AN INVESTIGATION OF GROUNDWATER CONTAMINATION FROM AN ONSITE SEWAGE DISPOSAL SYSTEM (OSDS) AT A SINGLE FAMILY HOME IN FLORIDA

Phase 3 Status Report

Prepared for:

THE SOAP AND DETERGENT ASSOCIATION
475 Park Avenue South
New York, New York 10016

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Tampa, Florida 33619

Ayres Associates JN: 4415.10

April, 1994

AYRES ASSOCIATES

APPENDIX A

Septic Tank Effluent (STE) Analytical Results

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I. INTRODUCTION

The Soap and Detergent Association (SDA) retained Ayres Associates to investigate the occurrence of certain chemical constituents in groundwater below and downgradient of Onsite Sewage Disposal Systems (OSDS) in Florida. The purpose of the investigation was to define the contaminant plume of such a system and then to determine if key constituents of certain household cleaning products are present in the plume and if they are present, to what extent. This report summarizes work completed during preliminary phases (Phase I and Phase II) of the investigation including determination of the preliminary contaminant plume and describes work conducted during the subsequent Phase III portion of the project.

1.1 Background

Ayres Associates conducted a study of the impacts of OSDS on groundwater quality as part of the Florida Onsite Sewage Disposal System Research Project from 1987 to 1990. An individual home in St. Johns County was chosen from this prior study by the SDA Committee as a potential site for further investigation of groundwater quality impacts. The investigation specifically focused on determining the plume of impacted groundwater and subsequent evaluation of groundwater samples for key parameters of interest to SDA.

The preliminary phase of this project (Phase I) was completed in March, 1991. The objective of the first phase of the project was to attempt to delineate the effluent plume with conservative parameters such as chloride, conductivity, or nitrate-nitrogen. Once the effluent plume was delineated, a plan was to be developed for further investigation that incorporated additional parameters.

Household water use was metered to estimate wastewater loading to the OSDS drainfield and samples of septic tank effluent (STE) were obtained to characterize the quality of the wastewater discharged to the OSDS infiltration system. Three groundwater piezometers were installed to determine groundwater flow direction. A stainless steel probe system, originally designed for soil gas monitoring in the unsaturated zone, was used to obtain groundwater samples without the time and expense of installing permanent groundwater monitoring wells. Forty-seven groundwater samples were collected and analyzed in the field for chloride, nitrate-nitrogen, and conductivity. Four groundwater monitoring wells were installed and groundwater samples for various water quality parameters were obtained to compare with the results of groundwater samples obtained with the stainless steel probe.

The results of the Phase I investigation indicated:

1) Groundwater flow direction was south-southwest.

2) Wastewater flow was estimated to be 168 gpd.

3) Surfactant concentrations in septic tank effluent, as measured by methylene blue active substance (MBAS), were two to three times higher than those measured previously and significantly higher than any household samples collected as part of the Florida OSDS Research Project. Additional sampling of STE was recommended to determine the accuracy of the MBAS sampling and analysis.

4) The field analyses of conservative groundwater quality parameters indicated two areas of potential impact. One area was upgradient (east) of the infiltration system and one area was downgradient (southwest). The cause of the impacted area east of the system was not determined. Effluent impact on groundwater in the area downgradient of the OSDS did not extend further than approximately 10 to 15 feet from the system. This finding indicated that there was either an extremely slow rate of horizontal groundwater movement, which was contradictory to those groundwater velocities calculated during the previous OSDS study, or that vertical movement of groundwater may have carried contaminants to a deeper level.

Based on these results, further work was recommended including: The collection of additional water use data and STE quality data; the installation of nested sets of shallow and deep groundwater monitoring wells, and; the installation of a more permanent downgradient miniature monitoring well network, collection and laboratory analysis of groundwater samples from the miniature wells, and the preparation of a data summary report. The SDA contracted Ayres Associates to conduct the additional work in May, 1992. The work was completed in January, 1993. Results of the Phase II investigation include:

1) Average concentrations of several STE parameters increased over the concentrations found in the previous Florida OSDS Research study and the concentrations appeared to have increased over time; particularly between 1992 and 1993. The average concentration of MBAS was six times the average of the previous study and average values for total kjeldahl nitrogen (TKN) and chloride were approximately twice those of the previous study.

2) The total nitrogen average in STE for this study (75.5 mg/L) was higher than the normal range of values for total nitrogen in STE found in the literature. Literature values for total nitrogen in STE range from 29.8 to 60.8 mg/L (Stolt and Reneau, 1991, and Ayres Associates, 1989).

3) The average daily wastewater flow was estimated to be 186 gpd and the estimated wastewater loading to the infiltration area was 0.89 gpd/ft^2.

4) The surficial groundwater flow direction was south-southwest at a gradient of 0.0027 feet/foot. Depth to groundwater at the site during this study ranged from approximately 1.5 to 5 feet below ground surface (bgs). Depth to groundwater in November, 1990 ranged from 5 to 6 feet bgs.

5) At the time of the highest measured groundwater levels (January 12, 1993) the thickness of unsaturated soil below the OSDS infiltration system was only 0.34 feet.

6) With the exception of the southeast corner of the property, the groundwater flow appears to have a very low vertical component. The vertical gradient at the nested set of monitoring wells in the southeast corner of the site is approximately the same as the horizontal groundwater gradient which indicates that groundwater in this area may move downward as it moves downgradient of the site.

7) Grainsize analyses of soil samples obtained from boreholes at the site indicated that the soils were primarily composed of fine sand.

8) The contaminant plume appears to have increased in horizontal extent since the last sampling event approximately two years ago and the total horizontal extent had not yet been defined. Concentrations of parameters indicative of STE were elevated above background levels in groundwater obtained from the 6 foot depth approximately 25 feet downgradient of the OSDS.

9) With the exception of nitrate-nitrogen, no evidence was observed that parameters characteristic of effluent had migrated below 12 feet bgs.

10) The higher groundwater surface and the partial failure of the OSDS may have led to anoxic conditions beneath the infiltration area which, in turn, led to reduced nitrification at the site. As a result, ammonia nitrogen concentrations are elevated while nitrate-nitrogen concentrations are low. The concentrations of MBAS in groundwater downgradient of the system also suggested an anoxic environment. The higher groundwater table also appears to have reduced adsorption of phosphorus. Phosphorus concentrations in groundwater closest to the infiltration area were similar to the total phosphorus concentration of the STE.

Based on the results of the Phase II investigation Ayres Associates recommended further work including: Continued monitoring of wastewater flow and composition; continued monitoring of water table elevations; the installation of additional wellpoints for collection and laboratory analysis of groundwater, and; aquifer testing.

1.2 Objectives

The objectives of the third phase of the SDA project were to further delineate the contaminant plume at the OSDS of a single family home in St. Johns County, Florida and continue to evaluate the fate and transport of key water quality parameters of interest to the SDA.

1.3 Scope of Work

In order to accomplish these objectives, Ayres Associates proposed the following scope of work:

- Continue monitoring household wastewater quantity and quality to establish a history of estimated flows and loading to the infiltration system. Obtain daily grab samples for one week to determine the variability of STE parameters.

- Continue to monitor groundwater elevations to develop a history of water levels and flow direction. Conduct a bromide tracer test to more accurately determine groundwater flow direction and travel time. Results obtained from the bromide tracer test will be used to calculate hydraulic conductivity; particularly in the area of the infiltration system.

- Determine horizontal and vertical extent of various effluent parameters, including MBAS, to groundwater under "worst case" (shallow groundwater table) and "best case" (deep groundwater table) conditions.

- Prepare a brief status report describing results of the study.

II. SITE CHARACTERISTICS

2.1 Residence Characteristics

The residence depicted in this investigation is located in St. Johns County, Florida, south of the city of Jacksonville. The home is in a 200 unit subdivision located approximately one-half mile east of the St. Johns River. A general location map of the site is shown in Figure 2-1.

The residence has three bedrooms and two bathrooms and was constructed in 1976. It is served by an OSDS consisting of a 900 gallon septic tank and a 210 ft^2 infiltration system composed of three, 2-foot wide gravel-filled trenches. Further characteristics of the study residence are listed in Table 2.1. A plan view of the home's OSDS and backyard are shown in Figure 2-2.

