CLOSURE REPORT

DESIGN-BUILD UNDERGROUND STORAGE TANK REPLACEMENT PROJECT

CONTRACT NO. RM000019RR2

U.S. DEPARTMENT OF ENERGY

Rocky Flats Environmental Technology Site
Golden, Colorado

April 1998

Prepared by:

Roy F. Weston, Inc.
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and

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LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Roy F. Weston, Inc. (WESTON®), has completed site assessment and closure of 19 underground storage tanks (USTs) at the Rocky Flats Environmental Technology Site (RFETS) (Figure 1-1). The RFETS UST Replacement Project included in-place closure of 19 USTs, and installation of five new USTs and 15 above ground storage tanks (ASTs).

Closure and assessment of the USTs was completed in accordance with the procedures outlined in a letter from the Colorado Department of Public Health and Environment (CDPHE), dated March 13, 1996 (Appendix A). As specified in the Rocky Flats Cleanup Agreement (RCFA), CDPHE is the lead agency for RFCA activities in the Industrial Area, including those associated with the Colorado Petroleum Storage Tanks Act (Tanks Act). CDPHE and the Colorado Department of Labor and Employment, Oil Inspection Section (OIS), which is the state agency responsible for implementation of the Tanks Act, agreed to the following for the RFETS UST Replacement Project:

- An assessment was previously completed in the vicinity of four tanks behind Building 331. The CDPHE agreed that these tanks could be closed in place without additional assessment activities. The assessment of these tanks was documented by CH2M-Hill and WESTON (CH2M-Hill 1992; Weston 1994). Information regarding the prior assessment activities is not included in this report. This report addresses general assessment procedures and site conditions for the 15 tanks. In addition, tank and site-specific closure and assessment information is included in the appendices and attachments.

- If possible, one Geoprobe® sample was to be taken on each side of each tank, in the backfill material, as close as practicable. The Geoprobe® sampler was to be driven to the bottom of the tank excavation, and a soil sample collected.

- Each soil sample was to be field tested for total petroleum hydrocarbons (TPH).

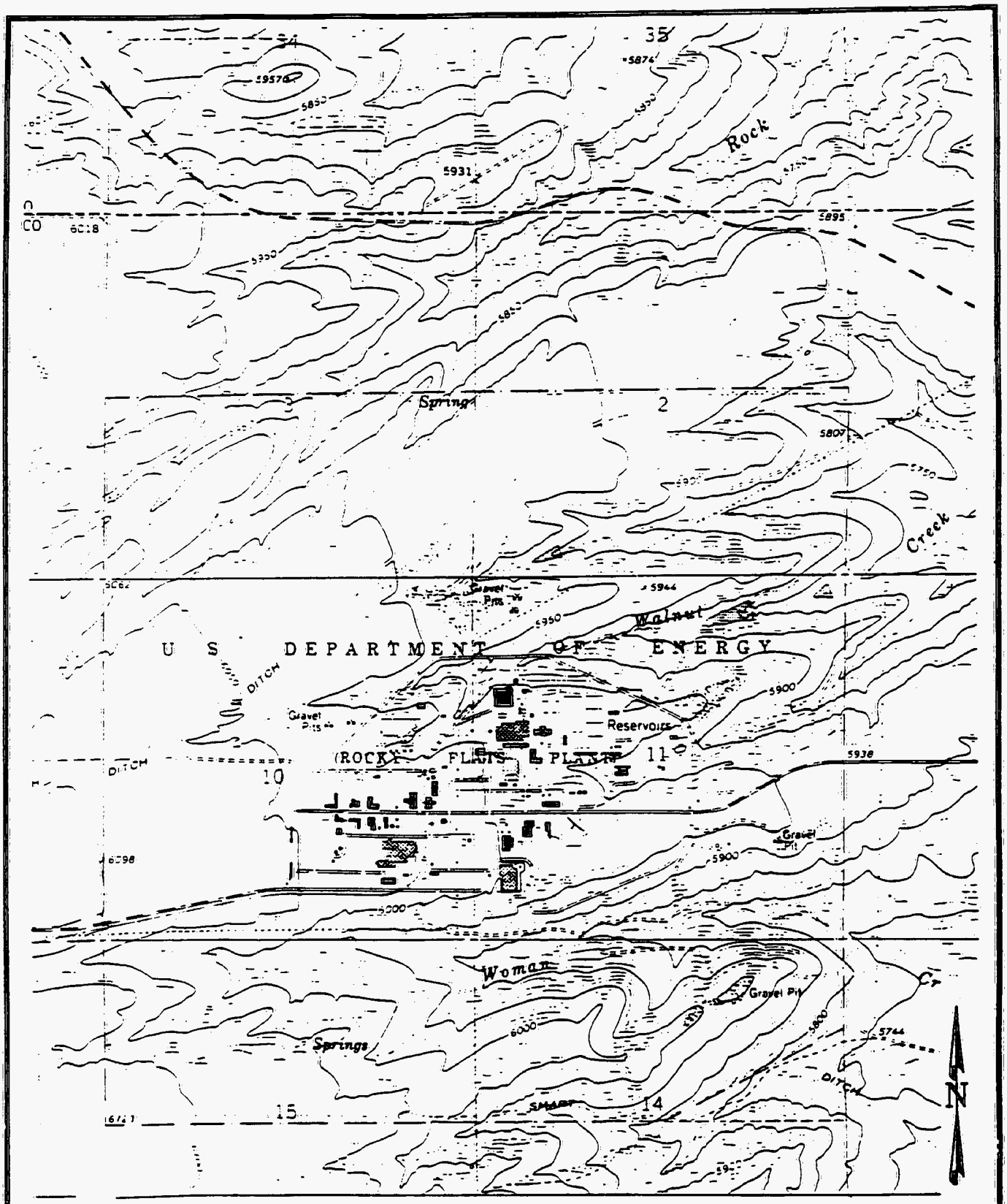
- If encountered, a groundwater sample was to be collected and field tested for TPH.

- If TPH concentrations detected in all of the soil samples collected in the vicinity of each tank were less than 5,000 parts-per-million (ppm), the tank could be closed in place without additional remedial activities.

- One closure report was to prepared and submitted to CDPHE and OIS for review.

The assessment and closure activities were also conducted in accordance with the "Site Assessment and Sampling and Analysis Plan" (SASP), prepared by WESTON in May 1996 (Weston, 1996a).

All of the USTs addressed in this closure report stored diesel fuel for use in emergency generators.



from: USGS 7.5' QUAD., LOUISVILLE, CO

SCALE: 1" = 2000'

WESTON® MANAGERS DESIGNERS/CONSULTANTS

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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

SITE LOCATION MAP

FIGURE 1-1

B8X10C1

2.0 BACKGROUND INFORMATION

2.1 PROJECT SUMMARY

The RFETS is a U.S. Department of Energy (DOE) complex located at Highway 93 and Cactus Drive, approximately eight miles north of Golden, Colorado. The RFETS complex was originally constructed to manufacture plutonium triggers for nuclear warheads. Many of the processes used in the manufacture of these triggers required continual building operations. Diesel powered emergency generators were installed to assure continual building operations in the event of unplanned power outages. The current nuclear functions at these facilities also require emergency generators. USTs were originally installed to supply diesel fuel for these emergency generators. These USTs, which range in age from 11 to 30 years old (Table 2-1), were not equipped with spill, overflow, and corrosion protection, as will be required by December 22, 1998, under current regulations. As such, DOE implemented this UST replacement project to close existing USTs, and replace them with either ASTs or USTs equipped with spill, overflow, and corrosion protection systems.

The objective of this program was to close permanently the 19 USTs at the RFETS. As discussed, this report addresses 15 of the USTs, which are located at fifteen various buildings throughout the RFETS complex (Figure 2-1). Each emergency generator system included a single tank, a vent pipe, and a feed line to the emergency generator.

2.2 REGIONAL GEOLOGY

The surficial geology at the RFETS is described as the Rocky Flats Alluvium. This alluvium is generally a poorly sorted, unconsolidated deposit of gravel, cobbles, and occasional boulders with clay, silt, and sand matrices. The Rocky Flats Alluvium primarily includes quartzite and granitic gravels, pebbles, cobbles, and boulders. These components tend to be subangular to subrounded, and range in grain size from a trace of fine-grained to primarily medium- to coarse-grained. Zones of sand and clay are frequently interbedded and interspersed throughout the gravels and cobbles. Bedrock was not encountered.

TABLE 2-1
RFETS UST Information

Tank ID No.[1]	Building Location	Installation Date	Construction Material	Capacity (gallons)
1	120SE[2]	1985	CS	1,000
3	127W	1978	FRP	550
4	318N	1977	FRP	48,790
14	559NE	1967	CS	1,000
15	562E	1975	CS	3,000
16	709NW	1968	CS	4,000
18	727W	1975	CS	3,000
19	729	1974	CS	650
21	771S	1973	FRP	5,260
23	776NW	1985	CS	5,000
24	779NE	1975	CS	500
25	827S	1971	CS	2,000
32	920NW	1985	CS	1,000
33	989E	1973	CS	3,000
66	881SE	1986	CS	5,000

Notes:
1 Refers to Tank Numbers on Figure 2-1
2 Directions refer to tank location with respect to building
CS Carbon Steel
FRP Fiberglass Reinforced Plastic

2.3 REGIONAL HYDROLOGY

Groundwater in this area occurs in the alluvial material under unconfined conditions. In the areas of the RFETS where the tanks are located the depth to groundwater ranges from 0 to 50 feet below the surface. Although the depth to the water table is variable, it generally becomes shallower from west to east, as the alluvium thins. Regionally, groundwater flow is in an easterly direction, but it splits along Central Avenue, flowing southeast south of Central Avenue and northeast north of Cental Avenue, and the hydraulic conductivity is highly variable.

3.0 CLOSURE PROCEDURES

Prior to all field activities, the approved Site Specific Health and Safety Plan (SSHSP) for this project (Weston, 1996b) was reviewed and signed by all site personnel. Also, the site utilities were located by qualified Rocky Mountain Remediation Services (RMRS) personnel, and confirmed by Weston and the construction contractor, Enviro Check, Inc. (ECI), prior to conducting any intrusive work.

3.1 TANK CLOSURE PROCEDURES

Nineteen USTs were closed-in-place during the program. All product in the USTs was removed and recycled by Approved Oil Services, Commerce City, Colorado, prior to the initiation of the assessment and closure activities. All USTs were closed in-place using a closed-cell polyurethane foam. ECI, from Littleton, Colorado, completed the UST closure tasks, including examination of the tanks, rinsing the tanks and pipes, disconnecting the pipes, and placement of the foam.

UST closure was performed according to RFCA requirements (CDPHE, 1996) and OIS regulations (OIS, 1997). In addition, the RFETS fire department was notified regarding the closure schedule, prior to permanent closure.

3.1.1 Examination of Tanks

Prior to closure, all USTs were checked to verify that they were empty. This was performed with a 1/8-inch graduated rod and water paste. The rod was inserted into the tank through the fill pipe, exercising care to place the rod in the center of the UST. Once in place, the rod was removed and a reading taken. This procedure was repeated three times, wiping the rod clean after each reading. An average of the three readings was calculated to determine the depth of product and water in the UST, if any. A tank chart or the dimensions of the tanks was used to convert depth to gallons. A visual check of the UST using reflected sunlight was also performed to help verify rod readings. Spill contingency measures during "sticking" the tanks consisted of spill pans and absorbent pads.

3.1.2 Rinsing Tanks and Piping

A high-pressure, high-temperature water and soap spray was used to rinse and clean the interior of the USTs and piping. The spray was delivered to the USTs and piping by inserting a semi-flexible hose with a multiple spray jetting-type nozzle into the tank. The hose was pulled back and forth along the length of the UST or pipe to clean and rinse as much of the tank or pipe as possible. The rinsate was vacuumed from the tank and pipelines with a vacuum truck system. Each tank and pipeline was triple-rinsed; the rinsate was removed and disposed of by Resource Environmental Group Services, Ltd., and disposed of at Conservation Services, Inc. Absorbent pads, booms, and spill containers were on standby during pipe and UST cleaning to pick up drips, leaks, and spills, as required.

3.1.3 Disconnecting Piping at Building Penetrations

Piping at building penetrations was disconnected at unions or flanges, to the extent possible. If a union or flange was not available in the existing line, the line was cut and disconnected at the fitting closest to the building. Drip pans and a vacuum truck system were used to remove product from the open line. Care was taken to ensure that the pressure was relieved, and that all valves and electrical service were locked out in the "off" or "closed" position prior to cutting the lines. The lines were cut with a hand-operated pipe cutter and/or band saw to minimize fire and explosion potential. LEL readings in and around the cutting operation were monitored on a continuous basis. Before any piping was disconnected, the building manager was notified 24 hours in advance to ensure that operations, safety, lock out/tag out, and other notifications were completed.

3.1.4 Closing Tanks and Piping

An inert closed-cell polyurethane foam was pumped into all voids in the tank and piping to permanently close the USTs systems in-place. A second opening required for venting during the foaming process also provided a means for verification that the tank and piping were filled. In

most instances, this opening was located on the opposite end of the tank from the fill opening. The inert materials were placed and verified according to 7 CCR 1101-14, exercising care during pumping and cleanup of equipment, to minimize spills, leaks, drips, and waste. Tank closure was considered complete after closed cell foam filling verification was made by the WESTON Site Manager or designee.

3.2 DRILLING PROCEDURES

In order to fulfill the CDPHE requirements for UST closure, Geoprobe® direct-push drilling technology was used to obtain soil characterization samples from locations adjacent to each of the 15 USTs. Prior to drilling, utilities were located by RMRS excavation specialists, and verified by ECI. Geoprobe® drilling was conducted by Tierra, Inc., under the direction of RMRS Environmental Restoration (ER) personnel, and was supervised by an on-site WESTON geologist/hydrogeologist. All field activities were conducted in Level D personnel protection equipment, in accordance with the SSHSP.

The plan was to advance four borings in the vicinity of each UST for soil sampling purposes, in accordance with the SASP. In some circumstances, less than four soil borings were advanced in the vicinity of a tank, due to utilities or limited site access.

The SASP dictated that should borings encounter groundwater, the boring was to be terminated at that depth and a groundwater sample collected. Any subsequent borings drilled at that UST site were only to be advanced to one foot above the depth at which groundwater was encountered in the previous boring. If groundwater was not encountered, the borings were to be advanced to a depth equivalent to the estimated base of the tank, or the base of the tank excavation fill material (if outside the UST backfill). The soil sample collected for field analysis was obtained from the bottom of the boring, as described in Section 3.3, and lithologically described in accordance with the SASP.

Following the completion of soil sampling activities, the boring was abandoned by plugging with bentonite chips, in accordance with the SASP. The bentonite chips were hydrated with fresh water after placement to allow for expansion, and to prevent potential cross-contamination by surface water or groundwater migrating down and along the boring.

3.3 SOIL SAMPLING PROCEDURES

The soil samples were collected using the hydraulic direct push unit in the Geoprobe® van. A 1.5-inch diameter stainless steel drill rod was advanced immediately above the desired sampling depth. At this depth, a clear polybuterate tube was inserted into the leading drill rod, and the unit was pushed through the interval desired for soil sampling. A disposable tip was then released from the end of the lead rod to allow the sampling tube to collect soil from that specific target depth. The drill rods were removed from the boring, brought to the surface, and the sample was extracted from the tube.

During Geoprobe® boring advancement, soil characterization samples were obtained at each location for analysis using the TPH (diesel fuel only) field screen test kit (Section 3.5). Soil sampling was conducted in such a manner that only the minimum amount of soil needed for the field test kit was collected. The excess soil collected and not used in the analytical field screen procedure was placed in core storage boxes for future disposition.

A portable photoionization detector (PID) was used to monitor the breathing zone around the Geoprobe® unit as the drill rods were removed from the boring, as required in the SSHSP. Total organic vapor concentrations were also monitored using a PID (in accordance with the SASP) as the soil was removed from the sampling tube and placed in sampling containers.

Cross-contamination of sampling equipment was prevented by decontaminating all Geoprobe® equipment with a steam cleaner between each UST location at the RFETS decontamination pad by RMRS personnel and in accordance with the SASP. Any small equipment, such as tools or drill rod tips, were decontaminated in the field with a phosphate-free soap wash followed by a distilled water rinse. All decontamination fluids were transported to the main RFETS decontamination pad, for disposal by RMRS personnel.

3.4 GROUNDWATER SAMPLING PROCEDURES

In accordance with the RFCA, groundwater samples were to be collected when encountered. Groundwater was encountered only at Tank Site 33, and a groundwater sample was collected using the Geoprobe® rig by ER personnel. The groundwater sample was collected from a location believed to be hydraulically down-gradient of the UST. Groundwater was retrieved from the boring using 1/4-inch diameter Teflon tubing inserted through the drill rod into a slotted screen rod. The tube was attached to the Geoprobe's® on-board vacuum system, and the groundwater sample was pumped to the surface. The tube was then removed from within the rod, and the groundwater sample extracted from the tube directly into a sampling container.

