrel sampler was washed in tri-sodium phosphate and rinsed with water prior to the collection of each sample. An AET geologist conducted headspace tests to screen organic vapors in the soil. The soil boring locations were surveyed by the AET drilling crew for horizontal and vertical control. The bench mark used during the survey was the top of the cement relieving wall near the corner of the LaFarge building. The wall was assigned an arbitrary elevation of 100.0 feet. The elevations of the soil borings were surveyed relative to that arbitrary elevation. The boring logs and their relative elevations can be found in Appendix C. The soil boring log for the geotechnical boring (soil boring 93-25) has also been included in Appendix C. The location of boring 93-25 is shown on Figure 3.

Soil boring SB-1 was drilled south of the geotechnical boring where contamination was detected. Soil boring SB-2 was drilled to the southwest of the geotechnical boring. Soil boring SB-3 was drilled between soil borings SB-1 and SB-2. After receiving information from the MPCA regarding the UST removal and contaminated soil excavation, AET was able to approximate the excavation limits. Soil boring SB-4 was drilled through the center of that excavation and boring SB-5 was drilled upgradient of the excavation. All of the borings were drilled to depths between 9.0 and 15.0 feet.

Fill consisting of silty sand, sand and gravel was encountered in every boring. Native material was not encountered in any of the borings. Soil borings SB-2 and SB-3 were drilled approximately 5.0 feet below the base of the contamination in order to define the vertical extent of the contamination. Soil borings SB-4 and SB-5 were drilled to 5.0 feet below the water table. Soil boring SB-1 was drilled as far as the hole would stay open without jetting (water was encountered at 2.5 feet). Soil samples were collected for chemical analyses from the base of soil boring SB-1 and from that portion of soil boring SB-3 that had the highest headspace readings. Soil samples were also collected from soil boring SB-4 and SB-5 from the most contaminated zone and the base of the borings.

A headspace analysis (procedure outlined in the MPCA Guideline Documents) was completed on representative portions of the soil sample collected from each 2.5 foot interval. An OVM (Model 580B) photoionization detector (10.6 Ev lamp) was used to measure the amount of petroleum-related vapors in the headspace of an eight ounce jar. The headspace results are summarized in Table 1. The OVM meter yielded organic vapor readings ranging from 0.0 to 240.0 parts per million (ppm) on the soil samples collected from the five borings. In addition to the headspace analysis, human senses (olfactory and visual) were also used to determine the extent of the contamination. The highest OVM readings were found in the zone between 9.0 and 11.0 feet in soil boring SB-4 (in the center of the excavation). A zone of contamination was found between 4.5 and 15.0 in boring SB-1, and between 2.0 and 6.5 feet deep in soil boring SB-3. Boring SB-2 contained no contamination. The OVM readings from soil boring SB-1 appeared to be somewhat high compared to the odor of the sample (the soil samples collected below 2.5 feet were saturated with water, which can adversely effect the OVM readings).

TABLE 1.
HEADSPACE RESULTS-REMEDIAL INVESTIGATION

Soil Boring	Depth (ft)	Head-space*	Soil Boring	Depth (ft)	Head-space*
SB-1	0-1	1.1	SB-2	0-2	0.0
	2-4	24.1		2-4	0.0
	4.5-6.5	71.1		4.5-6.5	0.0
	7-9	8.3		7-9	0.0
	9.5-11.5	21.3	SB-3	2-4	18.9
	13-15	52.0		4.5-6.5	14.6
				7-9	5.3
				9.5-11.5	0.0
SB-4	0-2	0.0			
	2-4	8.0	SB-5	2-4	1.5
	9-11	240.00		7-9	15.0

*headspace results in parts per million (ppm)

Chemical Analyses

Two soil samples were collected from soil borings SB-1 and SB-3 for chemical analyses. A sample was collected for chemical analysis from soil boring SB-3 from the most contaminated portion of that boring. One sample was also collected from the base of boring SB-1 (the most contaminated soil boring) to confirm the vertical extent of the contamination. Soil samples were also collected from the most contaminated zone and the boring base in SB-4 and SB-5. After collection, the samples were placed in a cooler. The samples were submitted to Legend Technical Services (Legend) in St. Paul for chemical analysis.