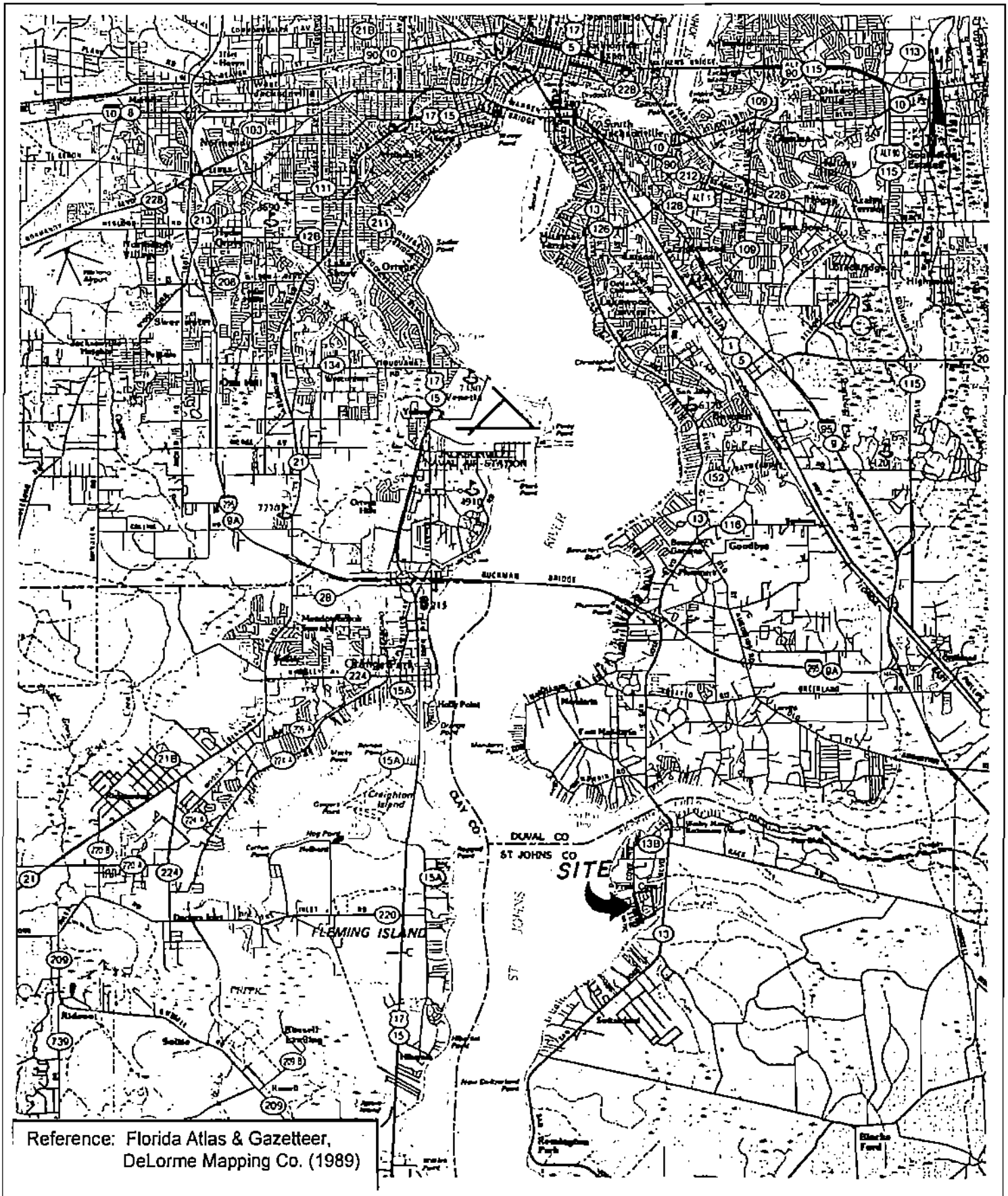
Table 2.1. Characteristics of Individual Monitoring Site[1].

Number of Residents	4
Adults	2
Children	2 (ages 7 and 11)
Lot Size	0.47 acres
Age of Home	17 years
Occupancy	11 years
Number of Bedrooms	3
Number of Bathrooms	2
Dishwasher	Yes
Clothes Washer	Yes
Garbage Disposal	No
Water Softener	No
Septic Tank	900 gallon
Date Last Pumped	August 1988
Infiltration System Area	210 ft^2
Infiltration System Type	2-foot wide, gravel-filled trenches
Effluent Distribution	Gravity flow, 4" perforated pipe

[1] Based on information obtained as of 1993.

2.2 Physiography and Climate

The site is located in the physiographic province referred to as the Coastal Lowlands. The topography of the lowlands is controlled by a series of marine terraces which were formed during Pleistocene time. Elevations at the site range from 10 to 15 feet above mean sea level (MSL). Surface drainage in the area is primarily through the St. Johns River and its tributaries. The majority of surface runoff at the site is directed south-



SCALE: 1:150,000	REVISED:	SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT	FIGURE:
AYRES ASSOCIATES	DRAWN BY: MW DATE: 4/94	GENERAL LOCATION MAP	2.1
	CHECKED BY: DATE:	St. Johns County Subdivision	
	APPROVED BY: DATE:	Fruit Cove, St. Johns County, Florida	

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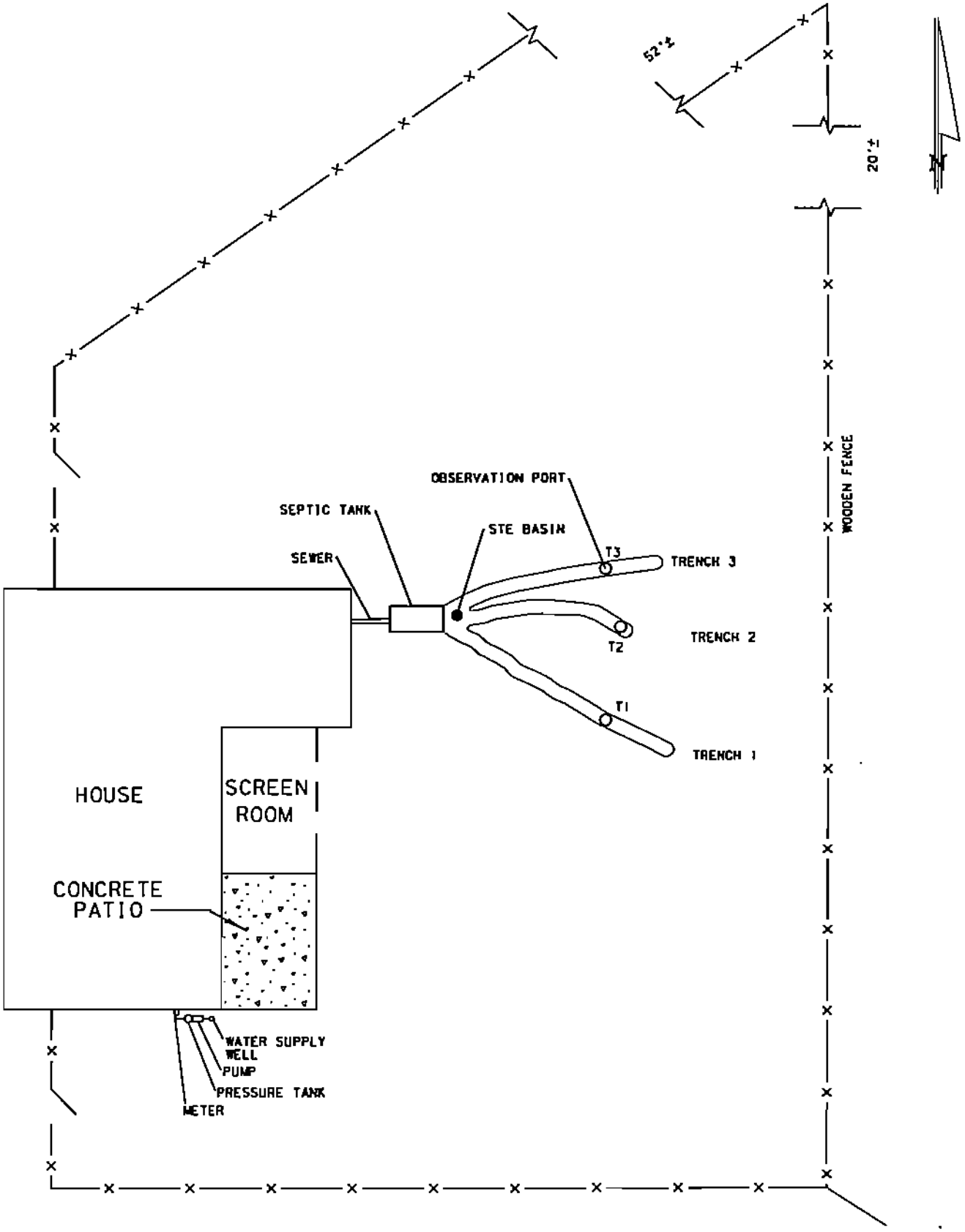

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SCALE: 1"=20'	REVISED:		SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT	FIGURE:
AYRES ASSOCIATES	DRAWN BY: MW	DATE: 4/94	SITE PLAN	2-2
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	APPROVED BY:	DATE:		

southeast towards a local topographic depression. Drainage ultimately enters the St. Johns River via a creek south of the site. The St. Johns River generally flows northward towards Jacksonville where it turns sharply eastward and empties into the Atlantic Ocean.

The climate of St. Johns County is subtropical and is characterized by warm, humid summers and mild, dry winters with occasional frost between November and February. Annual average rainfall is approximately 54 inches. Rainfall is seasonal with the majority falling during the months of June through September. During these months, the rain usually falls from localized heavy showers of short duration.

2.3 Regional Geology and Hydrogeology

St. Johns County is underlain by two major geologic units of differing lithologies. The uppermost unit consists of clastic sediments including poorly to moderately consolidated sand, clay, and shell material of Miocene to Holocene age. This overlies a thick sequence of limestone and dolomite, commonly referred to as the Floridan aquifer (Parker et. al, 1955). The top of the limestone of the Floridan aquifer is typically encountered at approximately 400 feet below MSL in this area.