The groundwater sample was analyzed in the same manner utilizing the TPH field test kit (Section 3.5).

3.5 ANALYTICAL PROCEDURES

The analytical methods used for this project were immunoassay field test kits specific to identifying TPH in soil and water (Appendix B). This method was approved for use during the project by CDPHE and OIS. The field test method can correctly identify 95% of samples that are free of petroleum fuels, and also those containing petroleum fuels at or above the selected test level (based on analysis of standards). For this project, the test level was set at the agreed upon concentration of 5,000 milligrams per kilogram (mg/kg), or ppm.

The basis for field kit TPH identification is the use of colormetrics. A sample that develops color, less than or equal to a TPH standard, is interpreted as positive. A sample that develops more color than the TPH standard is interpreted as negative, and the concentration of TPH in that sample is therefore less than the selected test level. The entire test procedure is conducted in phases, as outlined in the SASP.

No outside laboratory analyses were performed as part of quality control/quality assurance; however, duplicate field analysis was performed in 10% of the samples.

4.0 RESULTS

A total of 55 soil samples were collected and analyzed from the 15 UST locations. Five duplicate soil samples were also analyzed. TPH was not detected above 5,000 mg/kg in any of the samples (Table 4-1). Groundwater was only encountered at one location, and a groundwater sample was collected and analyzed. TPH was not detected at a concentration greater than the 5,000 mg/kg detection level in the groundwater sample.

Boring locations are illustrated on figures included as individual attachments for each UST location (Appendix C). Photographs and a summary table are also included. The instances when borings could not be located on each side of the tank due to utilities or other access restrictions are noted on the Assessment Data tables (Appendix C).

Following completion of closure and assessment activities, a letter summarizing the activities and results for each site was submitted to RMRS.

TABLE 4-1
RFETS Underground Storage Tank Assessment Data

Tank ID No.[1]	Building Location[2]	Groundwater Encountered?	Evidence of Soil Staining?	PID Readings Above Background?	TPH Detected in Soil	TPH Detected in Groundwater
1	120SE	N	N	N	NL	NA
3	127W	N	N	N	NL	NA
4	318N	N	N	N	NL	NA
14	559NE	N	N	N	NL	NA
15	562E	N	N	N	NL	NA
16	709NW	N	N	N	NL	NA
18	727W	N	N	N	NL	NA
19	729	N	N	N	NL	NA
21	771S	N	N	N	NL	NA
23	776NW	N	N	N	NL	NA
24	779NE	N	N	N	NL	NA
25	827S	N	N	N	NL	NA
32	920NW	N	N	N	NL	NA
33	989E	Y	Y[3]	Y	NL	N
66	881SE	N	N	N	NL	NA

Notes:

N *No*
NL *Not in Excess of Agreed Upon Level*
NA *Not Applicable*
TPH *Total Petroleum Hydrocarbons*
PID *Photoionization Detector*
1 *Tank ID Numbers as shown on Figure 2-1*
2 *Directions refer to tank location with respect to building*
3 *Slight Diesel Odor Detected in soil and groundwater sample from one boring location (053296)*

5.0 REFERENCES

CDPHE, 1996. Letter from Joe Schieffelin, CDPHE, and Richard Piper, OIS, to Mark Silverman, USDOE, Dated March 13, 1996.

CH2M-Hill, 1992. "Data Summary Report for the Suspected Release Investigation at Building 331, U.S. Department of Energy, Rocky Flats Environmental Technology Site," CH2M-Hill, 1992.

OIS, 1997. CCR 1101-14, Petroleum Storage Tank Regulations, September 30, 1997.

Weston, 1994. "Site Characterization Report and Corrective Action Plan, Building 331, U.S. Department of Energy, Rocky Flats Environmental Technology Site," Roy F. Weston, Inc., Lakewood, Colorado, November 1994.

Weston, 1996a. "Site Assessment and Sampling and Analysis Plan, Design/Build Underground Storage Tank Replacement Project," Roy F. Weston, Inc., Lakewood, Colorado, May 1996.

Weston 1996b. "Site Specific Health and Safety Plan, Design/Build Underground Storage Tank Replacement Project," Roy F. Weston, Inc., Lakewood, Colorado, January 1996.

APPENDIX A

CDPHE LETTER

STATE OF COLORADO

Roy Romer, Governor
Patti Shwayder, Acting Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION

4300 Cherry Creek Dr. S.
Denver, Colorado 80222-1530
Phone (303) 692-3300
Fax (303) 759-5355

222 S. 6th Street, Room 232
Grand Junction, Colorado 81501-2768
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Colorado Department
of Public Health
and Environment

March 13, 1996

Mr. Mark Silverman
U. S. Department of Energy
Rocky Flats Office, Bldg 116
P.O. Box 928
Golden, Colorado 80402-0928

Dear Mr. Silverman,

The purpose of this letter is to describe how CDPHE and the Oil Inspection Section of the Colorado Department of Labor and Employment (OIS) will coordinate Rocky Flats Cleanup Agreement (RFCA) activities in the Industrial Area of RFETS that are regulated by the Colorado Petroleum Storage Tanks Act (Tanks Act).

OIS is the state agency responsible for implementation of the Tanks Act. However, pursuant to the Draft RFCA, Part 8, Regulatory Approach, CDPHE has been designated the Lead Regulatory Agency (LRA) for RFCA activities in the Industrial Area, including activities associated with implementation of the Tanks Act. Therefore, at RFETS, CDPHE will consult with OIS as described in this letter. To facilitate coordination among the parties, CDPHE, in its role as LRA, will assure that the substantive UST closure and remediation requirements are met.

All of the Underground Storage Tanks (USTs) on RFETS are owned by DOE, but are currently operated by a contractor or sub-contractor to DOE. Kaiser-Hill is overseeing the closure of 20 of the USTs, 18 of which have been and are currently being used to store diesel fuel and two of which have been and are currently being used to store gasoline.

Closure of the Tanks: Prior to closing 19 of the 20 USTs, an above-ground storage tank (AST) will be installed near the location of the USTs. Fuel in each UST will be transferred to the AST, each UST will be appropriately cleaned and then sealed with closed cell polyurethane foam. The remaining UST will be closed in place, but will not be replaced with an AST. OIS will be responsible for rendering permit decisions for any ASTs that require permits.

Assessment and Remediation of Any Tank Releases: Four of the 20 USTs are situated behind Building 331, the Site's garage (the Garage Tanks). Two of the Garage Tanks have been and are currently being used to store diesel fuel, and two have been and are currently being used to store gasoline. An assessment of the Garage Tanks has already been conducted. The first assessment was done by CH2M Hill in 1992. This investigation was undertaken when stained soils were discovered around the fill pipes during the installation of spill and overfill prevention equipment. CH2M Hill concluded that the staining was caused by several spills that occurred prior to the area having been paved with asphalt. CH2M Hill prepared and submitted to the State a report describing those activities. Weston conducted a further assessment of the area during 1994 and 1995. Weston assessed the soil, installed four groundwater monitoring wells, twice sampled the groundwater, and prepared and submitted to the State a Site Characterization Report and Corrective Action Plan and Groundwater Monitoring Reports. The analytical results for the groundwater samples all tested non-detect for BTEX and TPH. OIS has already agreed, and CDPHE endorses, that the Garage Tanks may be closed in place without any further assessment of the soil or groundwater. This agreement includes the proper abandonment of the four groundwater monitoring wells near the Garage Tanks should DOE decide to do so.

RFCA and the RFETS Vision incorporate continuing restricted land use for the site (open space and industrial use only), and development of a Site-wide groundwater strategy. Using these aspects of RFCA and the fact that diesel constituents are not very mobile, CDPHE, DOE, and OIS agree that the following site assessment will be conducted for each of the remaining 16 tanks, all of which stored diesel fuel: One geoprobe sample will be taken on each side of each tank, as close to the tank as is possible and in the backfill, if possible. The geoprobe will be driven at least to the bottom of the original trench for each tank. A soil sample will be collected at the bottom of the fill, or at an equivalent depth if outside the backfill, or one foot above the ground water, if ground water is present above the bottom of the fill material. Each soil sample will be field tested for TPH. In addition, although there is no requirement to drive the geoprobe to groundwater, groundwater will be field tested for TPH if encountered. For any tank with sample results below 5,000 ppm of TPH, the tank may be closed in place without further remedial action.

Given the need to coordinate both the installation of the ASTs as well as the closure of each UST, CDPHE, DOE, OIS, and Kaiser-Hill agree that one closure report will be submitted to CDPHE and OIS for review when all of the USTs have been assessed that includes all

tanks that meet the agreed upon 5000 ppm TPH standard. CDPHE will coordinate the review of the report with OIS, as well as any comments thereto, and will approve or disapprove the report as LRA pursuant to RFCA, Part 8, Paragraph 113(j), "Closeout Reports".

For any tank with sample results above 5,000 ppm of TPH, CDPHE, DOE, OIS, and Kaiser-Hill will meet to discuss further action to be taken, if any. On the basis of these discussions, one or more of the following actions will be taken:

1. a closure report will be submitted pursuant to the previous paragraph for each tank for which no further action is required;
2. the parties will initiate the process to revise, if necessary, the Site-wide ground water strategy;
3. a Proposed Action Memorandum (PAM) will be prepared covering all tanks for which corrective action is to be taken. This PAM will include the corrective action requirements for each tank and associated contamination, but will not need to identify utilities. CDPHE will coordinate the review of the PAM with OIS, as well as any comments thereto, and will approve or disapprove the PAM as LRA pursuant to RFCA, Part 8, Paragraph 113(k), "PAMs".

If you have any questions regarding these matters, please call CDPHE at the number below.

Sincerely,

Joe Schieffelin, Unit Leader
Federal Facilities Program
CDPHE
303-692-3356

for Dennis C. Hancock
Richard O. Piper
State Inspector of Oils
CDOLE

APPENDIX B

TPH FIELD TEST KIT OPERATING PROCEDURES

ENSYS INC.
ENVIRONMENTAL PRODUCTS

PETRO SOIL SamplePro

RAPID DETECTION KIT

User's Guide

Important Notice

This method correctly identifies 95% of samples that are petroleum fuels-free and those containing petroleum fuels at or above the selected test level. A sample that develops color, less than or equal to the standard is interpreted as positive. It contains petroleum fuels. A sample that develops more color than the standard is interpreted as negative. It contains petroleum fuel at less than the selected test level. The most sensitive SamplePro PETRO test level is 10 ppm for gasoline and 15 ppm for diesel and other petroleum fuels.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of petroleum hydrocarbons. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

FOUR PHASES OF PETRO SamplePro

The PETRO SamplePro Rapid Detection Kit is divided into four phases.

PHASE I - Extraction and Preparation of the Samples

Petroleum fuels are extracted from a 10 gram soil sample with methanol. The soil extract containing petroleum fuels is then filtered.

PHASE II - Dilution of Sample and Standards

Different test levels require different dilution procedures. Each test level has a designated SamplePro program number. PETRO Standards corresponding to the desired test level are provided in the kit and are diluted in the same way as the samples.

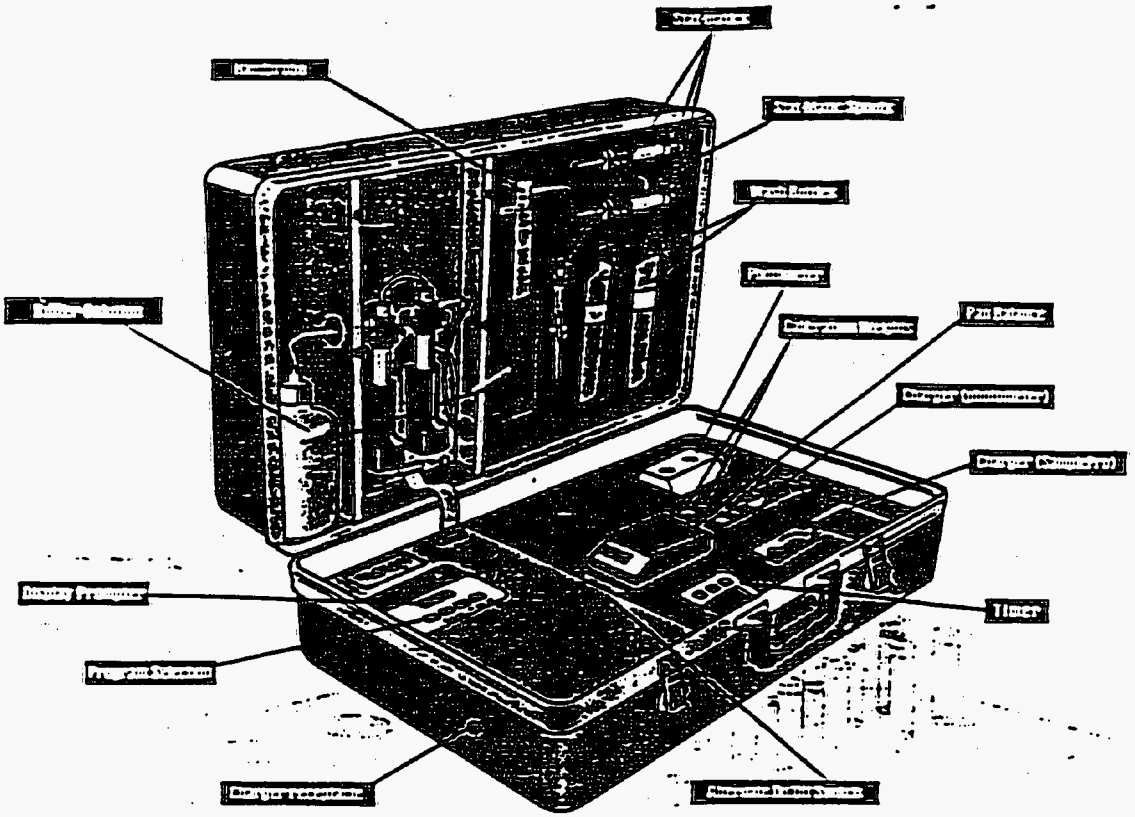
PHASE III - The Immunoassay

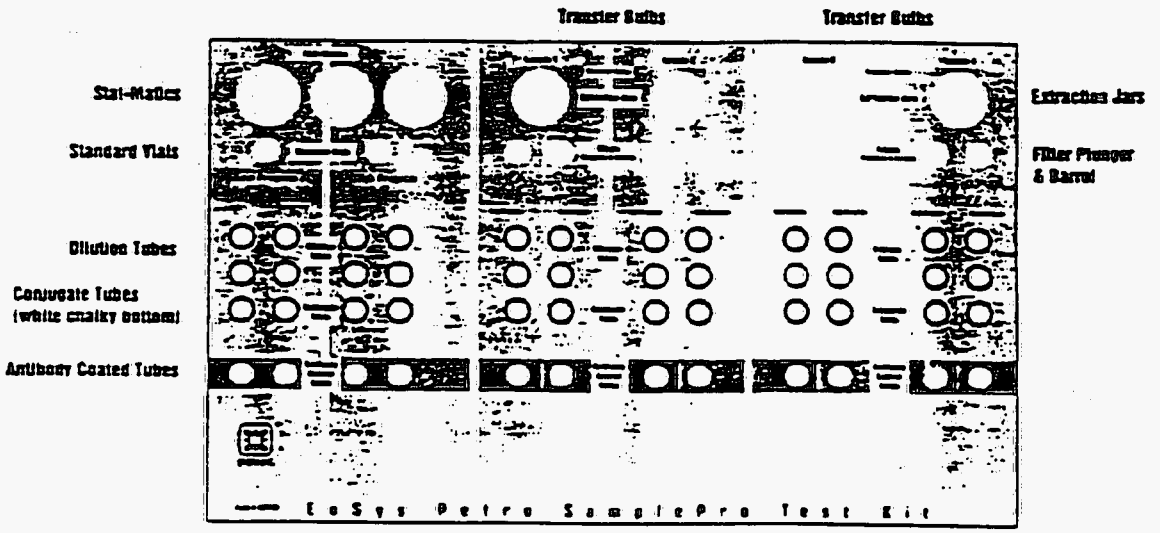
The PETRO samples and standards are diluted into the enzyme conjugate and then added to the antibody coated tubes. The petroleum hydrocarbons are allowed to bind to antibody binding sites for 10 minutes. During this incubation, the petroleum hydrocarbons in the sample and the enzyme conjugate are "competing" for antibody binding sites. Next, washing the antibody coated tubes removes any unbound petroleum hydrocarbons or enzyme conjugate. The addition of substrate solutions causes a colorimetric reaction.