The suite of chemical analyses requested by AET for the August sampling (SB-1 through SB-3) included DRO, BTEX, and total petroleum hydrocarbons (TPH) as gasoline. The TPH analysis was requested of the laboratory after discussions with the Development Services of America indicated that the UST contained gasoline and not fuel oil, as originally informed. The second suite of samples (SB-4 and SB-5) were also sent to Legend for GRO, BTEX, and MTBE. The results of the DRO, TPH as gasoline/GRO and BTEX analyses have been summarized in Table 2. The laboratory report and the chain of custody have been included in Appendix C.

TABLE 2.
SOIL CHEMISTRY RESULTS
DRO, TPH as Gasoline/GRO and BTEX*
LEGEND TECHNICAL SERVICES
9/17/93

BORING/ DEPTH	DRO (ppm)	TPHgas/ GRO (ppm)	BENZENE (ppm)	ETHYL BENZENE	TOLUENE	XYLENE (ppm)
SB-1 (14.5)	<8.0	<0.13	0.009	<0.001	0.001	0.012
SB-3 (3.5)	<8.0	7.6**	0.005	<0.001	<0.001	0.001
SB-4 (4.0)		<5.0	<0.05	<0.05	<0.05	<0.05
SB-4 (11.0)		19	0.27	0.28	0.57	2.9
SB-5 (4.0)		<5.0	<0.05	<0.05	<0.05	<0.05
SB-5 (9.0)		<5.0	<0.05	<0.05	0.16	<0.05

*results listed in ppm

**chromatographic profile resembles that of fuel oil

The chemical results of the diesel range organics analysis indicate that the contamination is below the laboratory method detection limit (MDL). The results of the TPH as gasoline analyses indicated that there was gasoline detected in the soil sample from soil boring SB-3 (3.5 feet deep) in concentrations of 7.6 mg/kg (ppm). The laboratory flagged the result as having a chromatographic profile resembling fuel oil. AET personnel discussed this with laboratory manager at Legend, who indicated that the sample from SB-3 appeared to be more typical of fuel oil because it was lacking the lighter components commonly found in gasoline. She also indicated that the sample from SB-1 could be very weathered gasoline because it contained some

of the lighter components typical of gasoline, like the BTEX components. GRO was detected in the sample collected from the center of the excavation (SB-4, 11.0 feet) in a concentration of 19 parts per million (ppm), which is below the MPCA recommended action limit of 50 ppm for sandy soil. Contamination (toluene) was also detected in boring SB-5 at the 9.0 foot sample

REMEDIAL INVESTIGATION DISCUSSION

This remedial investigation was completed in order to define the horizontal and vertical extent of the contamination related to the UST located on the Food Services of America property. Five soil borings were drilled in various locations around the geotechnical soil boring 93-25 which was completed during work for the proposed Bayfront Festival Stores. Contamination was encountered in that soil boring, and in the environmental borings SB-1, SB-3, SB-4 and SB-5.

The limit of the contamination was defined by data collected from field observations, headspace readings and chemical results. The horizontal and vertical limits represent limits of contamination that are below the MPCA Recommended Action Limit of 50 ppm of contamination in sandy soil (from headspace data and chemical analyses). Contamination was not detected in this investigation in concentrations above the MPCA limit of 50 ppm.

The approximate horizontal limit of the contamination is outlined in Figure 4. The horizontal limits were defined from data collected from the environmental borings as well as from the headspace data from the geotechnical soil boring 93-25. The horizontal limit of the contamination was defined to the west and to the south with data from soil borings SB-1, SB-2 and SB-3 and to the north with boring SB-5. The margin of the contamination was not defined to the east because of the garage. The approximate vertical limit of the contamination remaining on site is outlined on the cross section in Figure 5. Information regarding the vertical limit was collected from the chemical analyses as well as headspace data from soil borings SB-1 and SB-3

and the geotechnical boring 93-25. Based on data from chemical analyses, none of the contamination occurs in concentrations above the MPCA action limits.