The Floridan aquifer is the principal source of potable water in the area although potable water is also withdrawn from the surficial and the intermediate aquifers. The homes in the study area utilize private wells which are typically installed in the surficial aquifer at depths of 75 to 100 feet.

2.4 Soils

Soils throughout the subdivision were derived from sandy marine sediments. The morphology of the subdivision soils are, therefore, dominated by sandy profile descriptions.

According to the USDA Soil Conservation Service (SCS) publication "Soil Survey of St. Johns County" the site is located on Adamsville fine sand. The Adamsville series is a somewhat poorly drained soil with a rapid profile permeability. The water table is typically at 20 to 40 inches below grade for approximately two to six months of the year and below 40 inches for the rest of the year. The typical Adamsville profile has a fine sand texture throughout. Limitations for conventional septic system drainfields are classified as severe with the limitations due to wetness and poor filtration.

2.5 Site Specific Lithology

Subsurface characteristics of the site were determined from the installation of exploratory soil borings to a depth of 50 feet below ground surface (bgs) and by taking representative soil samples for particle size analysis. The site's subsurface lithology consisted of approximately four units with observed differences in lithology based primarily on changes in color because the texture remained fine-grained throughout.

The units and depths that were encountered are as follows: 1) very dark to dark gray fine-grained quartz sand with roots typical of topsoil, approximately 0 to 4 feet bgs; 2) a light gray to white fine grained quartz sand with some gray streaks of clay, approximately 4 to 20 feet bgs; 3) light gray to light brownish gray fine-grained quartz sand, approximately 20 to 30 feet bgs; and 4) dark gray to gray fine-grained quartz sand approximately 30 to 50 feet bgs.

Particle size analysis data indicate that approximately 85% to 97% by weight of the soil samples obtained were composed of fine sand. The percentage of fines (silts and clays) in the samples ranged from 0.9% to 6.0% . The samples obtained from the top few feet of sediment contained more fines than samples obtained at deeper intervals. Percentages of medium sand were generally less than 5% with the exception of soil samples obtained at approximately 27 to 32 feet bgs which contained approximately 10% medium sand.

III. METHODS OF INVESTIGATION

3.1 Septic Tank Effluent (STE) Characterization

STE Quality: Effluent from the septic tank at the site was collected and analyzed for most typical STE parameters on four to five occasions prior to the initiation of this study as part of the Florida OSDS Research Project (Ayres Associates, 1989). Septic tank effluent was collected and analyzed on three occasions (November 15, 1990, November 5, 1991, and January 7, 1993) during the Phase II SDA research effort. For the Phase III investigation, septic tank effluent samples were obtained continuously for seven days the week of August 15, 1993. One additional STE sample was obtained on November 3, 1993. All samples of STE were obtained from a septic tank effluent basin that was installed between the septic tank and the infiltration system. The more recent wastewater quality data were then compared with prior results and with literature values for STE quality.

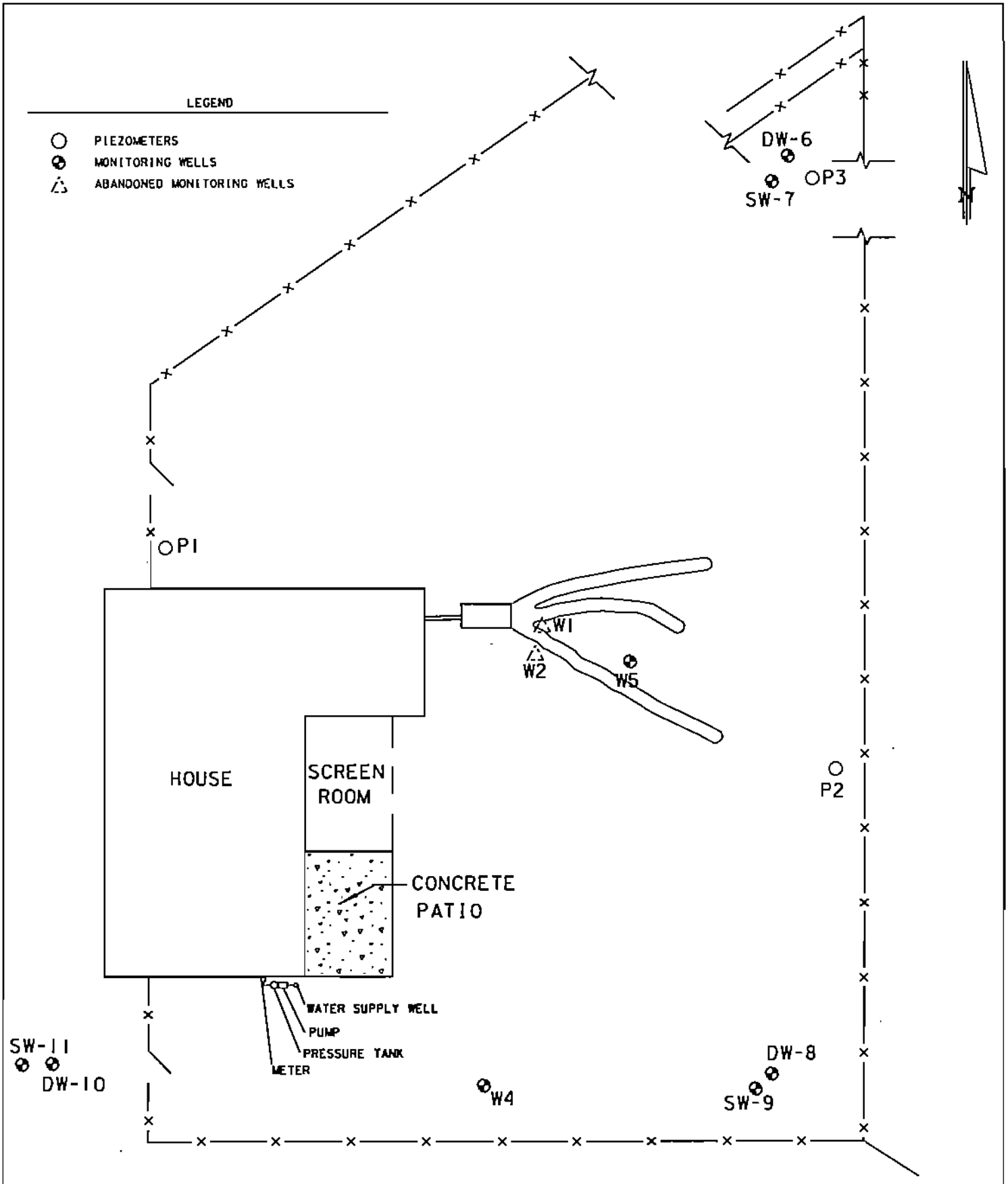
A homeowner's survey was also conducted immediately prior to the initiation of the Phase III study sampling period to determine types of cleaning products used in the home, thereby determining the types of surfactants that could potentially affect groundwater quality in the area.

STE Quantity: Wastewater flow at the home was estimated by reading water meters over several intervals during the study. The water meters were installed at several points on the household water system. A master meter was installed on the main supply line from the household well which monitored total water use. Individual meters were then installed on the exterior hose bibs to monitor outdoor water use. The home did not have an in-ground lawn sprinkler system. The home used a water to air heat pump system for household heating so an additional meter was installed on the downstream side of the heat pump to monitor its water use. Water from the air heat pump system discharged to the ground outside the house. The household's resident informed Ayres Associates in August of 1993, that he had stopped using the heat pump. By subtracting exterior water use from total water use, an estimate of interior water use could be obtained and used to derive wastewater loading to the OSDS. Meter readings were also recorded immediately prior to and after the installation of monitoring wells and groundwater sampling because large quantities of outside water were used during these periods. Water used during monitoring well installation and sampling was then subtracted from the total water usage.

3.2 Groundwater Monitoring Equipment Installation

Three types of groundwater monitoring equipment including piezometers, groundwater monitoring wells, and a direct-push miniature wellpoint probe were used at the site.