PHASE IV - Interpretation of Results

The intensity of the color in the tube is inversely proportional to the concentration of the petroleum hydrocarbons in the sample. The analysis of two standards provides a quality control check. Using the differential photometer the sample tubes are compared to the standard tube in order to make a greater than or less than interpretation for each test level.

SamplePro ACCESSORY KIT





SamplePro Petro Laminated Overlay for recognition and placement of your test components shown above.

MATERIALS

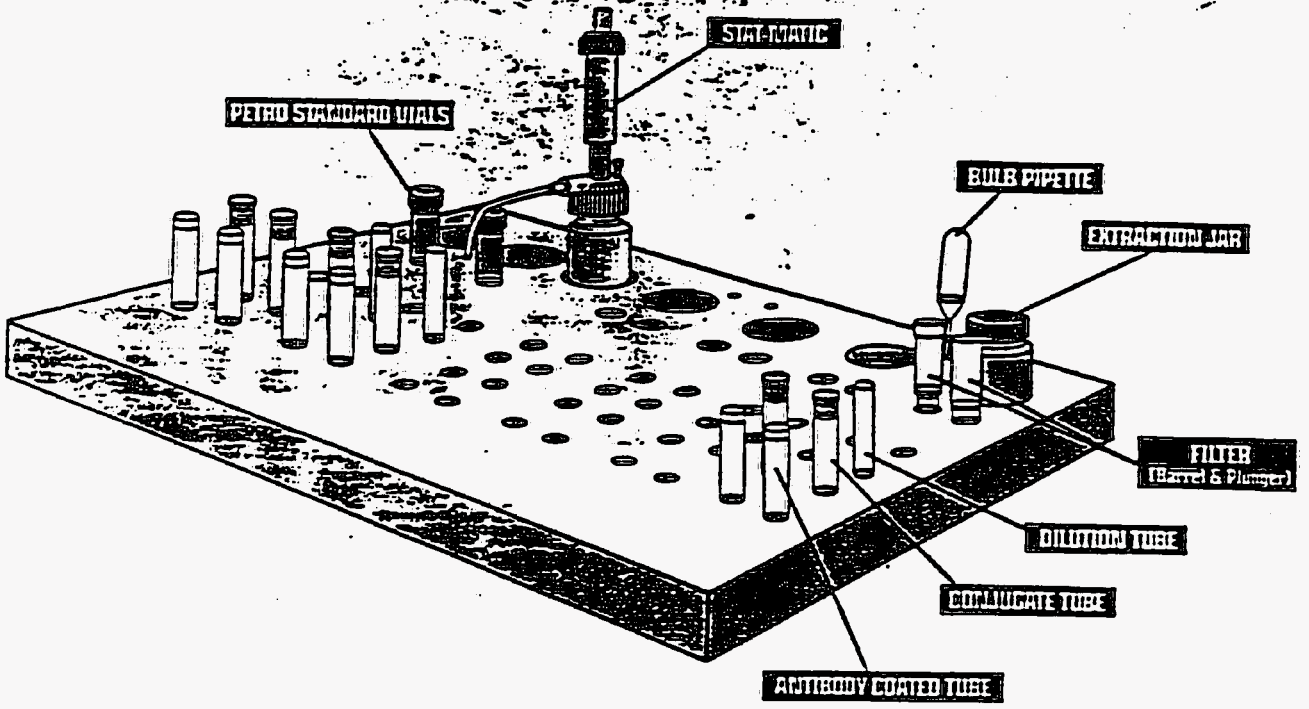
MATERIALS PROVIDED IN PETRO SamplePro DETECTION KIT

Test Preparation
3 PETRO Standards/Test level
6 Empty Vials
6 Transfer bulbs
1 10x Wash Concentrate
1 Ampule Cracker
1 Bottle of Buffer Solution
1 Bottle of Substrate A
1 Bottle of Substrate B
1 Bottle of Stop Solution

Phase I
24 Weigh Boats
24 Wooden Spatulas
24 Extraction Jars
24 Filtration Plungers and Barrels
24 Bulb Pipettes
24 Methanol Crimp Top Vials

Phase II
1 Box of Dilution tubes
1 Box of Handprobe tips

Phase III
6 Bags of Antibody Coated Tubes
72 Conjugate Tubes



ASSAY PERFORMANCE TIPS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WASH STEP

Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. Make sure to wash four times vigorously. Also make sure to wash the whole set of 12 tubes at once.

MIXING

Lack of thorough mixing, when instructed, can cause inconsistent results. Observe the times in the instructions and mix with sufficient force to ensure that the liquid is mixed.

TIMING

It is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the tests as long as all samples and standards within a run are incubated identically. The color development step timing is critical and should be no less than 2 minutes and no greater than 3 minutes.

WIPING TUBES

Antibody coated tubes should be wiped before they are read in the photometer because smudges and fingerprints on the tubes can give potentially false negative readings.

MIXING LOT #'S

Never mix lots! Each kit's components are matched for optimal performance and may give inaccurate results with the components from other kits with different lot #'s. Also, NEVER mix components from different types of kits (ex: Petro kit buffer can not be used with a PCB kit).

STORAGE OF ACCESSORY KIT

Never close unit and store without removing Buffer Bottle and flushing unit with DI water. Buffer Bottle may leak and flood electrical system.

STORAGE AND OPERATING TEMPERATURES FOR TEST KIT

Temperature requirements are very important and should be strictly adhered to. This information can be found in the kit User's Guide.

SHELF-LIFE

Each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

SAMPLEPRO QUICK TIPS AND REMINDERS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TEST PREPARATION

1) Plug in SamplePro overnight before first use and after each day of use. Do not store the unit with a dead battery. Charge before storage.
2) Peel the label from the standard ampule and transfer it to the screw cap vial.
3) Label the antibody coated tubes with sample identification and test level.
4) Save the caps from substrate bottles. If you need to pack up the *Stat-Matic* substrate dispensers, first disassemble and purge the remaining fluid back into the appropriate bottle. Then recap bottles and flush the *Stat-Matic* dispensers with water.

RUNNING THE TEST

1) Before running each phase of the test procedure, make sure you have all the necessary components set up and ready. For example; Assemble and prime the *Stat-Matic* substrate dispensers; Pre-dilute the wash concentrate with distilled water, etc.
2) ***Do not rest the handprobe tip on the bottom of the container as the sample/standard is being picked up.***
3) "Look" to see that the sample has been picked up.
4) When a mistake in dilution has been made, discard the dilution tubes and start the dilution over. Reset the SamplePro by pressing CHANGE PROGRAM. followed by ENTER. - Now ready for sample pickup. Plenty of extra dilution tubes are supplied.
5) Change handprobe tips between samples and standards.
6) ***Keep handprobe tip fully inserted in the dilution tube until the beep sounds.***
7) Prime the *Stat-Matic* with 8-10 pumps when it is assembled. Also, before each set of tubes is developed, remove any air bubbles visible in the *Stat-Matic*.
8) Push *Stat-Matic* substrate dispenser button all the way down to deliver the appropriate amount of substrate.
9) You must run 4 samples at once to acheive 24 sample tests per kit.
10) Accomplished users may refer to page 17 of the User's Guide for the Abbreviated Procedure.

FLUSHING

Flush SamplePro unit after each day's use to avoid salt crystallization in moving parts. Also, flush unit several times with DI water before using unit on a different kit format.

TEST PREPARATION

SamplePro Unit must be;

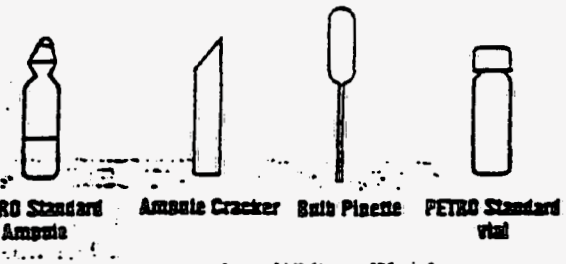
1. Charged overnight for 8 - 10 hours of normal use or operated from line voltage with charger attached.
2. To conserve battery, turn off SamplePro during long breaks.

MATERIALS NOT PROVIDED IN THIS KIT

Distilled Water
Paper towels
Liquid waste container
Permanent marking pen
Disposable gloves

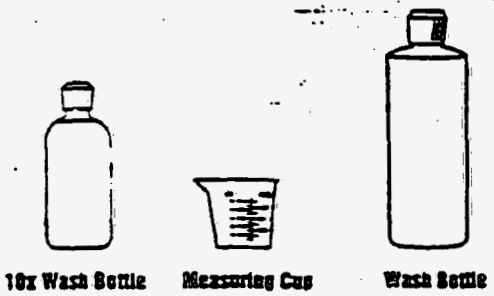
STANDARD PREPARATION

- Open PETRO Standard ampules by slipping ampule cracker over top, and then breaking tip at scored neck. Transfer solution to empty vial with Bulb Pipettes.
- Label vial with current date. Standard is usable for 2 weeks. Always cap tightly when finished using Standard.
- A new PETRO Standard should be opened for every 8 samples (Two test runs).



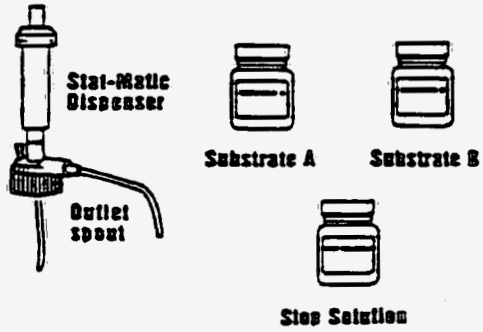
WASH PREPARATION

1. Measure 50ml of 10X Wash Concentrate into measuring cup.
2. Pour into an empty Wash Bottle and fill to top with distilled water.



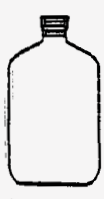
SUBSTRATE PREPARATION

Attach outlet spout to each *Stat-Matic*. Label the caps of the Substrate jars with "A", "B" & "Stop" and save the caps for reclosure. Attach Stat-Matic dispenser tops to Substrate A, Substrate B, and Stop Solution. Prime dispensers by pumping 8-10 times into a waste container.



SamplePro SET-UP

1. Attach the bottle of Buffer Solution to the cap assembly.
2. Switch unit on. **SamplePro prompt: Flush**
3. Aiming handprobe into liquid waste container press white button to flush line. BEEP will sound to indicate flush is complete.



PHASE 1 EXTRACTION & PREPARATION OF THE SAMPLE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

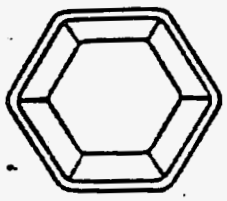
1a Open methanol crimp top vial and pour the entire contents into the extraction jar.

1b Place unused weigh boat on pan balance.

1c Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

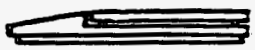
1d Weigh out 10 ±0.1 grams of soil.

1e If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.

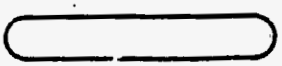


Weigh Boat

Methanol Crimp Top Vial



Pan balance



Wooden spatula

EXTRACT PETROLEUM HYDROCARBONS

2a Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

2b Recap extraction jar tightly and shake vigorously for one minute.

2c Allow to settle for one minute. Repeat steps 1a - 2c for remaining three samples to be tested.

Extraction jar

FILTER SAMPLE

3a Disassemble filtration plunger from filtration barrel.

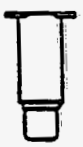
3b Insert bulb pipette into top (liquid) layer in extraction jar and draw up sample. Transfer at least ½ bulb capacity into filtration barrel. Do not use more than one full bulb.

3c Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).

Repeat steps 3a - 3c for each sample to be tested.

Filtration plunger

Bulb pipette



Filtration barrel

PHASE 2 DILUTION OF SAMPLES AND STANDARDS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

The samples and standards are now in methanol. It is necessary to dilute the samples and standards in buffer. SamplePro picks up the sample and dilutes it with a set amount of buffer. One to three dilutions are necessary depending on the desired test concentration of petroleum hydrocarbons . Higher test concentrations require more dilutions. If one dilution is needed, conjugate tubes will be set-up only in red row. If two dilutions are needed then conjugate tubes are set-up in red row with empty dilution tubes set-up in the blue row. Three dilutions require conjugate tubes in red row, and empty dilution tubes in the blue and black rows.

PETRO SamplePro Test Levels (ppm)

Find the test levels in the chart and set up necessary dilution tubes in Black & Blue rows. Set up conjugate tubes in the red row. Place tubes for lowest test level in the Purple column and tubes for the highest test level in the Green column.

Program	Gasoline	Diesel #2 Fuel Oil Kerosene Jet A JP-4	# 6 Fuel Oil	Mineral Spirits	
11	10	15	25	40	
12	20	30	50	80	
13	33	50	83	133	
13	40	60	100	160	USE Conjugate tubes in RED Row
13	50	75	125	200	
14	67	100	167	267	
15	100	150	250	400	
16	200	300	500	800	
17	333	500	833	1,333	
17	400	600	1,000	1,600	
17	500	750	1,250	2,000	USE Conjugate tubes in RED Row Dilution tubes in BLUE Row
18	667	1,000	1,667	2,667	
19	1,000	1,500	2,500	4,000	
20	2,000	3,000	5,000	8,000	
21	3,333	5,000	8,333	13,333	
21	4,000	6,000	10,000	16,000	
21	5,000	7,500	12,500	20,000	USE Conjugate tubes in RED Row Dilution tubes in BLACK,BLUE Rows
22	6,667	10,000	16,667	26,667	
23	10,000	15,000	25,000	40,000	

PHASE 2 DILUTION OF SAMPLES AND STANDARDS

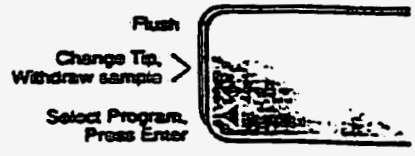
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

LOWER LEVEL TEST

1. Refer to chart to determine Program number for lower test level.

SamplePro prompt: Select Program, Press Enter

2. Use the + and - Arrow keys to set the SamplePro Program number. Press ENTER.
3. Working from left to right in workstation prepare conjugate and dilution tubes in all purple columns for all samples and lower level Standard using appropriate instructions on the following page.



HIGHER LEVEL TEST

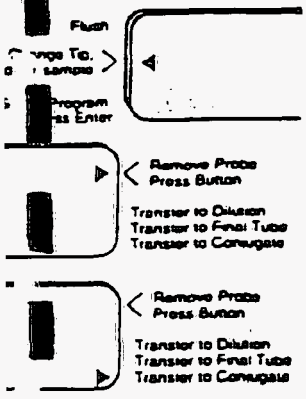
1. Refer to chart to determine Program number for higher test level.
2. Press Change Program. Use the + and - Arrow keys to set the SamplePro Program number. Press ENTER.
3. Working from left to right in workstation prepare conjugate and dilution tubes in all green columns for all samples and higher level Standard using appropriate instructions on the following page.

PHASE 2 DILUTION OF SAMPLES AND STANDARDS CONT'D

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

STEP D in each Dilution procedure must be completed <u>immediately</u> following STEP C within 1-2 seconds. <u>Remove tip from liquid</u> & press button a second time to avoid losing sample extract.

TO PREPARE RED CONJUGATE TUBES



SamplePro prompt: Change Tip, Withdraw sample.

A. <u>Firmly</u> install tip on handprobe.
B. Place tip below liquid level of sample, but not touching bottom of container.
C. Press and release handprobe button once to withdraw sample. *SHORT BEEP*

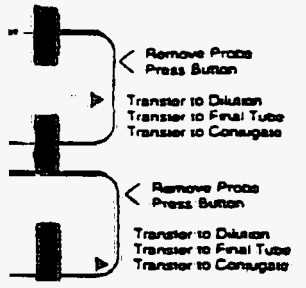
SamplePro prompt: Remove Probe, Press Button.

D. Remove handprobe from tube and press handprobe button again. *SHORT BEEP*

SamplePro prompt: Transfer to Conjugate

E. Fully insert tip into conjugate tube in RED row and press handprobe button to release diluted sample. *SHORT BEEP, LONG BEEP*
F. Eject tip into waste container.
G. Repeat steps A-F for each sample and Standard.

TO PREPARE BLUE DILUTION AND RED CONJUGATE TUBES



SamplPro prompt: Change tip, Withdraw sample

A. <u>Firmly</u> install tip on handprobe.
B. Place tip below liquid level of sample, but not touching bottom of container.
C. Press and release handprobe button once to withdraw sample. *SHORT BEEP*

SamplePro prompt: Remove probe, Press Button.