The contamination is located between 2.0 and 14.5 feet in soil boring SB-1, where headspace readings varied from 24.0 to 71.1 ppm. DRO and TPH as gasoline were not detected above the MDL at the base of that boring (14.5 feet). BTEX compounds were present in the following concentrations: benzene (0.009 ppm), ethyl benzene (<0.001 ppm), toluene (0.001 ppm), and total xylenes (0.012 ppm). The absence of TPH as gasoline and DRO above the MDL and the low concentrations of BTEX compounds indicates that the sample probably represents the base of the contaminant plume (vertical limit of the contamination).

The most contaminated zone of soil boring SB-3 is located from 2.0 to 6.5 feet deep. The OVM readings for the most contaminated zone varied from 14.6 to 18.9 ppm. TPH as gasoline was detected in concentrations of 7.6 ppm in a sample collected from the most contaminated part of that boring (3.5 feet deep). DRO was not detected above the MDL. The BTEX compounds were present in the following concentrations: benzene (0.005 ppm), ethyl benzene (<0.001 ppm), toluene (<0.001 ppm), and total xylenes (0.001 ppm). Based on the chromatographic profile of the samples, it appears as though there may be low-level fuel oil and gasoline contamination on the site.

The most contaminated boring was SB-4, through the center of the tank excavation. The headspace reading for the 9.0 to 11.0 foot interval was 280.0 ppm. The chemical analyses results from the 11.0 foot section indicated GRO was detected in 19 ppm, benzene was detected in a concentration of 0.27 ppm, toluene was detected in a concentration of 0.57 ppm, ethyl benzene was detected in a concentration of 0.28 ppm, and xylenes were detected in a concentration of 2.9 ppm. Toluene was detected in boring SB-5 (9.0 feet) in a concentration of 0.16 ppm.

Based on the horizontal and vertical limits, there is approximately 300 cubic yards of contaminated material left on the FSA Property. The contamination appears to be located within and below the fill. Contaminated soil is in contact with the groundwater, in fact, most of the contamination encountered during this study is located below the groundwater table. There are no downgradient drinking water receptors. The St. Louis River harbor is the sole down-gradient receptor.

This site is located so close to the St. Louis River Harbor that a number of factors will influence the migration of the contamination. Seiches (the fluctuation of the water level in Lake Superior due to weather fronts and wind) can cause the harbor water levels to fluctuate from 3 to 25 cm per seiche event. Mr. Keith Yetter, from the Zenith Dredge Company, indicated that the relieving wall bordering the St. Louis River Harbor has been constructed so that the area approximately 2.0 feet below the water is open to the circulation of water currents. This type of relieving wall enables the "flushing" of sediments behind the wall with fluctuating water levels in the harbor. The high water period of a seiche oscillation could cause a temporary reverse in the groundwater flow direction, potentially causing the contamination to migrate to the north (away from the harbor). Based on this information, it would seem likely that contamination is still located under the building and under the concrete loading dock immediately north of the UST excavation.

VAPOR RISK ASSESSMENT

A vapor risk assessment was completed for the FSA property. The assessment was based information regarding the soil type, type of product, building locations relative to the contamination, the locations of city sewer and water lines, and on chemical analysis data. The FSA warehouse (located immediately east of the former tank basin) is not presently in use. The building has been vacant since April or May of 1990. The building is served by city water and sewer and it does not have a basement. The threat of petroleum vapors becoming a risk in the

building is low because the building is located adjacent to the contamination. The soils on the site consist of silty sands and sands (approximate permeability of 1×10^{-3}), which are considered to be moderately permeable. The fill is underlain by a unit of beach sands, however it was not encountered during this investigation. The chemical fingerprints of the contaminated soil indicate that the product is probably weathered gasoline and/or fuel oil. If the product is weathered gasoline, it is likely that the most volatile components of the gasoline would have migrated or diffused. Diesel fuel is relatively viscous and is not very volatile. The chemical results from the most contaminated soil sampled collected on the site indicated low amounts of TPH as gasoline, and very low amounts of the BTEX compounds.