Piezometers: Three groundwater piezometers were installed at locations around the OSDS. Piezometer locations are shown on Figure 3-1 as P1, P2, and P3. Piezometers were constructed by coupling a 2-inch diameter, 0.010 inch slotted, three



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SCALE: SCALE: 1"=20'	REVISED:		SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT MONITORING WELL AND PIEZOMETER LOCATION MAP	FIGURE: 3-1
AYRES ASSOCIATES	DRAWN BY: MW	DATE: 4/94		
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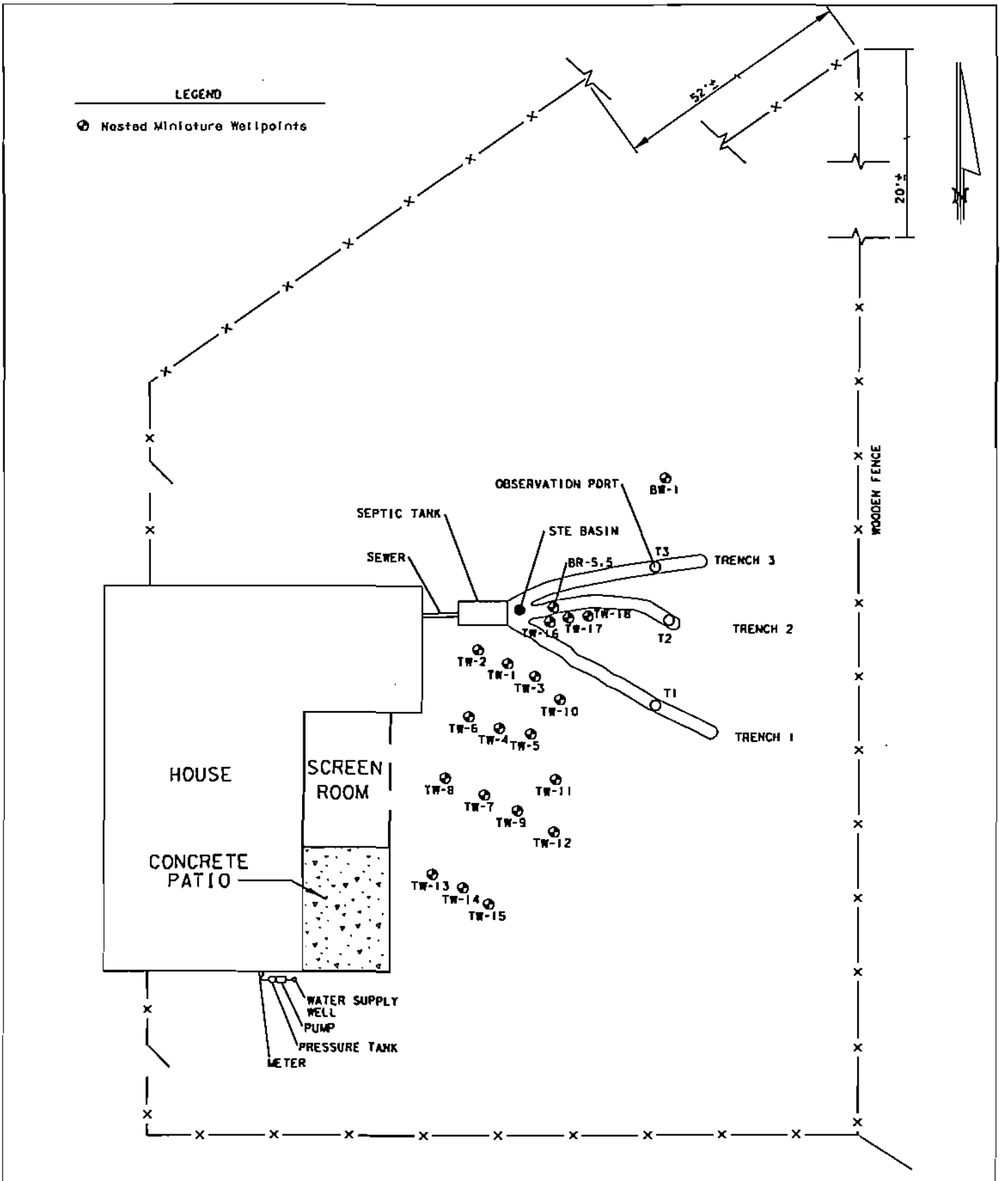
	APPROVED BY:	DATE:		



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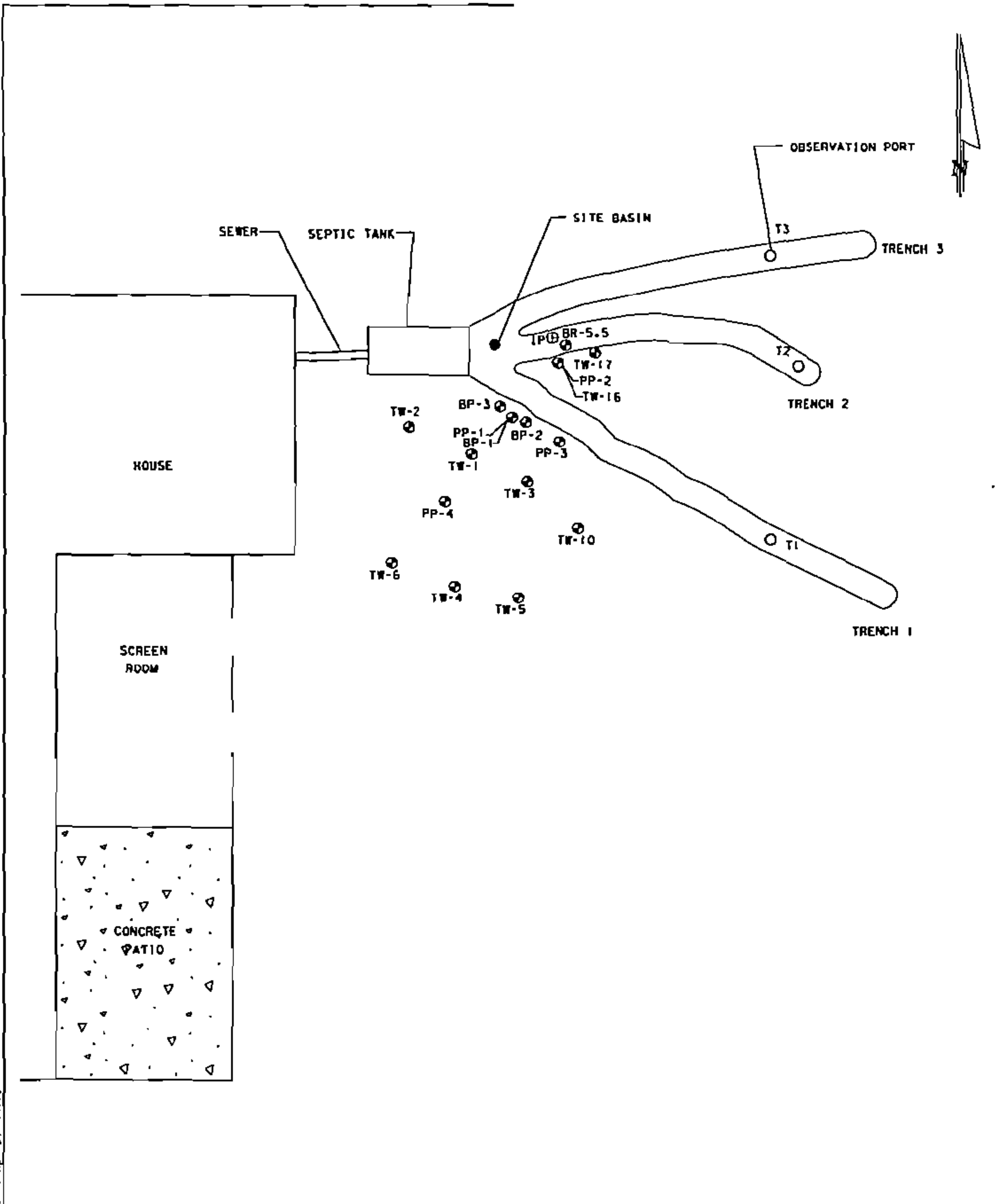
SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT

MINIATURE WELL SAMPLE POINT LOCATION MAP

FIGURE: 3-2 .



SCALE: 1"=10'	REVISED		SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT	FIGURE:
AYRES ASSOCIATES	DRAWN BY: M.W.	DATE: 4/94	BROMIDE TRACER SAMPLE WELL POINT LOCATION MAP	3-3
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foot long Schedule 40 PVC well screen to approximately 10 feet of blank 2-inch diameter, Schedule 40 PVC pipe. The piezometers were installed in native soil to a depth of approximately one to two feet below the water table surface using a stainless steel hand auger. The piezometers were used to determine groundwater elevations and to estimate the direction of groundwater flow.

Monitoring Wells: Four groundwater monitoring wells were installed near the subsurface infiltration system on January 28, 1990. Monitoring well locations are shown on Figure 3-1 as W1, W2, W4, and W5. These monitoring wells were constructed of five feet of 2-inch diameter, 0.010 inch slotted Schedule 40 PVC well screen coupled to approximately seven feet of blank Schedule 40 PVC pipe. Monitoring wells were installed by hand augering with a stainless steel barrel auger to the water table, then augering through 4-inch diameter casing which was advanced with the auger to three to four feet below the water table. The 2-inch diameter PVC monitoring wells were then installed inside the 4-inch diameter casing. A clean, graded sand pack was placed around the monitoring well and the 4-inch casing was removed leaving the sand packed monitoring well in place. The monitoring wells were developed by pumping them at four to five gallons per minute for five minutes after installation.

Additional groundwater monitoring wells were installed on November 23 and 24, 1992. Nested sets, of monitoring wells, (i.e., one shallow monitoring well and one deep monitoring well installed adjacent to each other) were installed at three locations onsite to determine the vertical hydraulic gradient. Monitoring well locations are shown on Figure 3-1 and are identified as DW-6, SW-7, DW-8, SW-9, DW-10, and SW-11.