D. Remove handprobe from tube and press handprobe button again.

SamplePro prompt: Transfer to Dilution

E. Fully insert tip into dilution tube in BLUE row and press handprobe button. Do not remove tip before *SHORT BEEP.*

SamplePro prompt: Transfer to Conjugate

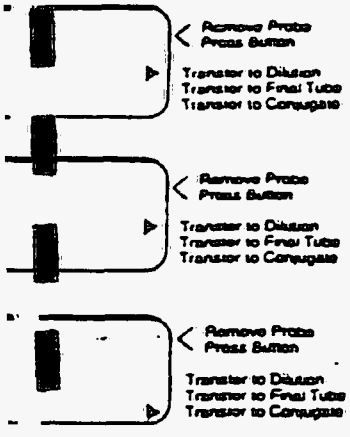
F. Fully insert tip into conjugate tube in RED row and press handprobe button. *SHORT BEEP, LONG BEEP.*
G. Eject tip into waste container.
H. Repeat steps A-G for each sample and Standard.

PHASE 2 DILUTION OF SAMPLES AND STANDARDS CONT'D

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

STEP D in each Dilution procedure must be completed <u>immediately</u> following STEP C within 1-2 seconds. <u>Remove tip from liquid</u> & press button a second time to avoid losing sample extract.

TO PREPARE BLACK & BLUE DILUTION TUBES & RED CONJUGATE TUBES



SamplePro prompt: Change Tip, Withdraw sample.

A. <u>Firmly</u> install tip on handprobe.

B. Place tip below liquid level of sample, but not touching bottom of container.

C. Press and release handprobe button once to withdraw sample.

SamplePro prompt: Remove probe, Press Button.

D. Remove handprobe from tube and press handprobe button again. *SHORT BEEP.*

SamplePro prompt: Transfer to Dilution

E. Fully insert tip into dilution tube in BLACK row and press handprobe button. Do not remove tip before *SHORT BEEP.*

SamplePro prompt: Transfer to Dilution

F. Fully insert tip into dilution tube in BLUE row and press handprobe button. Do not remove tip before *SHORT BEEP.*

SamplePro prompt: Transfer to Conjugate

G. Fully insert tip into conjugate tube in RED row and press handprobe button. *SHORT BEEP, LONG BEEP.*

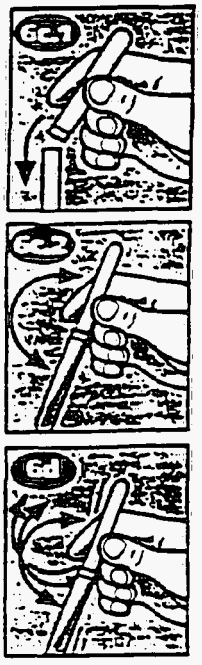
H. Eject tip into waste container.

I. Repeat steps A - H for each sample and Standard.

PHASE 3 THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TRANSFER FROM CONJUGATE TUBE TO ANTIBODY COATED TUBE



6a. Label the antibody coated tubes with sample identification and test level [H(High), L(Low)]

6b. Set timer for 10 minutes.

6c. Working left to right in the workstation:

1. Fit all antibody coated tubes firmly on top of all corresponding conjugate tubes.

2. Start timer and immediately invert all connected tube pairs so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom.

6d. Invert all tube pairs several more times making sure the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

6e. Disconnect and discard the smaller glass conjugate tubes. [It is not important to worry about drops of liquid adhering to lips of tubes].

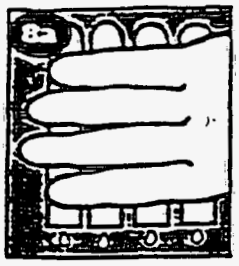
PHASE 3 THE IMMUNOASSAY

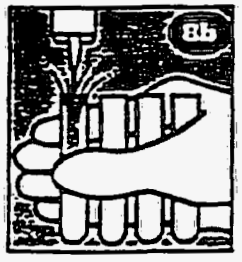
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING/ WASH PROCEDURE

- An accurate test requires a vigorous wash accomplished by directing a strong stream into the antibody coated tubes.
- The wash solution is a mild, dilute solution of detergent.
- Wash all 12 tubes at once.

WASH





8a After the 10 minute incubation, empty antibody coated tubes into liquid waste container.

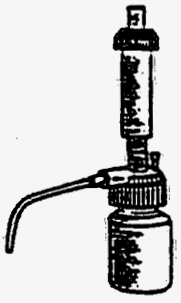
8b Wash antibody coated tubes by vigorously filling and emptying a total of 4 times.

8c Tap antibody coated tubes upside down on paper towels to remove excess liquid. Residual foam in the tubes will not interfere with test results.

COLOR DEVELOPMENT

- **Fully depress plunger button to dispense from *Stat-Matic* Dispenser.**
- **Add Solutions to tubes working from left to right in the workstation using the Stat-Matics.**

9a. Dispense Substrate A (yellow label) once in each tube.
9b. Set timer for 2 1/2 minutes.
9c. Start timer and dispense Substrate B (green label) once in each tube. *Solution will turn blue in some or all tubes.*
9d. Gently shake tubes
9e. At 2 1/2 minutes, dispense Stop (red label) once in each tube. *Solution will turn yellow in some or all tubes.*



Stat-Matic

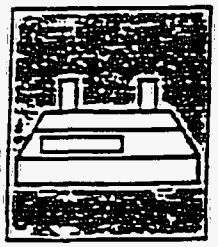
PHASE 4 INTERPRETATION OF RESULTS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

PERFORM THESE FUNCTIONS FOR EACH TEST LEVEL

- Wipe outside of all antibody coated tubes before placing them in the photometer.

SELECT STANDARD

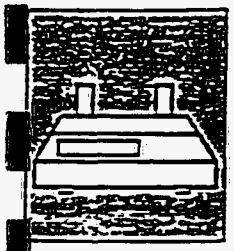


10a. Place the pair of Standard tubes for the lower test level in photometer.

10b. Switch tubes until the photometer reading is negative or zero. Record reading.
If reading is greater than - 0.3 in magnitude, results are outside QC limits. Retest the sample(s).

10c. Remove and discard tube in right well. The tube in the left well is the darker Standard.

MEASURE SAMPLE



11. Place first sample tube for the lower test level in right well of photometer and record reading.

If photometer reading is negative or zero, petroleum hydrocarbons are present.

If photometer reading is positive, concentration of petroleum hydrocarbons is less than the test level.

Continue and read the remaining sample tubes for the lower level.

Repeat the above process for the higher test level:
Select the darker of the two Standards and measure the sample tubes for the higher test level.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each PETRO SamplePro System contains enough material to perform 24 complete tests, each at two test levels.

The PETRO SamplePro System is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-242-RISC (7472).

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

Petroleum fuels-free soil and soil containing petroleum fuels at or above the test level were tested with the EnSys PETRO SamplePro analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains fuel. A sample that has developed more color than the standard is interpreted as negative. It contains fuel at less than the selected test level.

The company does not guarantee that the results with the PETRO SamplePro Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

EnSys, Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

EnSys, Inc. neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall EnSys, Inc. be liable for incidental or consequential damages resulting from the use or handling of this product.

How It Works

Standards, Samples, and color-change reagents are added to test tubes, coated with a chemical specific to petroleum fuels. The concentration of petroleum fuel in an unknown Sample is determined by comparing its color intensity with that of a Standard.

Note: Petroleum fuel concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of petroleum fuel.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Kit with reagents or test tubes from another Kit.
- Do not use the Test System kit after its expiration date.
- Do not attempt the test using more than 12 antibody coated tubes (4 of which are Standards) at the same time.
- Do not exceed incubation periods prescribed by the specific steps.
- Always wash the number of times indicated in this guide.
- Use a method which is appropriate for your specific regulatory situation to confirm results.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If Stop Solution, PETRO Standard or liquid from the extraction jar comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures between 15°C/60°F and 39°C/100°F.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS
EnSys RIS© TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. EnSys recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. Sample Documentation
   1. Location, depth
   2. Time and date of collection and field analysis

B. Field analysis documentation - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. Method calibration - this is an integral part of EnSys RIS© immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)

D. Method blank - analyze methanol from the extraction jar.

E. Site-specific matrix background field analysis - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. Duplicate sample field analysis - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. Confirmation of field analysis - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. Performance evaluation sample field analysis (optional, but strongly recommended) - field analyze performance evaluation sample daily to document method/operator performance

I. Matrix spike field analysis (optional) - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

EnSys technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives.

PETRO *SamplePro* - Abbreviated Procedure

STEP	PROCEDURE
1	Prepare PETRO standards, wash, substrates and extraction jars. Attach buffer to SamplePro, turn unit on, and flush.
2	Weigh out 10 grams of sample and transfer it to extraction jar. Shake extraction jar for 1 minute. Filter the extracted sample.
3	Set up the workstation and label tubes. Select your LOW program. Dilute all samples and standards in the purple columns.
4	Select your HIGH program. Dilute all samples and standards in the green columns.
5	Set timer for 10 minutes. Fit antibody coated tubes (AbCT) on corresponding final tubes (red row). Working from left to right, invert all tube pairs and return to workstation. Invert each pair several more times.
6	After 10 minutes, IMMEDIATELY: Wash AbCT vigorously 4 times.
7	Working left to right, dispense Sub A (yellow) once in each AbCT. Set timer for 2 1/2 minutes. Start timer and dispense B (green) once in each AbCT, shake. After 2 1/2 minutes, dispense Stop (red) once in each AbCT.
8	Read tubes in photometer.

APPENDIX C

CLOSURE DOCUMENTATION BY TANK

TANK 1 - BUILDING 120

Summary of Tank 1 Assessment Data
Building 120

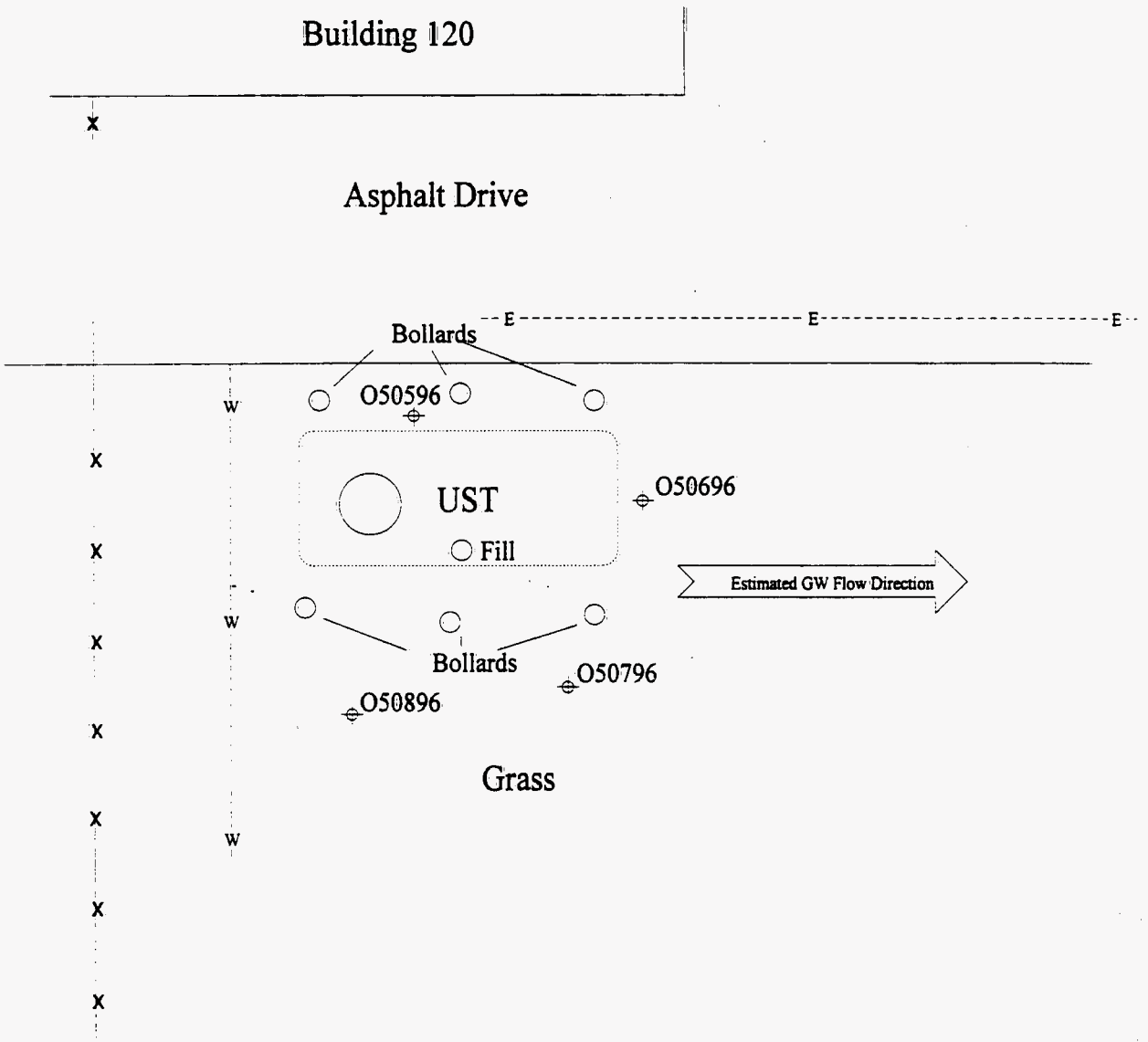
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
SILTY CLAY: Yellowish grey to brownish grey; loose to firm; low plasticity; damp to dry. No odors or stains.	No readings above background	7	050596	N	N	7.0 - 8.0	Less than 5,000
			050696	N	N	7.0 - 8.0	Less than 5,000
			050796	N	N	7.0 - 8.0	Less than 5,000
			050896	N	N	7.0 - 8.0	Less than 5,000

Notes:

Four borings were completed immediately adjacent to the UST, two on the south side, one each on the north and east side of the UST. No boring was completed on the west side of the tank due to the proximity of underground utilities.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note:
See Summary Table of Tank Assessment Data
for information regarding boring placement.



LEGEND

- Fence
- UST
- Water Utility Corridor
- Electric Utility Corridor
- GeoProbe Location

Not to scale

N

TANK LOCATION

Tank #1
Building 120

Job No. 1/95-059-01.1100

DRAWING COMMRM C:\Projects\19505901\1100\tank1.skd

TANK 3 - BUILDING 127

Summary of Tank 3 Assessment Data
Building 127

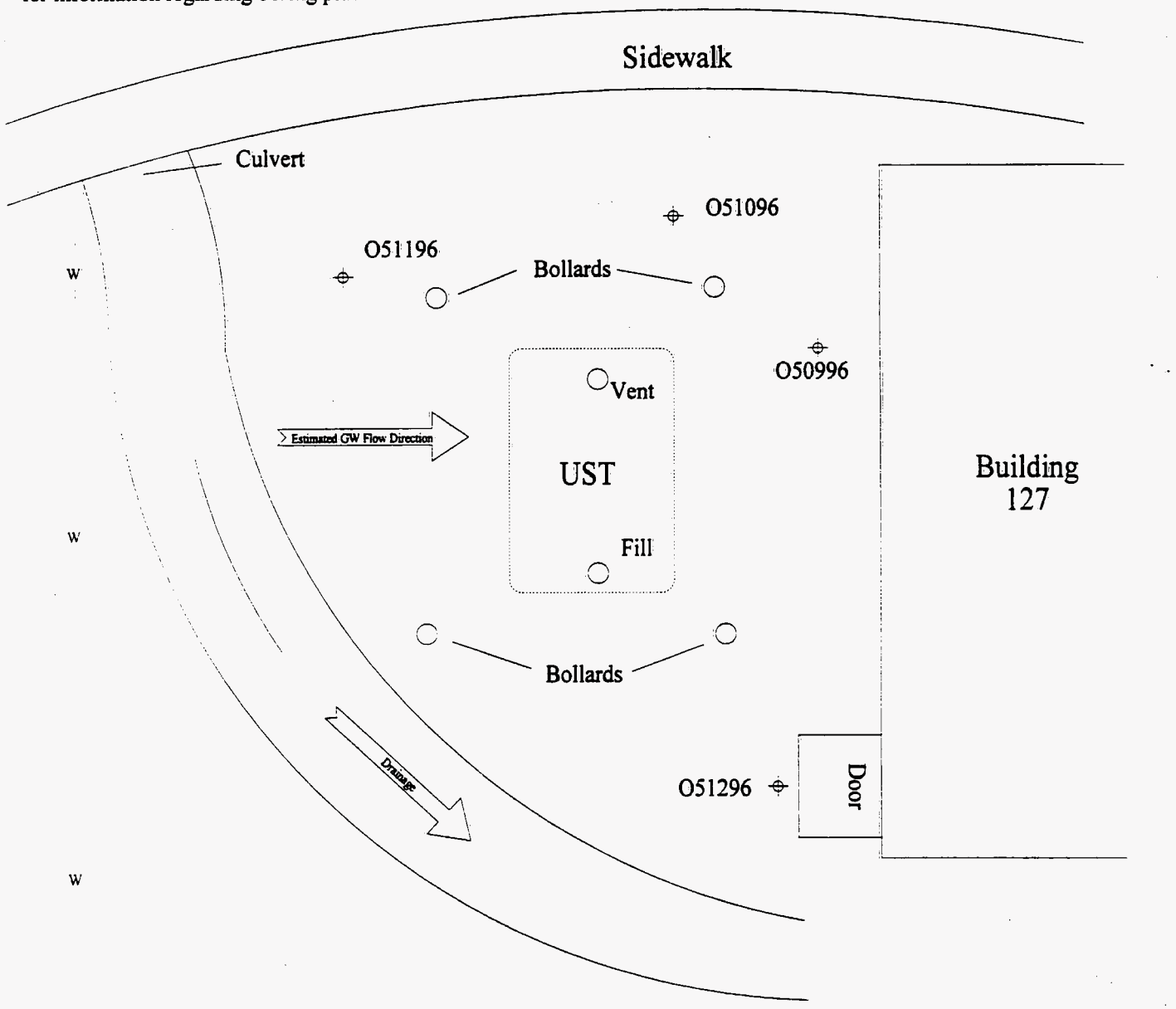
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
CLAYEY SILT TO CLAYEY GRAVEL: light brown to dark brown; large angular with medium- to coarse-grained sand; matrix loose; unconsolidated; damp. No odors or stains	No readings above background levels	7	050996	N	N	8.0 - 9.0	Less than 5,000
			051096	N	N	8.0 - 9.0	Less than 5,000
			051196	N	N	8.0 - 9.0	Less than 5,000
			051296	N	N	8.0 - 9.0	Less than 5,000
			050996 Dup.	N	N	8.0 - 9.0	Less than 5,000

Notes:

Four borings were completed immediately adjacent to the UST, one boring on each side of the tank. Underground utilities prohibited borings from being placed close to the tank.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
Dup. *Duplicate quality control sample*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note:
See Summary Table of Tank Assessment Data
for information regarding boring placement.