The data collected for the vapor risk assessment indicate that the vapor risk associated with this site is very low. This opinion is based on the location of the product (adjacent to and downgradient of the warehouse on the site), the age of the product (if it is gasoline), the low volatility and viscosity of the product (if the product is fuel oil), the chemical results which show that the BTEX compounds were detected in low amounts, and the fact that the building is vacant and has no basement. As a result of the above evidence, a vapor survey was not completed for the site.

CONCLUSIONS AND RECOMMENDATIONS

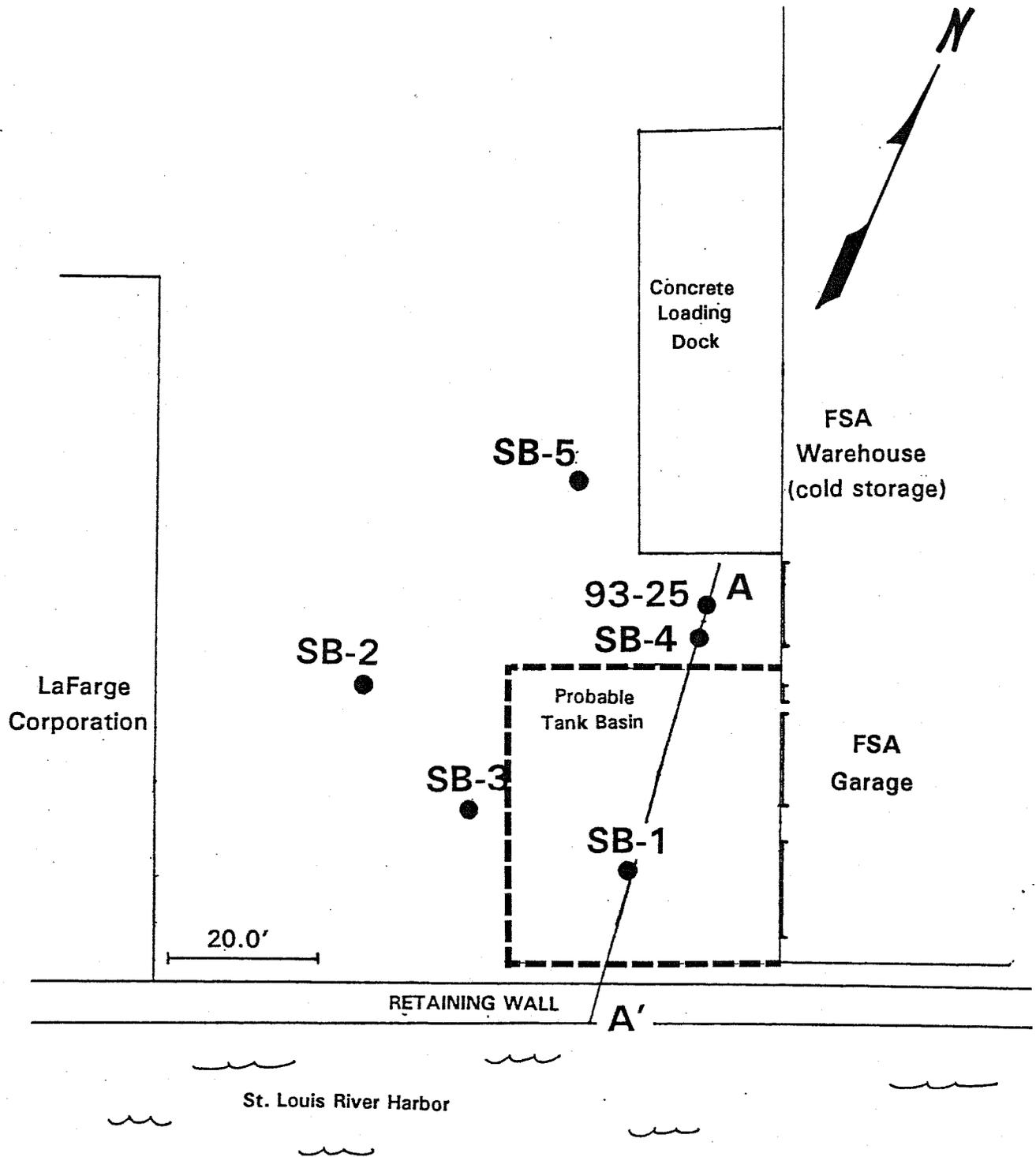
The data collected during this remedial investigation indicate that there is soil contamination remaining to the west of the FSA warehouse. The stratigraphy on the site consists of approximately 15 to 20 feet of fill which is underlain by lacustrine sands and clay. Groundwater was encountered during this investigation (estimated depth to groundwater is approximately 3.0 feet). There are no downgradient drinking water receptors. The abandoned FSA warehouse (to the east of the plume) and the LaFarge Corporation buildings are connected to city water.