Groundwater Protection, Inc. installed the monitoring wells using 8.25 inch outside diameter (OD) hollow stem augers. During the installation of monitoring well DW-6, soil samples were collected at two foot intervals using a split spoon sampler. Standard penetration resistance tests (a measure of soil density) were conducted and blowcounts were recorded at each two foot interval. Soil samples were collected at various intervals from the three deeper boreholes for grain size analysis. Lithologic descriptions were also recorded during the installation of the monitoring wells.

The shallow wells were installed to a depth of approximately eight feet below ground surface (bgs) and were constructed of five feet of 2-inch diameter, 0.010 inch slotted PVC well screen attached to 2.5 feet of 2-inch diameter blank PVC pipe. The deeper wells were installed to a depth of approximately 50 feet bgs and were constructed of 2.5 feet of 2-inch diameter, 0.010 inch slotted well screen coupled to approximately 48 feet of 2-inch diameter solid PVC pipe. The annular space between the well was filled with clean 20/30 silica sand to the top of the well screen. A one foot thick bentonite seal was placed immediately above the sand pack during the construction of the shallow monitoring wells. A one foot thick layer of fine sand was used as a seal above the sand pack in the deeper wells. The remaining annulus was filled with Portland Type I cement to land surface. A protective flush-mounted manhole cover and pad was constructed around the top of the wells. The monitoring wells were developed by pumping with a centrifugal pump to remove fine sediment from the sand pack. These wells were not sampled but were used for additional groundwater measurements to determine the direction of groundwater flow and to determine if vertical flow of groundwater was significant at the site. Vertical groundwater flow would influence

contaminant transport at the site by causing a downward movement of contaminants as they move away from the site.

In January, 1993, monitoring wells W1 and W2 were abandoned. The monitoring wells were pulled from the ground and the remaining boreholes were backfilled to the surface.

Stainless Steel Probe: A stainless steel miniature wellpoint probe system, originally designed for soil gas vapor monitoring in the unsaturated zone, was used to obtain groundwater samples around the site. The probe unit utilized a "push-pull" wellpoint attached to 1/2 inch stainless steel tubing which was pushed or driven into the unsaturated zone. Groundwater samples were then obtained through a teflon sampling tube, inserted inside the stainless steel tube, by applying suction with a peristaltic pump. The entire probe system could then be pulled from the ground and installed at a new sample location. This system allowed collection of groundwater samples from 10 to 15 different locations per day, and was especially useful for identifying the extent of the contaminant plume at the project site.

A more permanent monitoring network was established during the Phase II study. First, the area of impacted groundwater downgradient of the drainfield was further defined using the miniature wellpoint probe system. A row of eight sample locations were installed along the edge of the southernmost trench (Trench 1) using the push-pull probe and groundwater samples were obtained for field screening (Figure 3-2). Based on these results, 30 miniature stainless wellpoints with teflon tubing were permanently installed within the impacted area downgradient of the infiltration system. A total of three rows of wellpoints were established. The first row of wellpoints was placed five feet downgradient of Trench 1. Each additional row was placed approximately 10 feet further downgradient (i.e., at 15 feet and 25 feet downgradient of Trench 1, respectively). Each row contained four sample points. At sample points T-1 through T-6, wellpoints were installed at 3 depths (approximately 6, 12, and 20 feet bgs). At sample locations T-7 through T-9, wellpoints were installed at two depths (approximately 6 and 20 feet bgs). Sample points T-10 through T-12 contained one wellpoint each that was installed at approximately six feet bgs. A background sample point was also installed upgradient of the drainfield with separate wellpoints at approximately 5, 10, and 15 feet bgs.

For the Phase III investigation, 22 additional wellpoints (six at new sample locations and four at previously designated sample locations) were installed on August 16 through August 18, 1993 (Figure 3-2). Three wellpoints (TW-16, TW-17, and TW-18) were installed between trenches 1 and 2 and three wellpoints (TW-13, TW-14, and TW-15) were installed 40 feet downgradient of Trench 1. Wellpoints were installed to depths of 6, 12, and 20 feet bgs at each of these new sample locations. One additional wellpoint was installed to a depth of 20 feet bgs at BW-1 and three additional wellpoints were installed to a depth of 12 feet bgs at sample locations TW-7, TW-8, and TW-9.

3.3 Groundwater Elevations and Flow Direction

Groundwater Flow Direction: Groundwater movement in shallow aquifers is generally governed by forces of gravity and, therefore, moves from areas of higher water table elevations to areas of lower water table elevations. Water table elevations can be contoured to distinguish areas of higher or lower water table elevation. The groundwater flow direction is perpendicular, or normal to these water table elevation contour lines. Water table elevation contour lines are determined by obtaining the depth to groundwater at various locations and referencing that depth to a known elevation at the site.

An initial direction of groundwater flow was determined by the installation of three piezometers (P-1 through P-3) at the site. The elevations of the tops of the piezometer casings were initially surveyed by Ayres Associates on November 27, 1990, and referenced to a common datum. Depth to groundwater measurements were obtained by measuring from a mark on the top of the casing to the water table surface with a chalked steel tape. Subsequent depth to water measurements were obtained at periodic intervals in 1992 and 1993 using a Keck KIR-89 electronic water level indicator. As monitoring wells were installed, the tops of casing were surveyed and depth to water measurements were referenced to the casing elevations.

Thickness of Unsaturated Soil: Water table elevation data was also obtained to determine the thickness of the unsaturated soil at the site. The thickness of the unsaturated soil layer between the bottom of the infiltration system and the groundwater surface is an important component in a study of OSDS impact to groundwater quality. Theoretically, the greater the thickness of unsaturated soil beneath the infiltration system the greater the degree of treatment of septic tank effluent before it reaches groundwater.

The depth to the bottom of the drainfield was measured through observation ports that had been installed in the drainfields. One observation port had been installed in each of the three trenches and was named accordingly (i.e., T-1 through T-3). The observation ports were installed to the infiltrative surface, which is the base of the drainfield, and depth to that surface was measured. Depth to groundwater measurements were obtained from wells located next to the drainfield to determine the range in thickness of the unsaturated soil layer over time.

3.4 Bromide Tracer Testing

A bromide tracer solution was added to the drainfield of the OWTS to aid in determination of groundwater flow direction and velocity. The tracer solution was comprised of sodium bromide (NaBr) dissolved in distilled water to a final concentration of 410,000 mg/L as bromide ion (Br^-).

To discharge the tracer solution to the drainfield at a known location, a 4-inch diameter PVC casing was installed into the drainfield gravel of Trench 2 to act as a tracer input port. This port is designated as IP on Figure 3.3. A miniature wellpoint was installed immediately below this point by angling the push probe so as to place the wellpoint

without penetrating the drainfield gravel. This wellpoint was placed at a depth of 5.5 feet below the infiltrative surface of the drainfield at the input point and is designated as BR-5.5 on Figure 3-3. Wellpoint BR-5.5 was used to intercept the "front" of bromide as the tracer entered the water table from the unsaturated zone below the input point.

Other downgradient wellpoints were utilized to monitor bromide movement from the source. Monitoring location TW-16 was established approximately 1.5 feet downgradient of the input port and had wellpoints placed at the 6, 12, and 20 foot depths. In addition, wellpoints were added at the 6 foot depth just downgradient of Trench 1 to monitor bromide concentrations as the tracer migrated from below the drainfield. These points are labeled BP-1, BP-2, and BP-3 on Figure 3.3. In addition, the push-pull sampling probe was utilized at various locations as needed to identify the location of the bromide plume.

3.5 Groundwater Sampling

Preliminary field screening of groundwater for chloride and conductivity was conducted on December 14-15, 1992 using the push-pull temporary stainless steel probe. Results of the preliminary field screening indicated that impacted groundwater extended beyond the initial plume outlined in November, 1990. Based on these data, a network of 12 sample points were installed in the area on December 15 through 17, 1992, and January 5 and 6, 1993. The chloride and conductivity values obtained during the preliminary screening also varied with depth. Background wellpoints were then installed approximately 15 feet upgradient of the infiltration system to determine if the values observed were due to the vertical movement of the contaminant plume or could be attributed to natural variations of chlorides in the native soil.

Groundwater samples from thirty wellpoints and 2 monitoring wells (SW-7 and W5) were obtained on January 7, 1993. Groundwater from these wellpoints and monitoring wells were subsequently sampled for the following water quality parameters:

- Chloride
- Foaming Agents (MBAS)
- Total Dissolved Solids
- Ammonia Nitrogen
- Nitrate-Nitrite Nitrogen
- Total Phosphorous
- Total Organic Carbon
- Fecal Coliform

Groundwater sampling during Phase III was conducted utilizing the same techniques as previous phases of the study. Briefly, a peristaltic pump with teflon tubing was utilized to pump groundwater samples from the miniature wellpoints directly into sample containers containing any necessary preservative. Each wellpoint had a dedicated teflon tube for sampling and the pump tubing was cleaned or replaced between sample points. Prior to filling the sample bottles, several liters of groundwater were pumped from the wellpoints to purge the system of stagnant water. Samples were placed on ice in coolers and shipped immediately to the laboratory for analysis.