LEGEND

- —x— Fence
- UST
- --W--- Water Utility Corridor
- GeoProbe Location

N

Not to scale

DRAWING COMMRM C:\Projects\19505901\1100\tank3.skd

TANK LOCATION

Tank #3
Building 127

Job No. 1/95-059-01.1100

TANK 4 - BUILDING 318

Summary of Tank 4 Assessment Data
Building 318

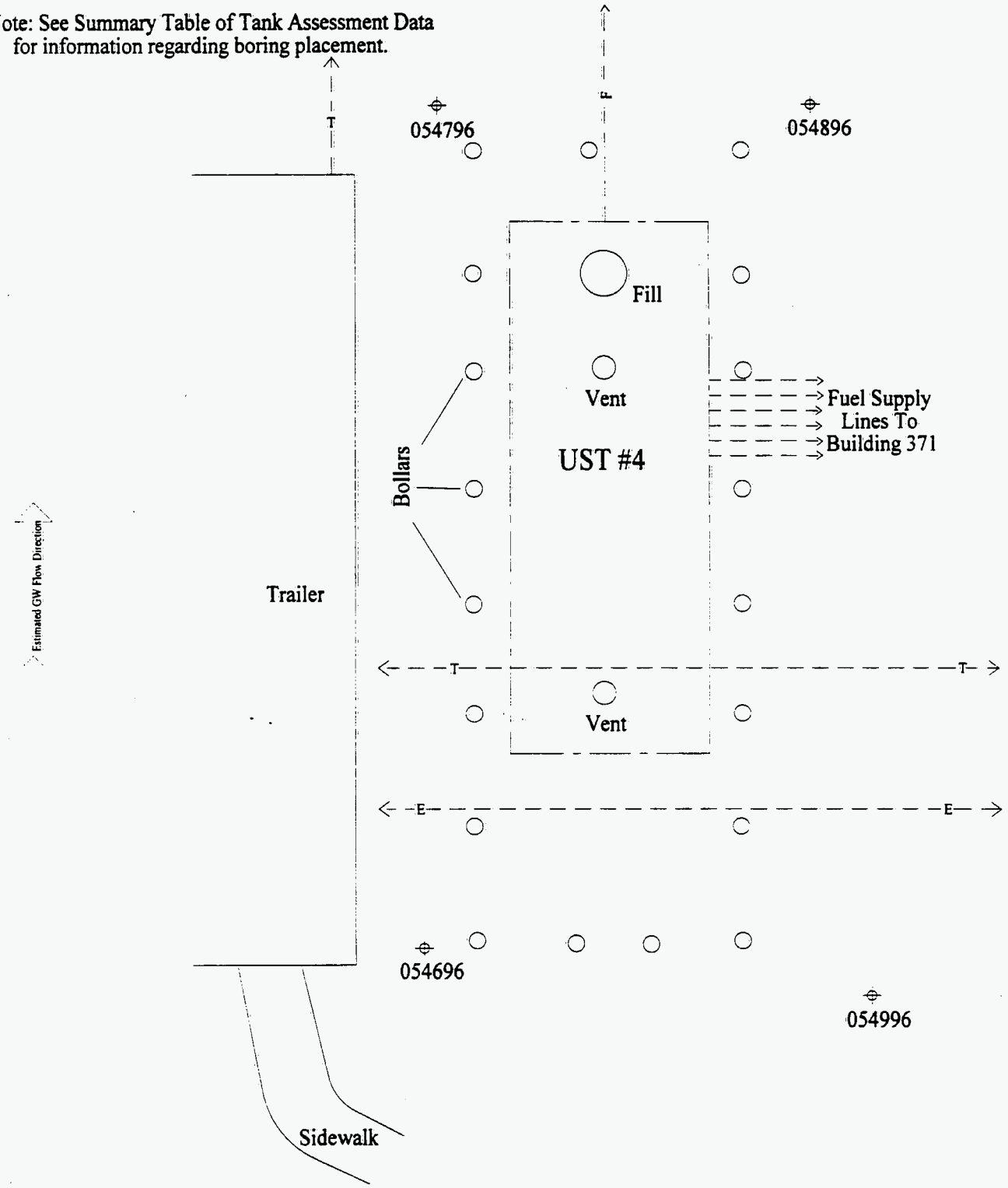
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
SILTY CLAY: Yellowish grey to brownish grey; loose to firm; low plasticity; damp to dry. No odors or stains.	No readings above background levels	13.5	054696	N	N	13.5-14.5	Less than 5,000
			054796	N	N	13.5-14.5	Less than 5,000
			054896	N	N	13.5-14.5	Less than 5,000
			054996	N	N	13.5-14.5	Less than 5,000
			054996 Dup.	N	N	13.5-14.5	Less than 5,000

Notes:

Four borings were completed near the tank; two to north and two to south. Borings were not located to east and west due to utilities and site access restrictions.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note: See Summary Table of Tank Assessment Data for information regarding boring placement.



LEGEND

- UST
- Telephone Utility Corridor
- Electric Utility Corridor
- Fuel Utility Corridor
- GeoProbe Location

N

Not to scale

TANK LOCATION

Tank #4
Building 318

Job No. 1/95-059-01.1100

DRAWING COMMRM C:\Projects\19505901\1100\tank4.skd

TANK 14 - BUILDING 559

Summary of Tank 14 Assessment Data
Building 559

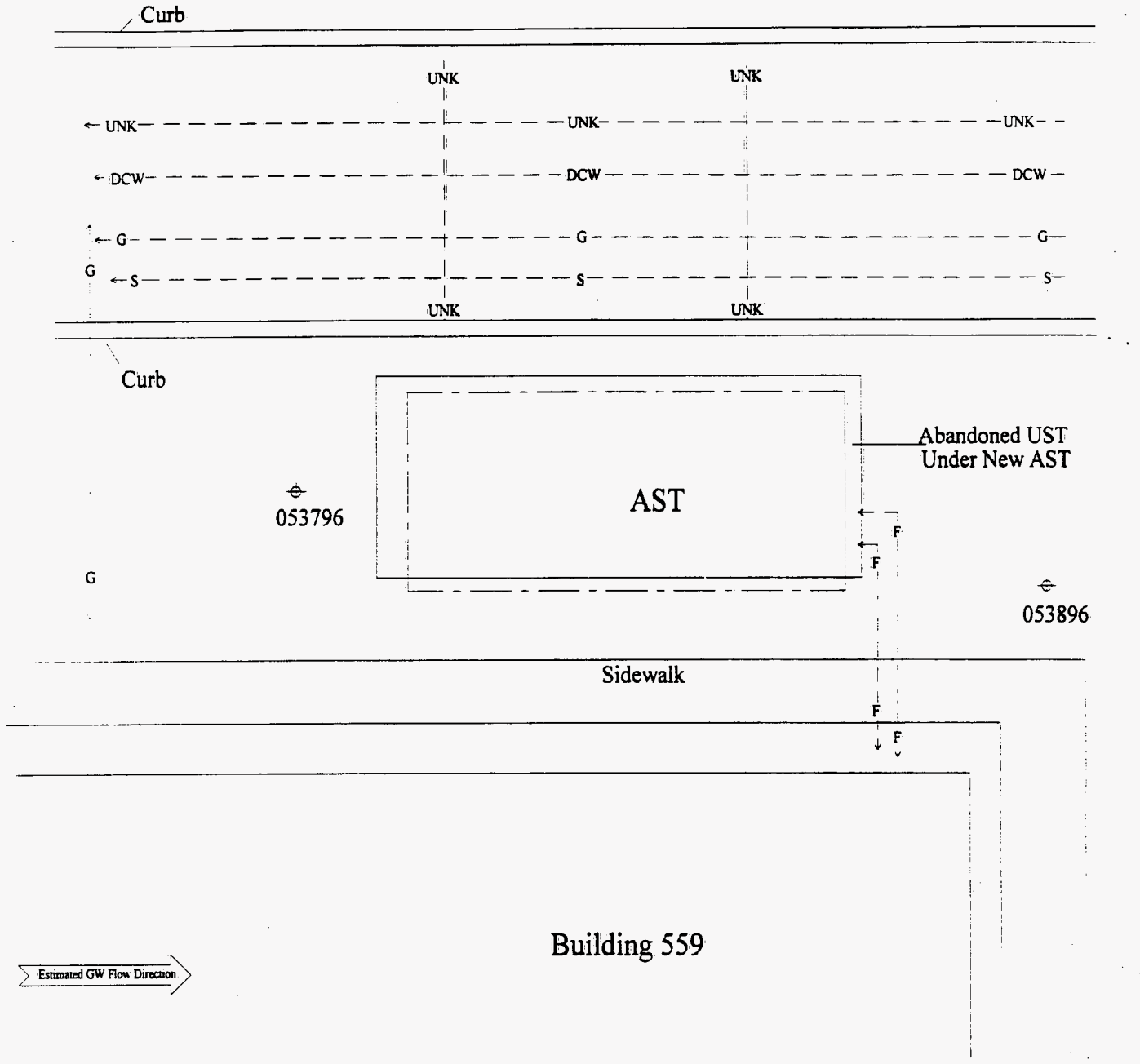
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
GRAVELLY CLAY TO SANDY CLAY: Light brown to dark brown, loose, with very large grain sand, granitic in nature and non-plastic overall, damp to dry. No odors or stains	No readings above background	7	053796	N	N	7 - 7.5	Less than 5,000
			053896	N	N	7 - 7.5	Less than 5,000

Notes:

Two borings were drilled at the site. Additional borings could not be drilled due to utilities.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note: See Summary Table of Tank Assessment Data for information regarding boring placement.



LEGEND

- UST
- Gas Utility Corridor
- Domestic Cold Water Utility Corridor
- Sewer Utility Corridor
- Fuel Utility Corridor
- Unknown Utility Corridor
- GeoProbe Location

N

Not to scale

TANK LOCATION

Tank #14
Building 559

Job No. 1/95-059-01.1100

DRAWING COMMRM C:\Projects\19505901\1100\tank14.skd

TANK 15 - BUILDING 562

Summary of Tank 15 Assessment Data
Building 562

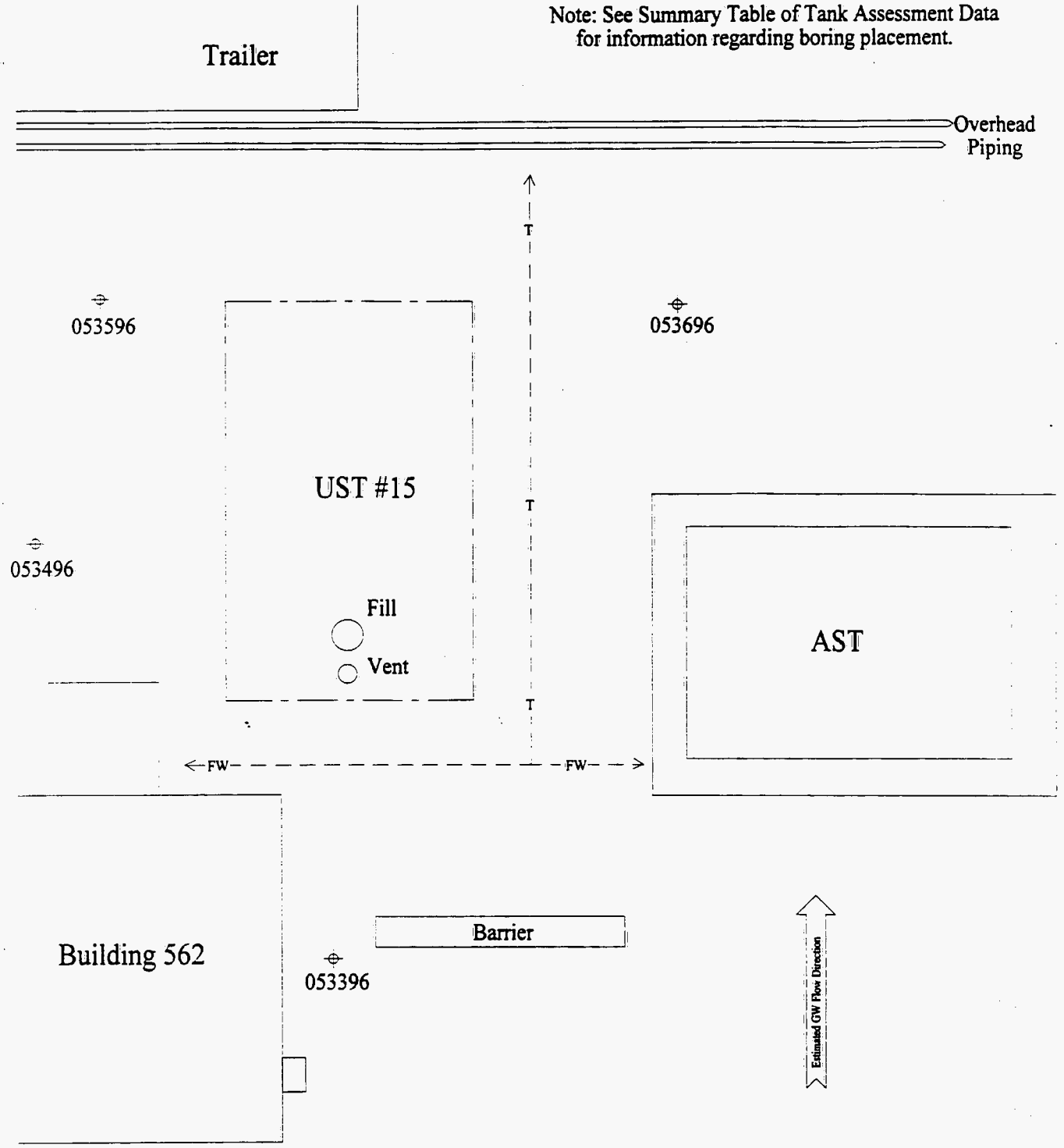
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
GRAVELLY CLAY: Moderate brown, loose to firm, with medium to coarse grained sand, sand matrix loose, damp to moist. No odors or stains.	No readings above background	9	053396	N	N	9 - 9.5	Less than 5,000
			053496	N	N	9 - 9.5	Less than 5,000
			053596	N	N	9 - 9.5	Less than 5,000
			053696	N	N	9 - 9.5	Less than 5,000

Notes:

Four borings were drilled at the site; two on the north side of the UST, one on the south side and one on the west side. A boring could not be located on the east side of the UST due to site restrictions.

N No
PID Photoionization Detector - readings in parts per million (ppm)
TPH Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)
1 Depth in feet below ground surface

Note: See Summary Table of Tank Assessment Data for information regarding boring placement.