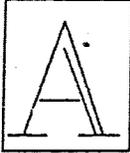
Approximately 457 cubic yards of contaminated soil were removed during the underground tank excavation in 1989. There are approximately 300 yards of contaminated soil remaining on the site. The results of the headspace analyses indicate that the highest contamination is located in the geotechnical boring 93-25. Chemical analyses were not completed on samples from that boring. The results of the chemical analyses from the additional soil borings indicate that the highest concentration of product is between 2.0 and 6.5 feet deep in soil borings that were drilled south of the geotechnical soil boring 93-25 (borings SB-4 and SB-1). The remaining contamination in the soil south of the geotechnical soil boring does not exist in concentrations above the MPCA action limit of >50 ppm (for sandy soil). The vapor risk associated with the site is very low. There are no potential drinking water receptors located downgradient from this site.

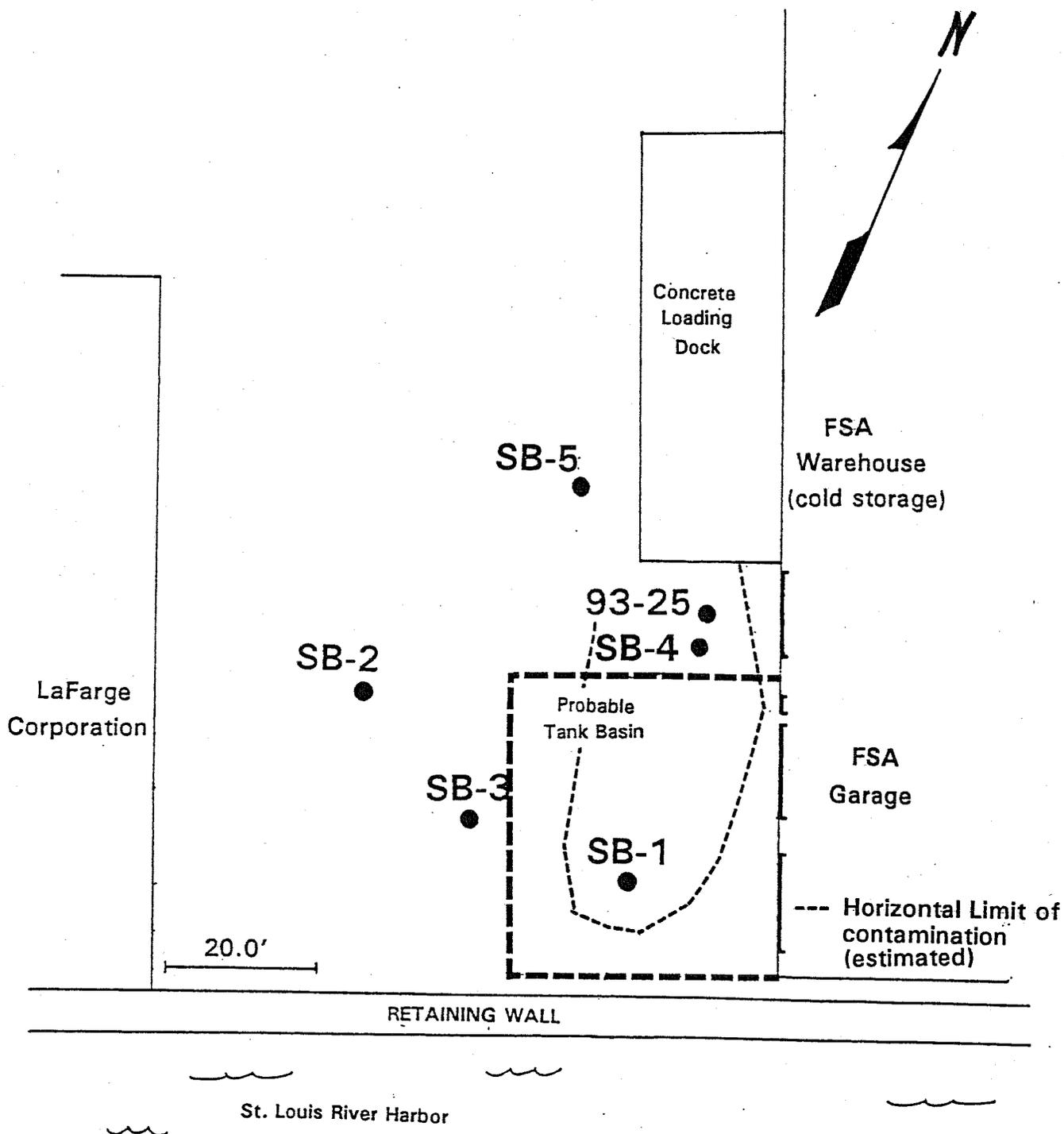
The potential for further contamination originating from the site has been significantly reduced by the removal of the UST and the removal of the most contaminated soil surrounding the tank in 1989. There may be some horizontal