IV. RESULTS

4.1 Septic Tank Effluent (STE) Characterization

STE Quality: Septic tank effluent was sampled at the site to assess the quality of wastewater discharged to the OSDS drainfield. Table 4.1 is a summary of the septic tank effluent (STE) quality for daily grab samples obtained during the week of August 15th, 1993. The daily grab samples were obtained to observe variations in the concentrations of the STE parameters. Samples were not obtained for TDS, total nitrogen, oil and grease, and fecal streptococcus analysis during the Phase III study. Total hardness as $CaCO_3$ was added to the list of STE parameters analyzed for the Phase III study. Appendix A includes the STE laboratory reports.

Several STE parameters showed variations in concentration during the week of August 15th, 1993. The parameters of importance that showed the greatest variations during the week included BOD_5 and total organic carbon. BOD_5 concentrations ranged from 160 mg/L to 419 mg/L, while STE values for total organic carbon ranged from 74 mg/L to 190 mg/L. These variations are within the range of normal septic tank effluent quality but the higher values may represent the effect of increased flow to the system near the beginning of the weekend.

Table 4.2 lists the average STE values obtained during the Florida OSDS research project, the average STE values of the three sampling events conducted for the Phase II study, and the average STE values of the seven sampling events conducted for the Phase III study. With the exception of total suspended solids (TSS) and total phosphorus (TP); the average STE values for the Phase II investigation and the average STE values for the Phase III investigation generally exceeded the prior average for typical STE parameters obtained during the OSDS research project.

A comparison of average STE values obtained during the Phase II and Phase III studies indicates some STE parameters have increased, some decreased, and some have remained relatively unchanged from the Phase II study to the Phase III study. Average values for BOD_5 and total organic carbon (TOC) increased from Phase II to Phase III. Average STE values obtained during the Phase III investigation for MBAS, TSS, TDS, TOC, and total phosphorous decreased when compared to the Phase II results. The average concentration of MBAS obtained during the Phase III study was approximately 40% less than the Phase II average. The average Phase II and III chloride, specific conductance, and TKN values were substantially higher than those determined during the OSDS study. However, the averages of these parameters remained relatively unchanged from Phase II to Phase III.

STE Quantity: Water meter readings were collected at the site on 17 different dates from November, 1990 to November, 1993. These data were used to estimate the average quantity of wastewater flowing from the home to the OSDS infiltration area. Water used by Ayres Associates during the installation of monitoring wells and

Table 4.1 Summary of Phase III Septic Tank Effluent Quality (mg/L unless otherwise noted).

PARAMETER	STE 8/15/93 Sun.	STE 8/16/93 Mon.	STE 8/17/93 Tues.	STE 8/18/93 Wed.	STE 8/19/93 Thur.	STE 8/20/93 Fri.	STE 8/21/93 Sat.	Mean	Std. Dev.	Range Min.	Range Max.
BOD_5	174	187	160	168	166	409	419	240.4	118.9	160.0	419.0
Foaming Agents (MBAS)	27	24	8.3	21	16	18	16	18.6	6.1	8.3	27.0
Total Suspended jSolids (TSS)	42	36	36	46	35	30	28	36.1	6.3	28.0	46.0
Total Hardness ($CaCo_3$)	180	180	180	180	170	180	180	178.6	3.8	170.0	180.0
Specific Conductance	1050	1100	980	1050	1050	1000	970	1028.6	46.7	970.0	1100.0
Chloride	65	53	65	56	41	57	51	55.4	8.4	41.0	65.0
Sulfate	4	<2	<2	<2	13	<2	<2	2.4	4.9	0.0	13.0
Total Phosphorus	8.1	8.30	7.00	7.50	6.90	10.00	9.40	8.2	1.2	6.9	10.0
Total Kjeldahl Nitrogen	54	57	67	68	68	78	77	67.0	9.1	54.0	78.0
Ammonia Nitrogen	54	57	62	66	61	61	64	60.7	4.1	54.0	66.0
Nitrate-Nitrite Nitrogen	0.05	0.02	0.03	0.02	0.02	0.01	0.01	0.0	0.0	0.0	0.1
Organic Nitrogen	<0.05	<0.05	5.00	2.00	7.00	17.00	13.00	6.3	6.6	0.0	17.0
Total Organic Carbon	78	79	81	79	74	190	184	109.3	53.2	74.0	190.0
Fecal Coliforms **		6.60E+06	1.20E+06	3.00E+06	1.30E+06			2.36E+06	2.52E+06	1.20E+06	6.60E+06

\+ Units are µhos/cm

** Units are colonies/100 ml; averages are based on a geometric mean

-- Not sampled

Table 4.2. Average STE Values for Florida OSDS Research Project, and Phase II and Phase III SDA Studies.

Parameter	Average from Previous Sampling Events *	Average STE Values Phase II	Average STE Values Phase III
BOD_5	139	179	240
Foaming Agents (MBAS)	5	31	18.6
Total Suspended Solids (TSS)	93	59	36
Total Dissolved Solids (TDS)	415	387	-- --
Specific Conductance +	712	1033	1029
Chloride	24	53	55
Sulfate	-- --	5	2.4
Total Phosphorus	15	17	8.2
Total Nitrogen	-- --	76	-- --
Total Kjeldahl Nitrogen	36	66	67
Ammonia Nitrogen	-- --	75 ++	61
Nitrate Nitrite-Nitrogen	0.06	0.02	0.01
Total Organic Carbon	56	73	109
Oil and Grease	25	37	-- --
Fecal Coliforms ***	5.45×10^6	1.02×10^7	2.36×10^6
Fecal Streptococci***	-- --	350	-- --

\+ Units are µhos/cm
* Results shown are the mean values for five sampling events conducted during the Florida OSDS research study
*** Units are colonies/100 ml; averages are based on a geometric mean
-- -- Not sampled
++ Only one sample, no average available

groundwater sampling was recorded and subtracted from the normal total water usage at the site. A summary of water use data collected at the study residence during Phase II and III and the estimated wastewater loading to the OSDS infiltration area are presented in Table 4.3.

Table 4.3. Average Daily Water Use Summary.

Period of Meter Readings	Total Water Use (gpd)	Heat Pump (gpd)	Exterior Use (gpd)	Estimated Wastewater Flow (gpd)	Estimated Wastewater Loading (gpd/ft^2)*
11/20-28/90	694.1	0	8.4	686.0	3.3
11/5/92-1/12/93	1166.5	973.5	7.0	186.3	0.9
8/15/93-11/1/93	583.1	301.7	32.0	253.3	1.2

* Based on an infiltration system area of 210 ft^2

The relatively high (3.3 gpd/ft$^{2)}$ estimated wastewater loading between November 20-28, 1990, was due to an increase in water use during the Thankgiving holiday and is probably not representative of average water use.

An estimated 1,166.5 gpd of total water was used during the remaining Phase II period. After subtracting heat pump and exterior water use, the estimated wastewater loading during the Phase II study was 0.9 gpd/ft^2.

Total water use for the Phase III study averaged 583.1 gpd at the site. The water usage attributed to the heat pump averaged 301.7 gpd which was less than the Phase II study period. The home owner notified Ayres Associates that the heat pump had been disconnected in August, 1993. Water use attributed to the outside faucets averaged 32.0 gpd which was more than the Phase II study period; however, the Phase III study period (August 15 to November 1, 1993) correlated with high temperatures and less rainfall. The quantity of exterior water use during the Phase III period may have been even higher than that recorded because one of the outside faucet meters was not functioning properly during that study period. After subtracting the exterior water use from the total water use, the wastewater flow was estimated to be 253.3 gpd which translates into an estimated 1.2 gpd/ft^2 wastewater loading to the infiltration area. This wastewater loading rate is moderate to high for a family of four, however, as explained in the previous sentence, some of the exterior water use may be figured into the estimated wastewater flow.

4.2 Groundwater Elevations and Flow Direction

Groundwater Flow Direction: Initial piezometer readings indicated the general direction of groundwater flow at the site was south-southwest toward the St. Johns River. Subsequent depth to groundwater measurements confirmed the groundwater flow direction. The groundwater gradient was relatively constant across the site and was calculated to be approximately 0.0029 feet/foot using the groundwater elevation data from November 5, 1993.

In November, 1990, depths to groundwater measurements obtained from monitoring wells installed at the site ranged from 5 to 6 feet bgs. Depth to groundwater at the site, during the remaining Phase II study period, ranged from approximately 1.5 feet to 4 feet bgs.

Depths to groundwater during the Phase III study were similar, ranging from approximately 1.5 to 5 feet bgs. The lowest relative groundwater elevations were recorded at monitoring well SW-11 located in the southwest portion of the site. The highest relative groundwater elevations were calculated to be at the piezometer P-3 and the monitoring well SW-7 which is located in the northeastern corner of the site. Table 4.4 lists the relative groundwater elevations calculated for depth to water measurements obtained from November, 1990 through January, 1993 and Table 4.5 lists the relative groundwater elevations calculated for the Phase III study. Figure 4-1 shows the groundwater elevations and contours calculated from data collected on November 5, 1993.