LEGEND

- UST
- Telephone Utility Corridor
- Fire Water Utility Corridor
- GeoProbe Location

N

Not to scale

TANK LOCATION

Tank #15
Building 562

Job No. 1/95-059-01.1100

DRAWING COMMRM C:\Projects\19505901\1100\tank15.skd

TANK 16 - BUILDING 709

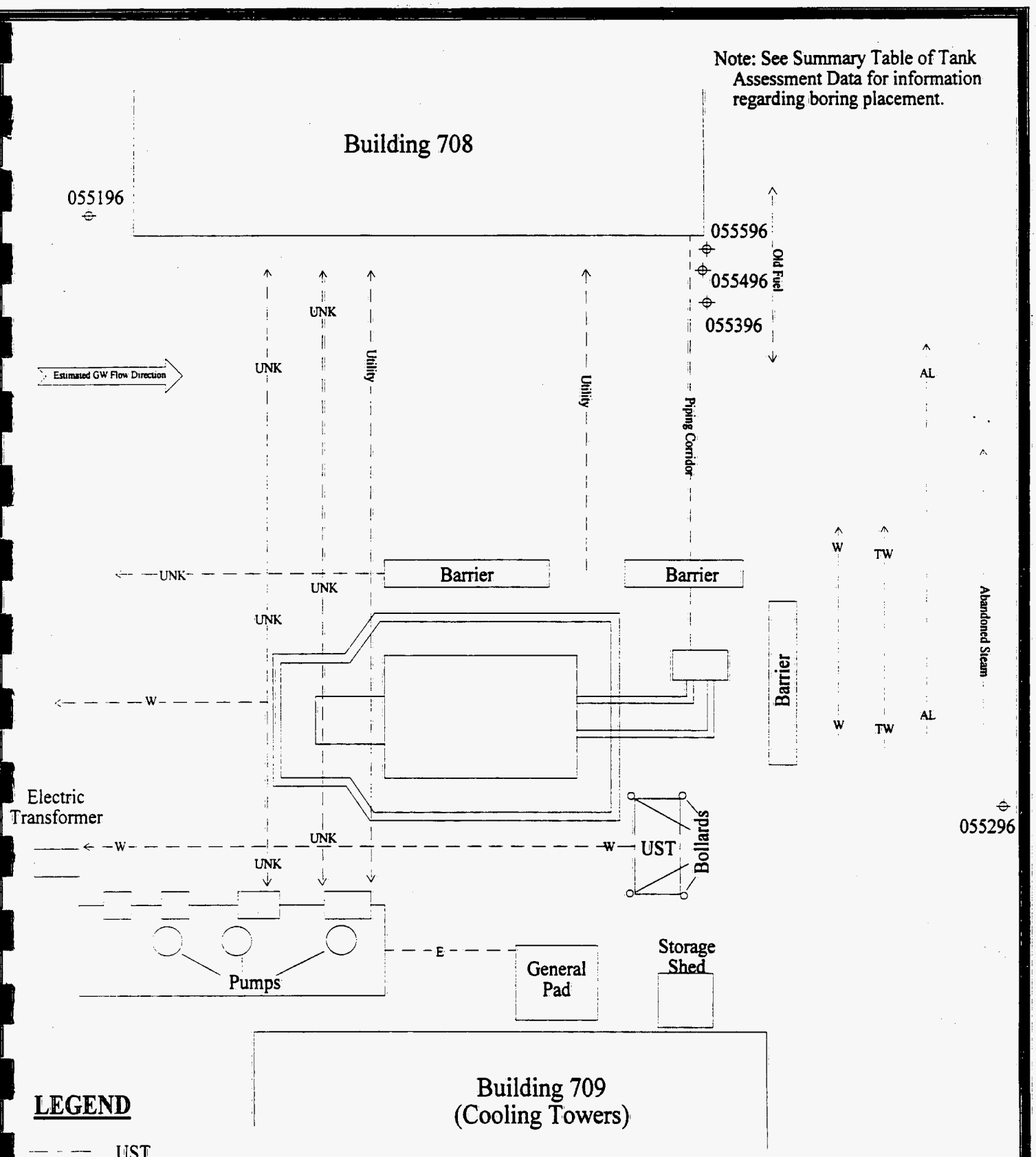
Summary of Tank 16 Assessment Data
Building 709

Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
SILTY CLAY: Yellowish gray to brownish gray, loose to firm, low plasticity, damp to dry. No odors or stains.	No readings above background	9	055196	N	N	9 - 9.5	Less than 5,000
			055296	N	N	9 - 9.5	Less than 5,000
			055396	N	N	9 - 9.5	Less than 5,000
			055496	N	N	9 - 9.5	Less than 5,000
			055596	N	N	9 - 9.5	Less than 5,000
			055596 Dup.	N	N	9 - 9.5	Less than 5,000

Notes:

Two borings (055196 and 055296) were drilled near the UST. Additional borings could not be drilled due to presence of utilities and other site access restrictions. Three borings were also drilled along an old fuel line near the UST.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*


Note: See Summary Table of Tank Assessment Data for information regarding boring placement.
Building 708
055196
055596
055496
055396
Old Fuel
Estimated GW Flow Direction
UNK
Utility
Piping Corridor
AL
W
TW
Abandoned Steam
Barrier
Barrier
Barrier
Electric Transformer
055296
UST
Bollards
Pumps
E
General Pad
Storage Shed
Building 709
(Cooling Towers)
LEGEND
UST
Water Utility Corridor
Electric Utility Corridor
Tower Water Utility Corridor
Unknown Utility Corridor
Utility Corridor
GeoProbe Location
Not to scale
N
TANK LOCATION
Tank #16
Building 709
Job No. 1/95-059-01.1100
DRAWING COMMRM C:\Projects\19505901\1100\tank16.skd

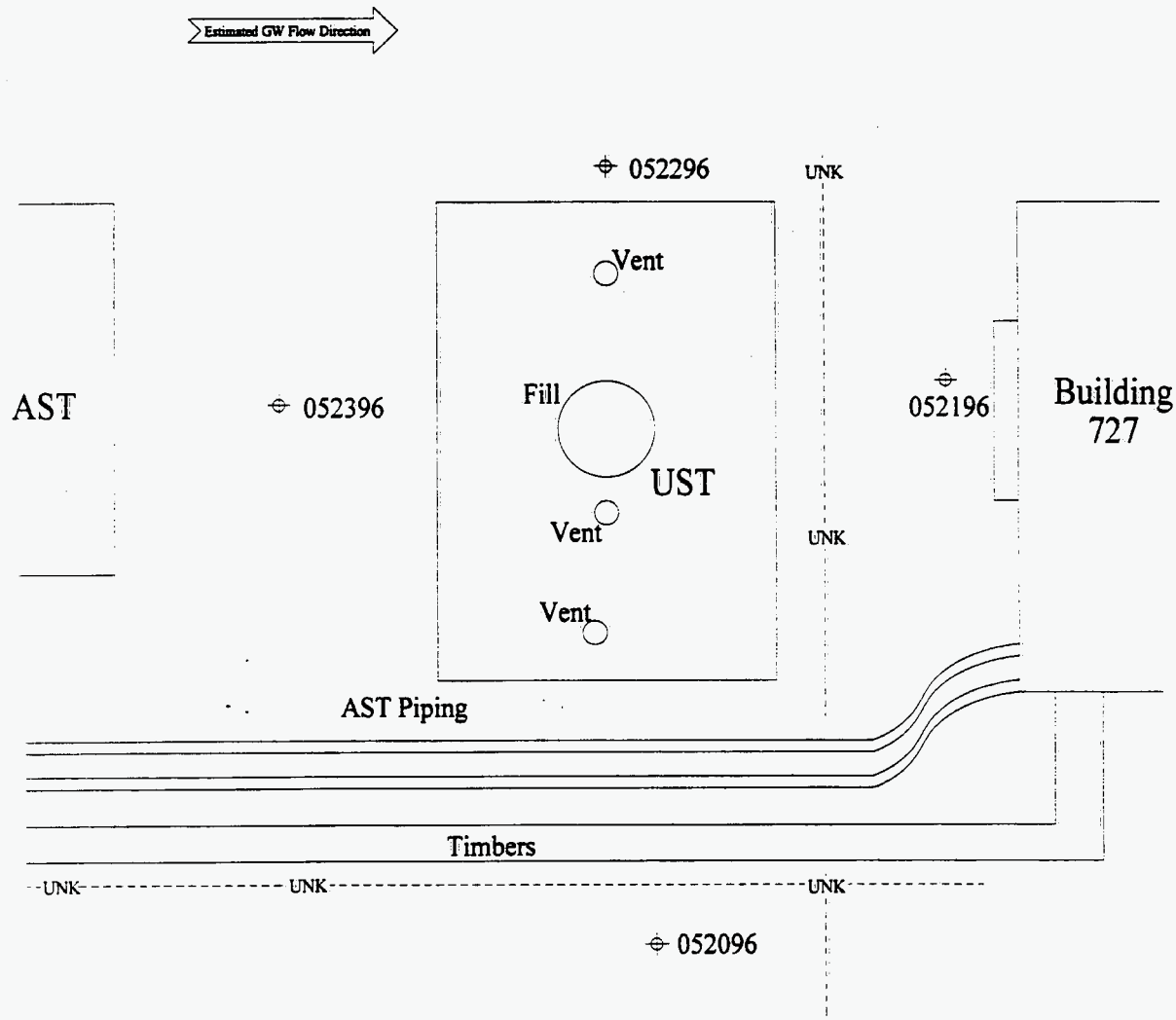
TANK 18 - BUILDING 727

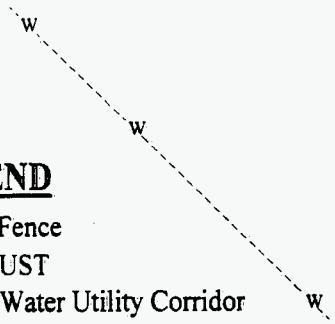
Summary of Tank 18 Assessment Data
Building 727

Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
SANDY GRAVEL: Light brown to light tan, with trace clay; loose; gravel angular; sand is medium- to fine-grained; damp to moist.	No readings above background levels	9	052096	N	N	8.5 -9.5	Less than 5,000
			052196	N	N	8.5 -9.5	Less than 5,000
			052296	N	N	8.5 -9.5	Less than 5,000
			052396	N	N	8.5 -9.5	Less than 5,000
			052096 Dup.	N	N	8.5 -9.5	Less than 5,000

Notes:
N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
Dup. *Duplicate quality control sample*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note:
See Summary Table of Tank Assessment Data
for information regarding boring placement.





LEGEND

- Fence
- UST
- Water Utility Corridor
- Unknown Utility Corridor
- GeoProbe Location

Not to scale

DRAWING COMMRM C:\Projects\19505901\1100\tank18.skd

TANK LOCATION

Tank #18
Building 727

Job No. 1/95-059-01.1100

TANK 19 - BUILDING 729

Summary of Tank 19 Assessment Data
Building 729

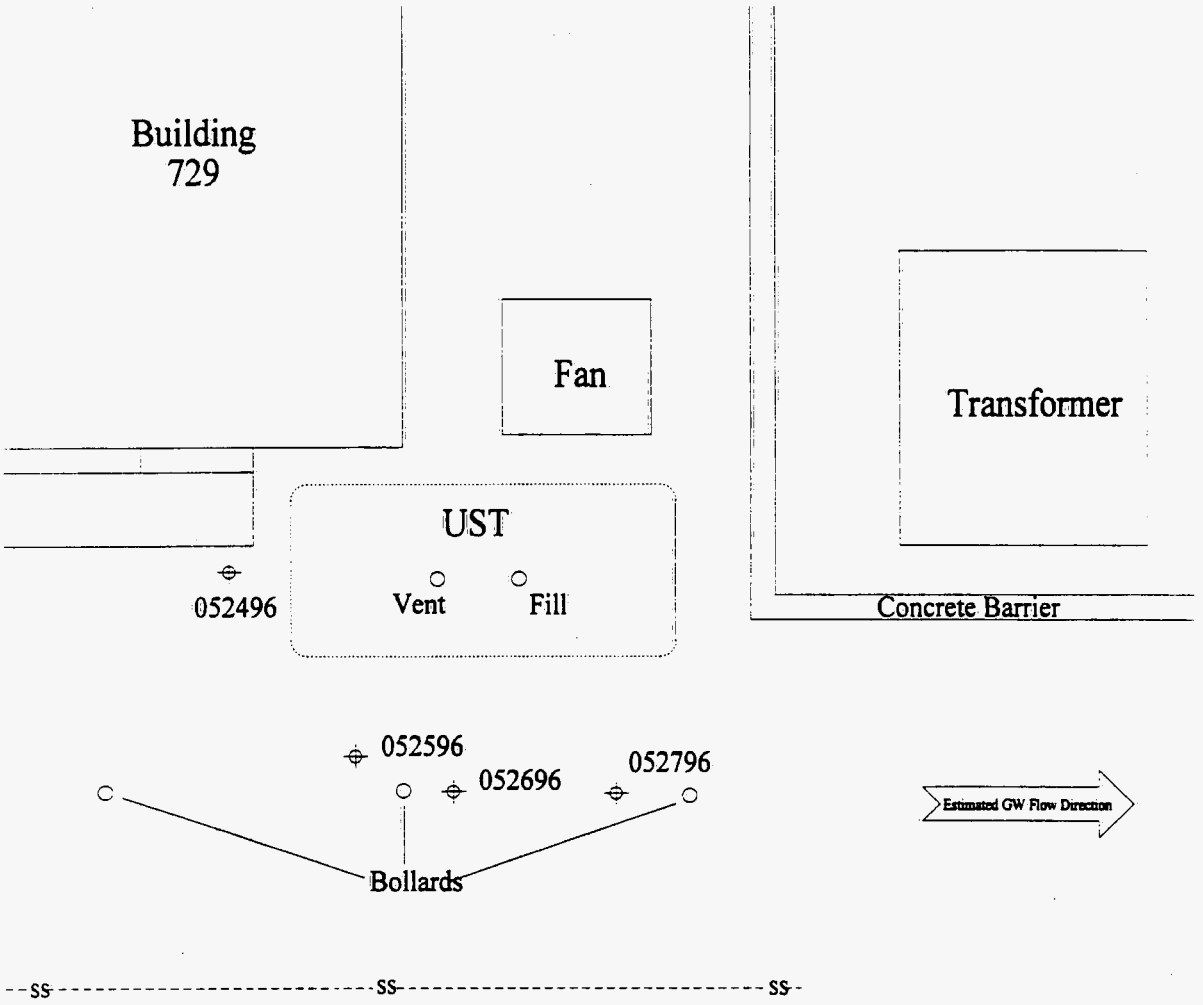
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
GRAVELY SAND: Light grey to medium brown, with some clay; sand is fine- to coarse-grained; poorly sorted; damp.	No readings above background levels	7	052496	N	N	6.5 - 7.0	Less than 5,000
			052596	N	N	6.5 - 7.0	Less than 5,000
			052696	N	N	6.5 - 7.0	Less than 5,000
			052796	N	N	6.5 - 7.0	Less than 5,000

Notes:

Four borings were placed on the south and west sides of the UST. No borings were placed on the north and east sides of the UST due to the proximity of surface structures, and the presence of underground utilities.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note:
See Summary Table of Tank Assessment Data
for information regarding boring placement.