migration of the existing contamination, however during the course of the migration the product will attenuate and adsorb to finer particles in the soil as well as degrade naturally. The contamination on the site does not represent a threat to public health or the environment. Based on this evidence, AET recommends that the site be considered for passive bioremediation. AET recommends no further action be taken at the site and that the MPCA consider this recommendation as a request for closure.

USE OF THIS REPORT

This report has been prepared for the exclusive use of the City of Duluth for specific application to the remedial investigation conducted at the Food Services of America property, 8th Avenue West and Waterfront, Duluth, Minnesota, MPCA Leak # 2094.



 AMERICAN ENGINEERING TESTING, INC. DULUTH & ST. PAUL, MN	PROJECT REMEDIAL INVESTIGATION - CITY OF DULUTH		AET JOB NO. 93-7	
	SUBJECT Figure 3. Soil Boring and X-Section Locations		DATE 10/18/93	
	SCALE 1:20	DRAWN BY DER	CHECKED BY TGK	PAGE



 <p>AMERICAN ENGINEERING TESTING, INC. DULUTH & ST. PAUL, MN</p>	PROJECT REMEDIAL INVESTIGATION - CITY OF DULUTH		AET JOB NO. 93-7462
	SUBJECT Figure 4. Horizontal Extent of Contamination		DATE 10/18/93
	SCALE 1:20	DRAWN BY DER	CHECKED BY TGK