One of the tasks of the Phase II study was to determine if a vertical component of flow was present at the site and, if so, whether that vertical component was great enough to cause the contaminant plume to "dip" into a deeper zone. Groundwater elevation data (Tables 4.4 and 4.5) indicated that there was a slight vertical gradient at the nested monitoring well set in the southeast corner of the site, DW-8 and SW-9. The groundwater elevation difference between SW-9 and DW-8 during the Phase III study ranged from 0.09 to 0.14 feet measured over a 46 foot distance between the top of the water table at the shallow well to the top of the screened interval at the deep well. This represented a vertical gradient which ranged from .002 to .003 feet/foot, approximately equal to the horizontal gradient. The vertical gradient of .002 to .003 feet/foot in this area had been consistent throughout the Phase II/Phase III study and it appears that some potential for downward groundwater flow exists at the site.

Unsaturated Zone Thickness: The average water table elevation and the ranges of water table elevations are presented in Table 4.6. Table 4.6 also shows the range of unsaturated soil thickness between the infiltrative surface and the water table for wells near the infiltration area.

At the time of the highest measured groundwater levels (November 1, 1993), the depth to groundwater at the site for the monitoring well closest to the infiltration area (W5) was 1.87 feet bgs. At that time the thickness of unsaturated soil beneath the infiltration system at the site was 0.03 feet. The unsaturated soil thickness at the site ranged from 1.44 to 0.34 feet during the Phase II study period and the water table was commonly within 1 foot of the infiltrative surface indicating that treatment efficiency may be reduced. The unsaturated soil thickness at the time of the Phase II sampling event was approximately 1.4 feet. The unsaturated soil thickness during the Phase III study ranged from 3.01 to 0.03 feet. The unsaturated soil thickness at the time of the Phase III "worst case" sampling event (November 1, 1993) was 0.03 feet.

4.3 Bromide Tracer Movement

The sodium bromide solution was poured into the drainfield on August 16, 1993 at 8:00 p.m. Bromide was detected in wellpoint BR5.5 with the first measurement on August 17, and continued to increase with each subsequent measurement. Figure B1 shows the bromide concentration with time at BR5.5, directly below the input port. The tracer plot shows a bromide peak at approximately 36 hours after input to the drainfield. The bromide peak should represent the approximate average travel time of water through the unsaturated zone from the drainfield infiltrative surface to the water table, a distance of approximately 3 feet at the time of bromide input. This result is significantly shorter than the travel times reported from tracer testing during the Florida Onsite Sewage Disposal System Research Project. Tracer testing at an OSDS in east central Florida resulted in an estimated travel time of 5 days for a fine sandy soil with a 1.75 foot unsaturated zone (Ayres Associates, 1993). Controlled testing at the USF Lysimeter Field Station resulted in estimated travel times of 3 - 4 days for a fine sand with a 2-foot unsaturated zone (Ayres Associates, 1993a). However, the results obtained at the St Johns County site during this study are in agreement with computer

Table 4.4 Relative Groundwater Elevation Data for Individual Home in St. Johns County November, 1990 and Phase II Study Period.

		November 28, 1990		November 24,1992		December 14,1992		January 5, 1993		January 12, 1993		
Location ID	T.O.C. Elevation	Depth to Water	Relative W.T.E.	Depth to Water	Relative W.T.E.	Depth to Water	Relative W.T.E.	Depth to Water	Relative W.T.E.	Depth to Water	Relative W.T.E.	Average W.T.E.
W-1	49.64	5.06	44.58	2.67	46.97	2.99	46.65	3.24	46.40	*	-- --	46.15
W-2	49.66	5.06	44.60	2.73	46.93	3.04	46.62	3.33	46.33	*	-- --	46.12
W-4	49.28	4.77	44.51	2.53	46.75	2.83	46.45	3.12	46.16	2.07	47.21	46.22
W-5	49.58	5.97	43.61	2.66	46.92	2.98	46.60	3.28	46.30	2.18	47.40	46.17
P-1	49.87	5.35	44.52	-- --	-- --	3.28	46.59	-- --	-- --	2.48	47.39	46.17
P-3	52.76	8.04	44.72	5.63	47.13	5.97	46.79	6.29	46.47	5.13	47.63	46.55
DW-6	53.62	-- --	-- --	6.45	47.17	6.82	46.80	7.16	46.46	5.93	47.69	47.03
SW-7	52.46	-- --	-- --	5.31	47.15	5.65	46.81	6.00	46.46	4.82	47.64	47.02
DW-8	48.94	-- --	-- --	2.26	46.68	2.55	46.39	2.81	46.13	1.81	47.13	46.58
SW-9	48.88	-- --	-- --	2.11	46.77	2.41	46.47	2.65	46.23	1.65	47.23	46.68
DW-10	49.71	-- --	-- --	3.02	46.69	3.30	46.41	3.63	46.08	2.54	47.17	46.59
SW-11	49.58	-- --	-- --	2.86	46.72	3.17	46.41	3.41	46.17	2.40	47.18	46.62

W.T.E. -Water Table Elevation-Elevations are relative to an arbitrary benchmark datum set up on the site.
-- -- -Depth to groundwater not measured
* -Monitoring wells W1 and W2 were abandoned

Table 4.5 Relative Groundwater Elevation Data for Individual Home in St. Johns County November, 1990 and Phase III Study Period.

		August 16, 1993		August 31, 1993		November 1, 1993		November 5, 1993		
Location ID	T.O.C. Elevation	Depth to Water	Relative W.T.E.	Depth to Water	Relative W.T.E.	Depth to Water	Relative W.T.E.	Depth to Water	Relative W.T.E.	Average W.T.E.
W-4	49.28	4.64	44.64	4.03	45.25	1.76	47.52	2.18	47.10	46.13
W-5	49.58	4.85	44.73	4.24	45.34	1.87	47.71	2.30	47.28	46.27
P-1	49.87	5.16	44.71	4.61	45.26	2.18	47.69	2.59	47.28	46.24
P-3	52.76	7.89	44.87	7.33	45.43	4.83	47.93	5.24	47.52	46.44
DW-6	53.62	8.75	44.87	8.21	45.41	5.71	47.91	6.10	47.52	46.43
SW-7	52.46	7.59	44.87	7.04	45.42	4.54	47.92	4.94	47.52	46.43
DW-8	48.94	4.39	44.55	3.72	45.22	1.53	47.41	1.93	47.01	46.05
SW-9	48.88	4.19	44.69	3.57	45.31	1.35	47.53	1.77	47.11	46.16
DW-10	49.71	5.14	44.57	4.54	45.17	2.22	47.49	2.65	47.06	46.07
SW-11	49.58	4.99	44.59	4.41	45.17	2.06	47.52	2.50	47.08	46.09

W.T.E. -Water Table Elevation

-- -- -Depth to groundwater not measured

Table 4.6 Average Water Table Elevation and Unsaturated Soil Thickness

Well ID #	Average Water Table Elevation (ft.)	Water Table Elevation Range (ft.)	Unsaturation Zone Range* (ft. below infiltrative surface)
W1	46.15	44.58 - 46.97	3.16 - 0.77 +
W2	46.12	44.60 - 46.93	3.14 - 0.81 +
W4	46.18	44.51 - 47.52	N/A
W5	46.21	43.61 - 47.71	4.13 - 0.03
P1	46.20	44.52 - 47.69	N/A
P3	46.50	44.72 - 47.93	N/A
DW-6	46.73	44.87 - 47.91	N/A
SW-7	46.72	44.87 - 47.92	N/A
DW-8	46.31	44.55 - 47.41	N/A
SW-9	46.42	44.69 - 47.53	N/A
DW-10	46.33	44.57 - 47.49	N/A
SW-11	46.35	44.59 - 47.52	N/A

* Based on elevation of 47.74 ft. for infiltrative surface of drainfield at observation port T-1.
N/A Wells not in area of drainfield.
\+ Data was not available on 11/1/93, the day of highest water table elevation, as monitoring wells W1 and W2 had been abandoned.

simulations conducted by Hansen and Mansell (1986) for Lakeland Sand, another Florida sand. These simulations predicted a travel time of 31.6 hours for a two foot unsaturated zone below a typical septic system drainfield trench.

The tracer moved downgradient as expected upon reaching the saturated zone. Bromide appeared in monitoring point TW16-6', 1.5 feet downgradient of BR5.5, approximately 13 days after the peak measurement at BR5.5. The peak concentration at TW16-6' occurred sometime between 13 and 75 days from the time of the peak at BR5.5, however, the peak concentration was not measured since no site visits occurred during this time period. From a graph of bromide concentration vs. time, it was estimated that the peak occurred during a period from 30 to 50 days after the peak at BR5.5. Based on this range of time and the 1.5 foot distance, an estimated average travel time from 0.03 to 0.05 ft/day was calculated. This agrees relatively well with velocity estimates using Darcy's Law. Assuming saturated hydraulic conductivities of 1.64 to 6.56 ft/day for a fine sand, Darcy's Law would yield velocity estimates of 0 02 to 0 08 ft/day based on the water table gradient measured at the Fredenhagen site.

Bromide appeared at monitoring location TW1, approximately 11 feet downgradient of the tracer input point, approximately 75 days after tracer input. At TW1 however, bromide concentration increased with depth and was highest at the 20 foot depth, indicating downward as well as horizontal groundwater movement. It did not appear that a peak concentration had been reached as of the last site visit, approximately 80 days after tracer input.