LEGEND

- Fence
- UST
- SS Sanitary Sewer Utility Corridor
- GeoProbe Location

N

Not to scale

TANK LOCATION

Tank #19
Building 729

Job No. 1/95-059-01.1100

DRAWING COMMRM C:\Projects\19505901\1100\tank19.skd

TANK 21 - BUILDING 771

Summary of Tank 21 Assessment Data
Building 771

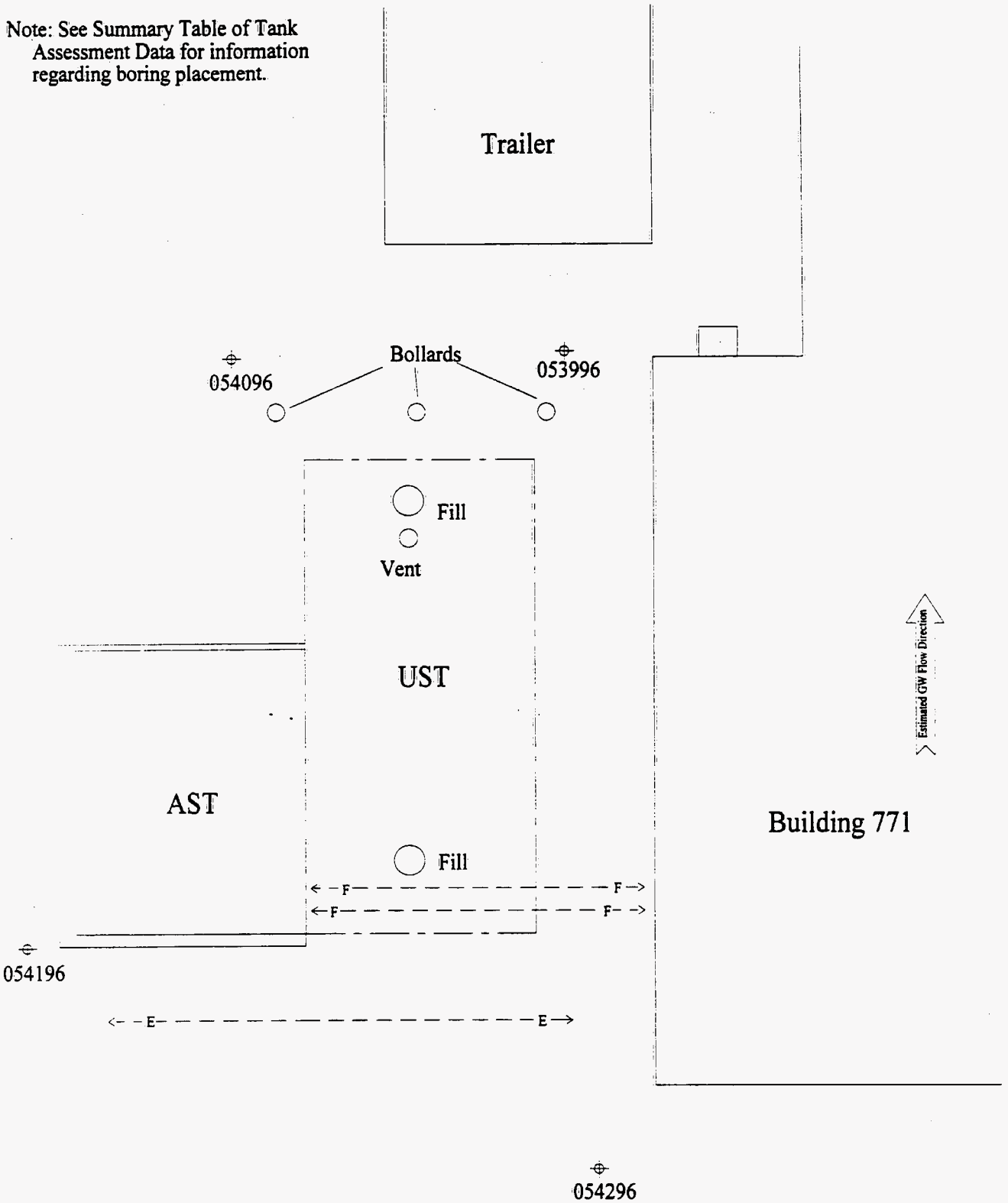
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
SILTY CLAY: Yellowish gray to brownish gray, loose to firm, low plasticity, damp to dry. No odors/stains	No readings above background	11	054096	N	N	11 - 11.5	Less than 5,000
			054196	N	N	11 - 11.5	Less than 5,000
			054296	N	N	11 - 11.5	Less than 5,000
			053996	N	N	11 - 11.5	Less than 5,000

Notes:

Four borings were drilled at the site; two east of the UST and two to the west. Borings could not be located to the north and south, due to the presence of utilities and other site access restrictions.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note: See Summary Table of Tank Assessment Data for information regarding boring placement.



LEGEND

- UST
- E Electric Utility Corridor
- F Fuel Utility Corridor
- GeoProbe Location

Not to scale

TANK LOCATION

Tank #21
Building 771

Job No. 1/95-059-01.1100

DRAWING COMMRM C:\Projects\19505901\1100\tank21.skd

TANK 23 - BUILDING 776

Summary of Tank 23 Assessment Data
Building 776

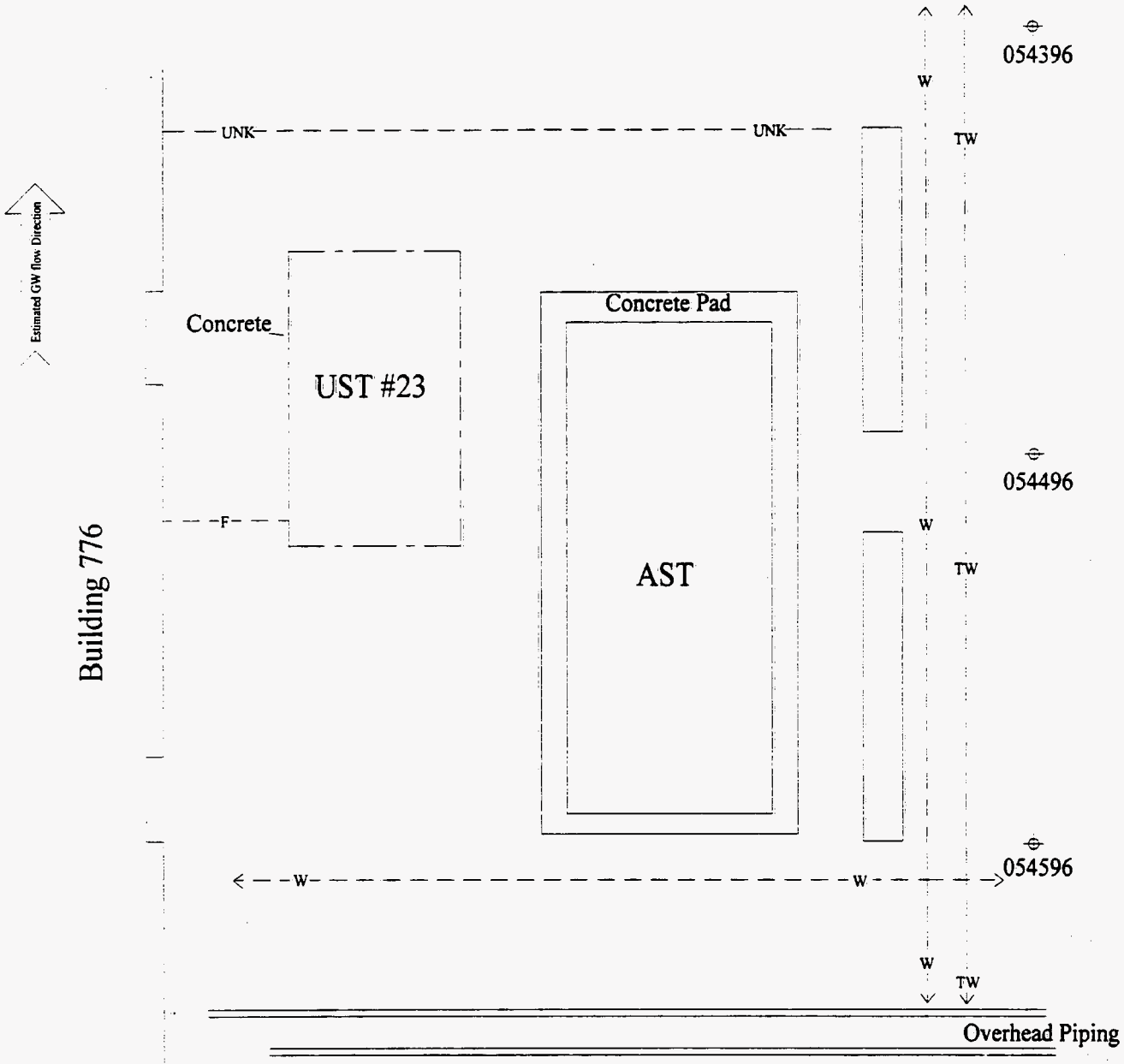
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
SILTY CLAY: Yellowish gray to brownish gray, loose to firm, low plasticity, damp to dry. No odors/stains	No readings above background	11	054396	N	N	11 - 11.5	Less than 5,000
			054496	N	N	11 - 11.5	Less than 5,000
			054596	N	N	11 - 11.5	Less than 5,000

Notes:

Three borings were drilled at the site, all on the south side of the UST. Borings could not be located to the north, east or west due to the presence of utilities and other site access restrictions.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note:
See Summary Table of Tank Assessment Data
for information regarding boring placement.



LEGEND

- UST
- W Water Utility Corridor
- TW Tower Water Utility Corridor
- F Fuel Utility Corridor
- UNK Unknown Utility Corridor
- GeoProbe Location

N

Not to scale

TANK LOCATION

Tank #23
Building 776

Job No. 1/95-059-01.1100

DRAWING COMMRM C:\Projects\19505901\1100\tank23.skd

TANK 24 - BUILDING 779

Summary of Tank 24 Assessment Data
Building 779

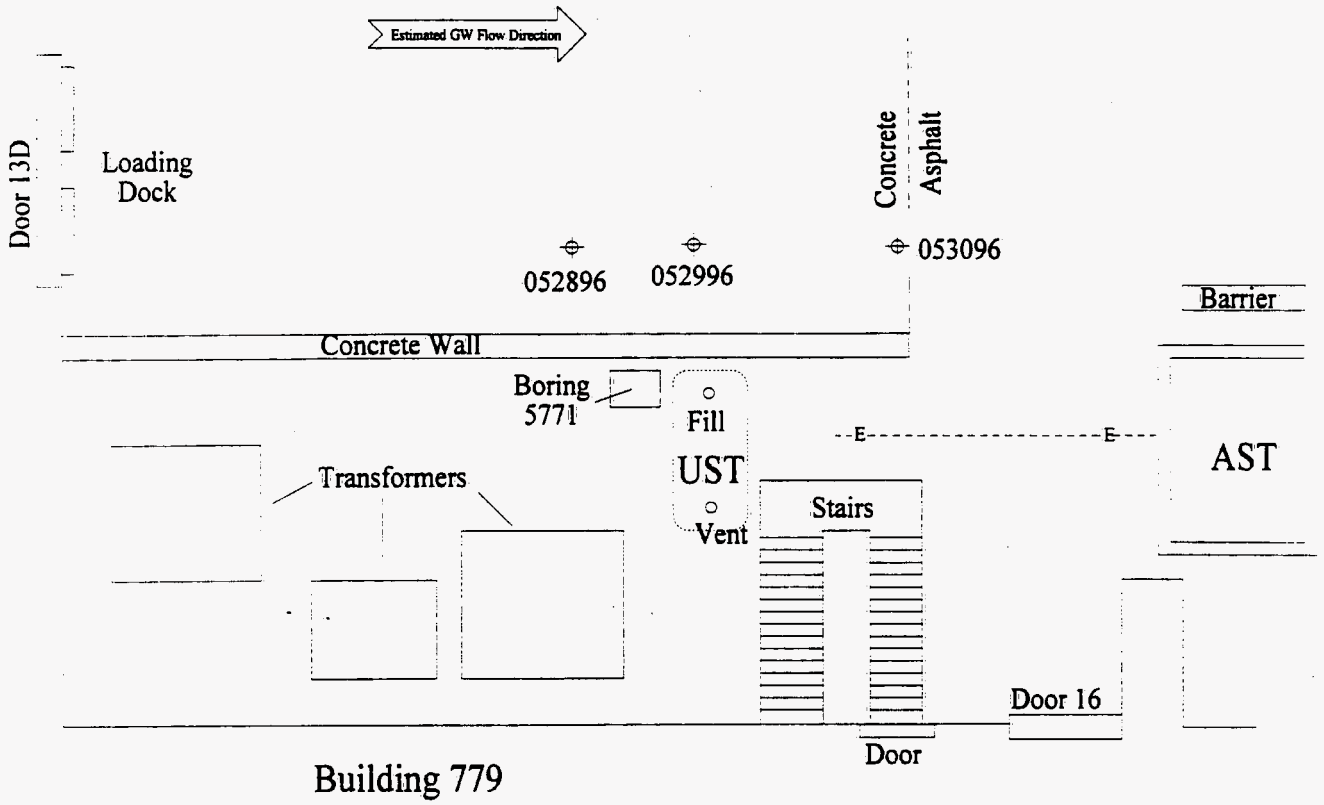
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
GRAVELY SILTY SAND: Light brown to tan, with trace clay; poorly sorted fine- to coarse-grained sand; damp to moist.	No readings above background levels	7	052896	N	N	5.0 - 6.0	Less than 5,000
			052996	N	N	5.0 - 6.0	Less than 5,000
			053096	N	N	5.0 - 6.0	Less than 5,000

Notes:

Three borings were placed on the north side of the UST in the driveway area of the building's loading dock. Surface structures (Building 779, transformers, and close proximity to the outside stairs) did not allow for the placement of a fourth boring, and impeded the placement of borings directly adjacent to the UST.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note:
See Summary Table of Tank Assessment Data
for information regarding boring placement.



LEGEND

- Fence
- UST
- Electric Utility Corridor
- GeoProbe Location

N

Not to scale

TANK LOCATION

Tank #24
Building 779

Job No. 1/95-059-01.1100

DRAWING COMMRM C:\Projects\19505901\1100\tank24.skd

TANK 25 - BUILDING 827

Summary of Tank 25 Assessment Data
Building 827

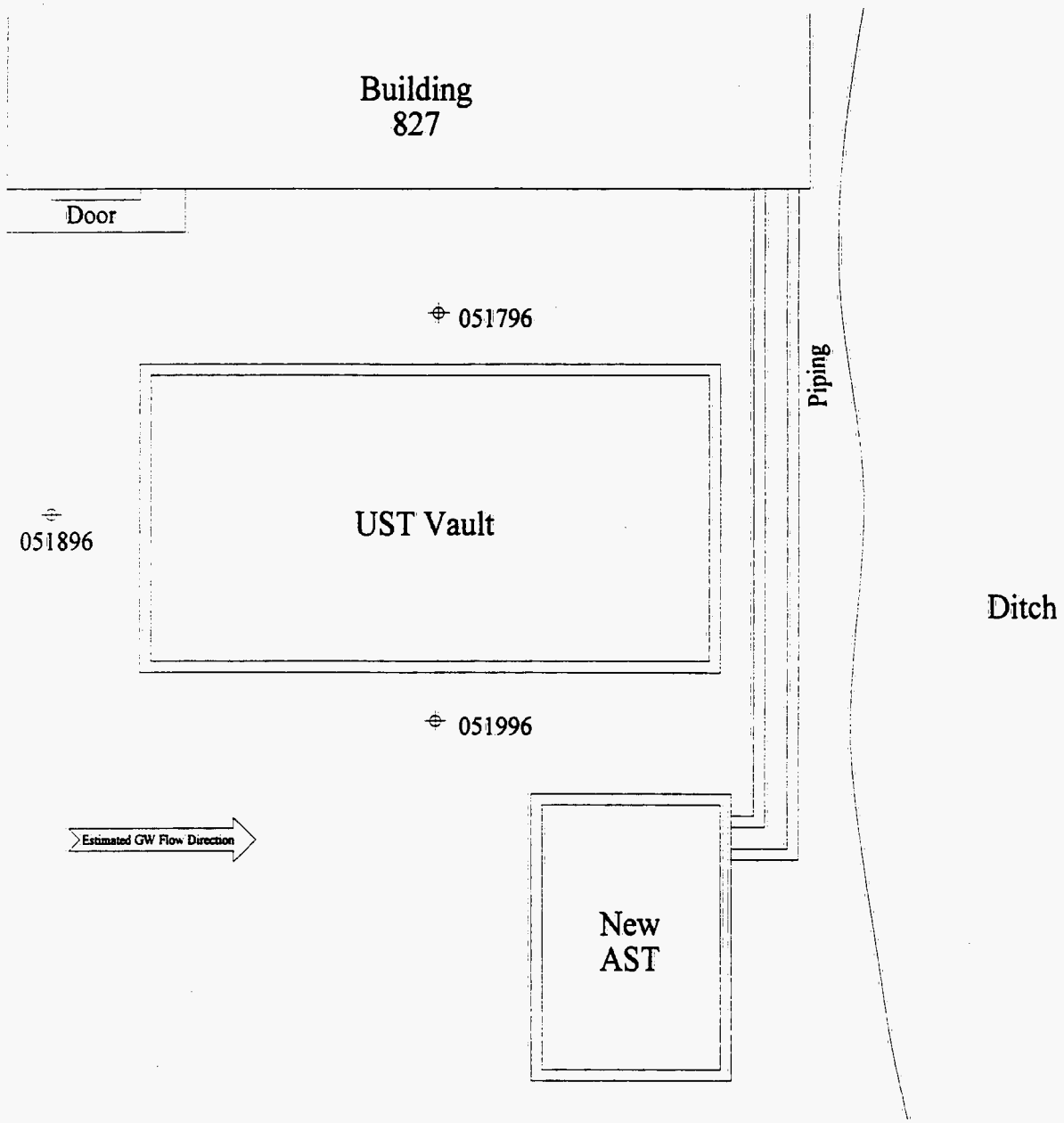
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
CLAYEY SAND TO SILTY SAND: Moderate brown, medium to coarse-grained sand with trace fine grained; clay matrix, stiff; non-plastic; damp.	No readings above background levels	9	051796	N	N	8.0 - 9.0	Less than 5,000
			051896	N	N	8.0 - 9.0	Less than 5,000
			051996	N	N	8.0 - 9.0	Less than 5,000

Notes:

Three borings were placed adjacent to the UST. The presence of a drainage ditch and AST piping located immediately adjacent to the east of the UST precluded the placement of a fourth boring.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note:
See Summary Table of Tank Assessment Data
for information regarding boring placement.