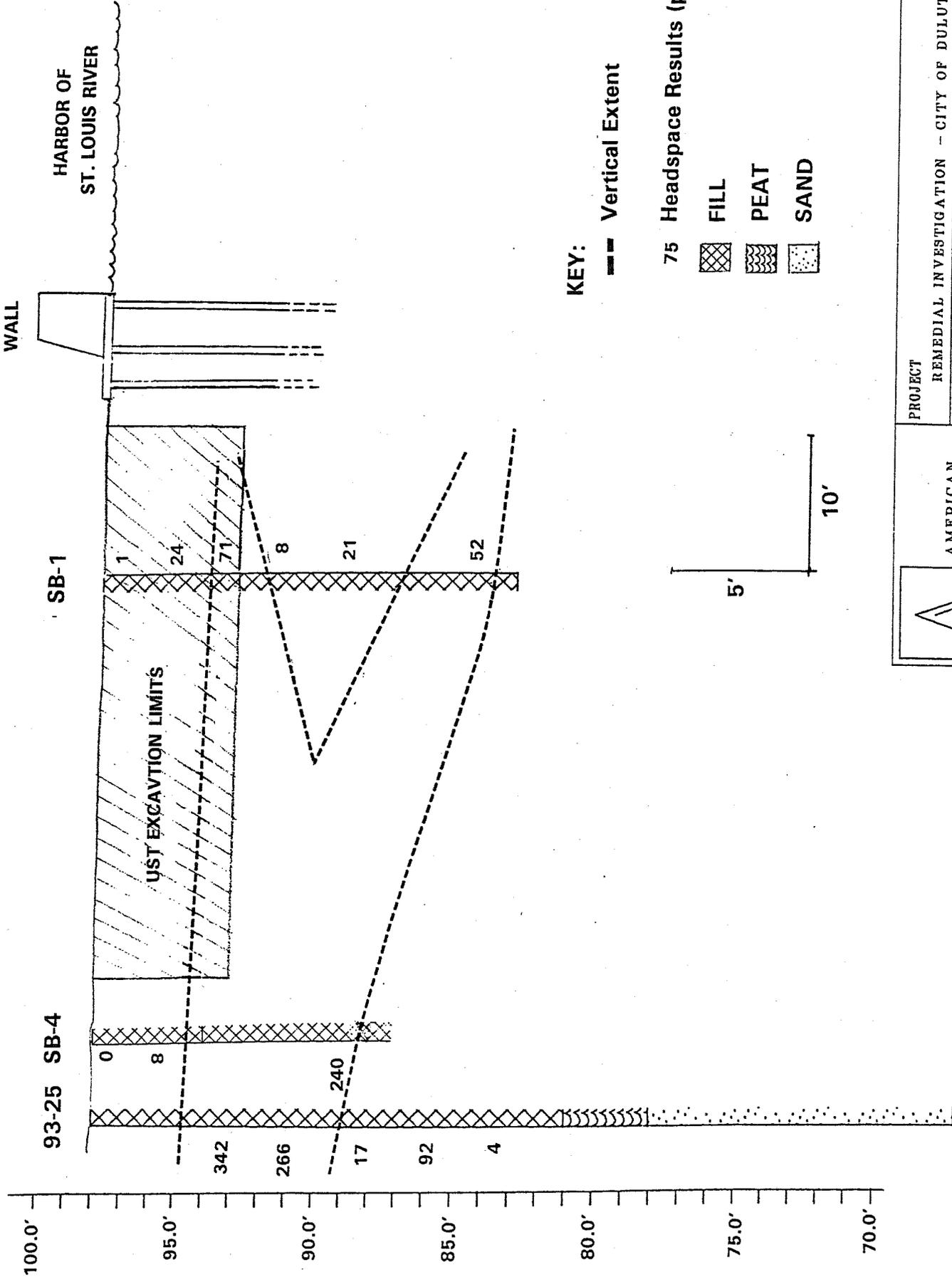
NORTH

A'

SOUTH

RETAINING WALL

HARBOR OF ST. LOUIS RIVER



KEY:

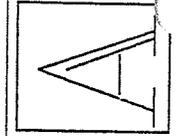
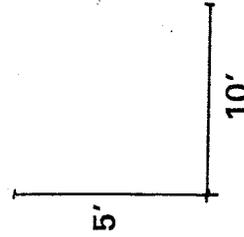
--- Vertical Extent

75 Headspace Results (ppm)

FILL

PEAT

SAND



AMERICAN
ENGINEERING
TESTING, INC.

DULUTH & ST. PAUL, MN

PROJECT

REMEDIAL INVESTIGATION - CITY OF DULUTH

SUBJECT
Figure 5. Vertical Extent of Contamination

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