LEGEND

- Fence
- UST
- GeoProbe Location

N

Not to scale

TANK LOCATION

Tank #25
Building 827

Job No. 1/95-059-01.1100

DRAWING COMMRM C:\Projects\19505901\1100\tank25.skd

TANK 32 - BUILDING 920

Summary of Tank 32 Assessment Data
Building 920

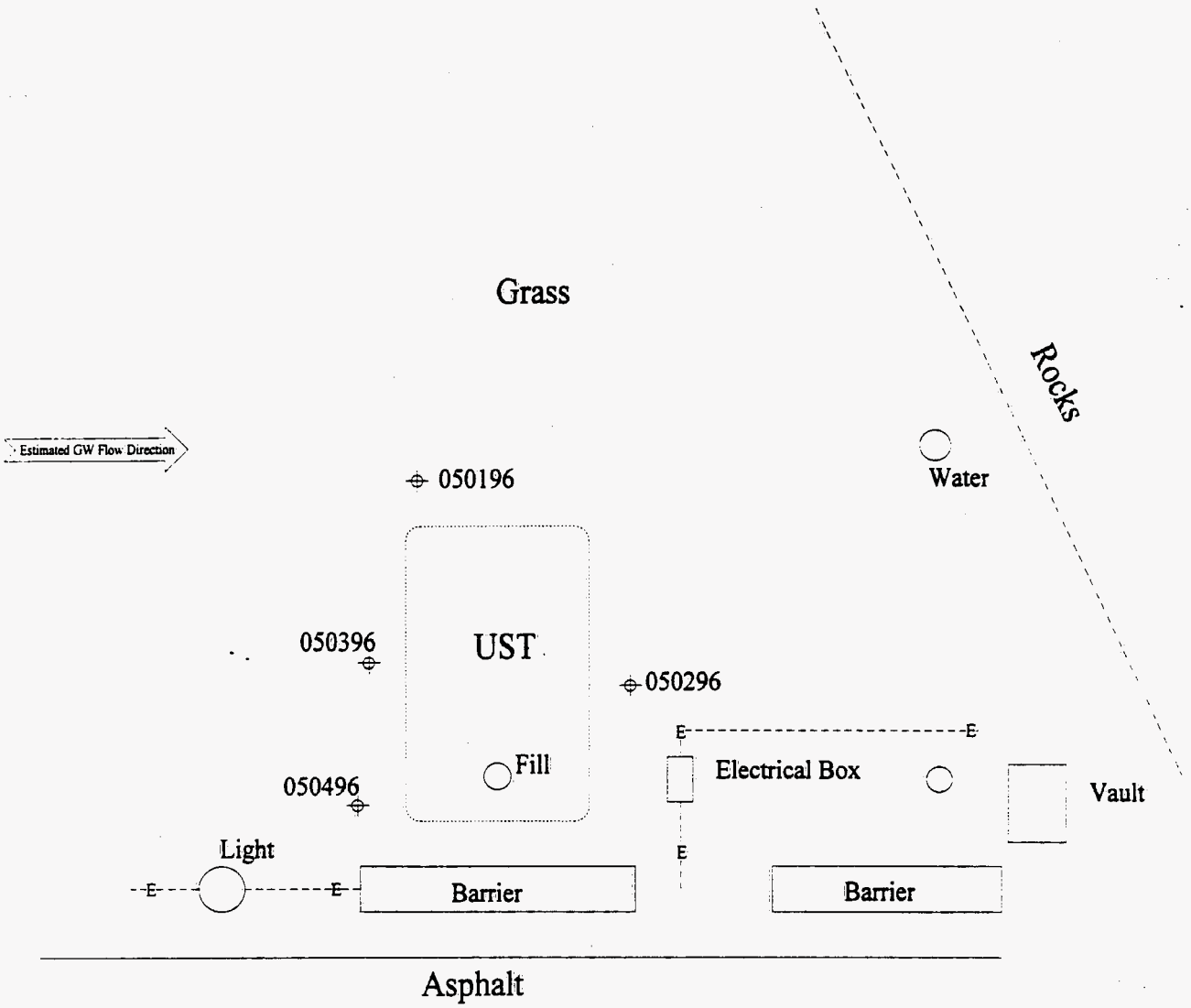
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
GRAVELY CLAY: Moderate brown; loose to firm; medium- to coarse-grained sand; sand matrix loose, dam to moist. No odors or stains.	No readings above background levels	7	050196	N	N	2.5 - 3.0	Less than 5,000
			050296	N	N	2.5 - 3.0	Less than 5,000
			050396	N	N	2.5 - 3.0	Less than 5,000
			050496	N	N	2.5 - 3.0	Less than 5,000

Notes:

Four borings were placed adjacent to the UST. The presence of a surface structures, accompanied by underground utilities, precluded the placement of a boring immediately to the south of the UST.

N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note:
See Summary Table of Tank Assessment Data
for information regarding boring placement.



LEGEND

- Fence
- UST
- Electric Utility Corridor
- GeoProbe Location

N

Not to scale

TANK LOCATION

Tank #32
Building 920

Job No. 1/95-059-01.1100

DRAWING COMMRM C:\Projects\19505901\1100\tank32.skd

TANK 33 - BUILDING 989

Summary of Tank 33 Assessment Data
Building 989

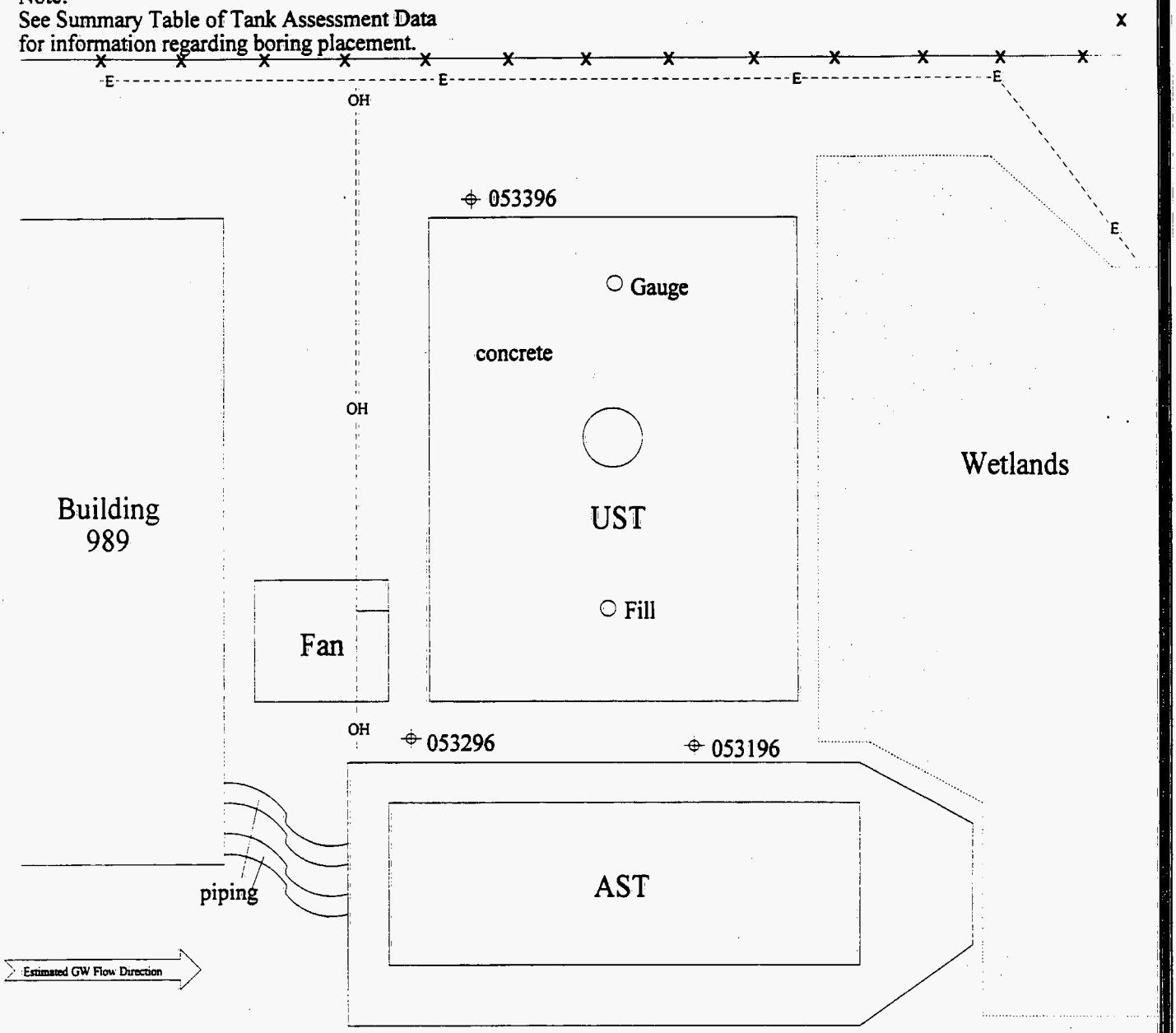
Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
SANDY GRAVEL: Light to dark brown; loose, fine gravel; subrounded; medium- to fine-grained poorly sorted sand; wet at five feet. Slight diesel odor.	0 - 8	9	053196	N	Y - 4.5 ft	4.0 - 5.0	Less than 5,000
			053296	Y[2]	Y - 4.5 ft	4.0 - 5.0	Less than 5,000
			053396	N	Y - 4.5 ft	4.0 - 5.0	Less than 5,000
			053396 Dup.	N	Y - 4.5 ft	4.0 - 5.0	Less than 5,000
			050296 GW	Y[2]	NA	NA	Less than 5,000

Notes:

Three borings were placed to the north and south of the UST. A wetland area located to the east of the UST would not allow the placement of a boring east of the UST. Surface structures and underground utilities would not allow for the placement of borings immediately to the west of the UST.

N *No*
Y *Yes*
NA *Not Applicable*
PID *Photoionization Detector - readings in parts per million (ppm) - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*
2 *No staining observed; slight diesel odor present in all samples.*
Dup. *Duplicate quality control sample*
GW *Groundwater sample*

Note:
See Summary Table of Tank Assessment Data
for information regarding boring placement.



LEGEND

- Wetlands Area
- Fence
- UST
- Electric Utility Corridor
- Overhead Utility Corridor
- GeoProbe Location

N

Not to scale

TANK LOCATION

Tank #33
Building 989

Job No. 1/95-059-01.1100

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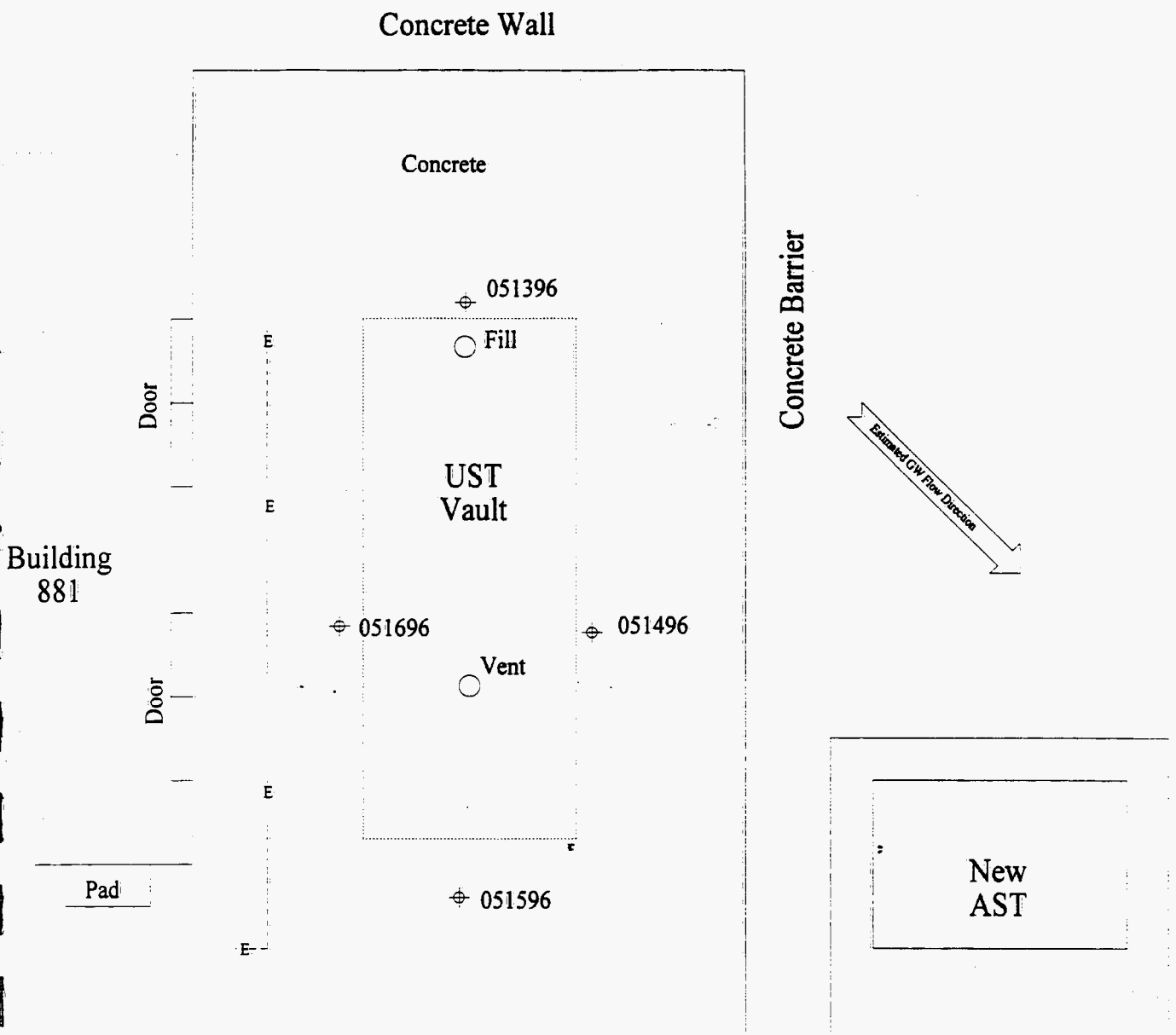
TANK 66 - BUILDING 881

Summary of Tank 66 Assessment Data
Building 881

Geology of Site	PID Results	Depth to Bottom of Tank (ft)[1]	Summary of Results				
			Sample No.	Staining/Odor	Groundwater Encountered	Depth of Soil Sample (feet)[1]	TPH Result (mg/kg)
GRAVELLY CLAY TO SANDY GRAVEL: Light brown to dark brown; loose, with very large gravel; granitic in nature; non-plastic overall; dry to damp. No odors or stains.	No readings above background levels	11	051396	N	N	9.0 - 10.0	Less than 5,000
			051496	N	N	9.0 - 10.0	Less than 5,000
			051596	N	N	9.0 - 10.0	Less than 5,000
			051696	N	N	9.0 - 10.0	Less than 5,000

Notes:
N *No*
PID *Photoionization Detector - readings in parts per million (ppm)*
TPH *Total Petroleum Hydrocarbons - concentrations in milligrams per kilogram (mg/kg)*
1 *Depth in feet below ground surface*

Note: See Summary Table of Tank Assessment Data for information regarding boring placement.



LEGEND

- Fence
- UST
- Electric Utility Corridor
- Geoprobe Location

N

Not to scale

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TANK LOCATION

Tank #66
Building 881

Job No. 1/95-059-01.1100

WINDSITE PLAN

SCALE 1"=400'-0"

EAST GATE PI

SCALE 1"=300'-0"

WEST GATE AND BUILDING 060

SCALE 1"=300'-0"

LEGEND

PAVED ROAD
DIRT ROAD
DRIVEWAY
RAILROAD
FENCE
BUILDING OR STRUCTURE
UNDERGROUND STRUCTURE
GRID STRUCTURE
HELIPORT

PLANT SITE PLAN

SCALE 1"=300'-0"

COORDINATES SHOWN ARE BASED ON ROCKY FLATS PLANT GRID COORDINATE SYSTEM

WESTON
MANAGERS DESIGNERS/CONSULTANTS

215 Union Boulevard
Suite 600
Lakewood, CO 80228
(303) 980-6800

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

FIGURE 2-1

UST LOCATION MAP

B11X1781