Overall, the groundwater flow direction and velocity estimates from the preliminary tracer testing results appear to agree relatively well with the conventional methods of estimating these parameters. Future site visits should yield better data on tracer movement due to the length of time which has elapsed and the number of monitoring points which may be impacted.

4.4 Water Quality Results

Fifty-two groundwater samples were obtained from the wellpoints installed at the site on November 3 - 5, 1993 and shipped to Southern Analytical Laboratory for analysis. In addition, groundwater was also obtained for analysis from the onsite private well. The laboratory results indicated that the plume of groundwater containing constituents characteristic of STE has extended approximately 35 to 40 feet downgradient. The laboratory results for MBAS, $CaCO_3$, BOD_5, TOC, CL^-, and SO_4 are summarized in Table 4.7. Laboratory results for the nutrients are summarized in Table 4.8. Final laboratory results are included in Appendix C. Figures 4-3 through 4-9 show concentrations of various parameters in groundwater obtained from wellpoints six feet and 12 feet bgs.

Phase II MBAS: With the exception of TW-11, groundwater obtained from the six foot depth during the Phase II study contained concentrations of MBAS above detection limits (Table 4.7). Groundwater obtained from four of the sample points, TW-1, TW-4, TW-5, and TW-10 had MBAS concentrations of 5.7 mg/L, 5.5 mg/L, 4.7 mg/L and 3.3 mg/L, respectively. Groundwater obtained from the remaining sample points contained less than 1 mg/L MBAS. MBAS concentrations in groundwater obtained from the 12 and 20 foot depths were generally not detectable (<0.05 mg/L).

Phase III MBAS: MBAS concentrations in groundwater obtained at six feet bgs and at twelve feet bgs are shown in Figure 4-2 and Figure 4-3, respectively. Laboratory results indicate that groundwater obtained from all wellpoints contained MBAS concentrations above background (<0.05 mg/L) at the 6 and 12 foot depths. MBAS concentrations had decreased overall when compared to the Phase II groundwater results. The highest concentrations of MBAS at the 6 foot depth were encountered in groundwater obtained from the wellpoints TW-2, TW-6, TW-8, and TW-9 which contained 1.8 mg/L, 1.5 mg/L, 1.3 mg/L, and 1.2 mg/L, respectively. MBAS concentrations have increased at the 12 foot depth significantly since the Phase II sampling. The highest concentrations of MBAS are now found in groundwater obtained from the 12 foot depth. Groundwater obtained from TW-4, TW-5, and TW-13 at 12' bgs contained MBAS concentrations of 1.9 mg/L, 2.6 mg/L, and 1.2 mg/L, respectively. MBAS was not detected in groundwater obtained from the 20 foot depth.

Table 4.7 Summary of Water Quality Results (mg/L unless otherwise noted) November 3-5, 1993

Sample Point	Sample Depth (ft. bgs)	MBAS	Total Hardness as $CaCO_3$	BOD_5	TOC	Cl^-	SO_4
STE (11/3/93)	N/A	28.00	160	199	82.0	64	4.0
Tap H_2O	N/A	<0.05	160	--	<1	9.5	<2
TW-1	6	0.44	210	<1	5.7	51	54
	12	0.54 (0.46)	260 (260)	--	6.1 (7.0)	250 (250)	36 (38)
	20	<0.05	130	--	2.1	230	91
TW-2	6	1.8	220	6.2	11.0	52	110
	12	0.32 (0.27)	210 (210)	--	4.7 (4.6)	40 (40)	36 (35)
	20	<0.05	85	--	2.3	21	100
TW-3	6	0.14	180	<1	4.6	46	38
	12	0.75	130	--	8.0	44	52
	20	<0.05	83	--	2.5	24	100
TW-4	6	0.65 (0.52)	160 (160)	--	6.0 (5.9)	49 (50)	95 (90)
	12	1.9	180	--	13.0	46	15
	20	<0.05	43	--	1.6	23	66
TW-5	6	0.26	140	--	4.8	41	56
	12	2.6	170	--	14.0	46	25
	20	<0.05	22	--	1.9	11	2
TW-6	6	1.5	120	--	12.0	52	84
	12	0.20	130	--	5.8	36	<2
	20	<0.05	75	--	1.2	26	60
TW-7	6	0.66	80	--	9.8	62	83
	12	0.09	100	--	5.1	20	<2
	20	<0.05	59	--	<1	16	57
TW-8	6	1.3	110	--	12.0	49	50
	12	<0.05	75	--	2.9	9.8	<2
	20	<0.05	83	--	1.2	24	66
TW-9	6	1.2 (1.3)	120 (93)	--	11.0 (9.9)	45 (49)	19 (20)
	12	0.21	100	--	5.2	16	<2
	20	<0.05	47	--	1.3	18	22
TW-10	6	0.25	120	--	4.7	48	45
TW-11	6	0.93	310	--	7.9	100	140
TW- 12	6	0.54	240	--	9.9	52	<2
TW-13	6	<0.05	45	--	4.6	2.1	4
	12	1.2	100	--	11	37	10
	20	<0.05	99	--	1.5	10	38
TW-14	6	0.12	35	--	6.1	12	4
	12	0.44	89	--	6.2	16	<2
	20	<0.05	93	--	1.6	11	29
TW-15	6	0.10	69	--	11	13	25
	12	0.99	200	--	10	43	17
	20	<0.05	99	--	1.3	13	23

Table 4.7. Continued

Sample Point	Sample Depth (ft. bgs)	MBAS	Total Hardness (as $CaCO_3$)	BOD_5	TOC	CL^-	SO_4
TW-16	6	0.15	120	<1	8.9	300	47
	12	0.54	100	--	6.8	41	44
	20	<0.05	110	--	1.6	28	120
TW-17	6	0.10	180	<1	4.4	46	49
	12	0.63 (0.57)	67 (73)	--	6.4 (6.3)	38 (38)	39 (38)
	20	<0.05	110	--	1.4	29	130
TW-18	6	0.15	190	<1	4.0	50	36
	12	0.81	91	--	7.1	40	44
	20	<0.05	110	--	1.5	28	130
BW-1	5	<0.05	22	--	3.1	12	12
	10	<0.05	35	--	5.9	3	16
	15	<0.05	65	--	1.6	29	56
	20	<0.05	110	--	1.4	32	120

-- — Not analyzed
MBAS- Methylene Blue Active Substance
TOC-Total Organic Carbon
(73)- Duplicate Sample
Cl^-- Chloride
SO_4- Sulfate

Table 4.8 Continued

Sample Point	Sample Depth (ft. bgs)	TKN	NH_3-N	NO_3-N	TP
TW-15	6	3.60	3.00	<0.01	0.32
	12	0.83	0.70	<0.01	<0.01
	20	0.12	0.08	<0.01	<0.01
TW-16	6	1.00	0.08	59.15	16.00
	12	0.52	0.03	9.8	0.29
	20	0.14	0.04	<0.01	<0.01
TW-17	6	7.10	8.40	52.00	5.3
	12	0.56 (0.59)	0.02 (0.02)	11.00 (11.0)	<0.01 (0.17)
	20	0.11	0.02	0.02	<0.01
TW-18	6	7.30	9.10	50.00	2.2
	12	0.54	0.03	9.34	0.02
	20	0.11	0.04	<0.01	<0.01
BW-1	5	0.16	0.03	0.17	<0.01
	10	0.29	0.10	<0.01	<0.01
	15	0.18	0.04	<0.01	<0.01
	20	0.10	0.06	0.33	<0.01

– – Not analyzed
TP-Total Phosphorus
( )- Duplicate Sample

NH_3-N- Ammonia Nitrogen
NO_3-Nitrate-Nitrite-Nitrogen

Phase II Total Hardness: Total hardness as $CaCO_3$ was not analyzed during the Phase II study.

Phase III Total Hardness: Total hardness (as $CaCO_3$) in groundwater obtained from 6 feet bgs ranged from 35 mg/L at sample point TW-14 to 310 mg/L at sample point TW-11. Background levels of total hardness were 22 mg/L at 5 feet bgs. Generally, total hardness concentrations at the 6 foot depth were higher closer to the infiltration system and decreased further downgradient. Total hardness in groundwater obtained from the 12 foot depth ranged from 67 mg/L at sample point TW-17 to 260 mg/L at sample point TW-1. Background levels of total hardness at 10 feet bgs were 35 mg/L. Total hardness was less than or equal to background (110 mg/L) in groundwater obtained from all wellpoints at the 20 foot depth with the exception of groundwater obtained from TW-1 which had 130 mg/L as $CaCO_3$.

Phase II Five Day Biochemical Oxygen Demand (BOD_5): BOD_5, a general measure of organic content, was not analyzed in the Phase II study.

Phase III Five Day Biochemical Oxygen Demand (BOD_5): BOD_5 was analyzed in groundwater obtained from five random sample points at the six foot depth during the Phase III study. With the exception of TW-2, which had a BOD_5 concentration of 6.2 mg/L, groundwater obtained from wellpoints at the six foot depth were found to have less BOD_5 concentration than the method detection limit. These results indicate that BOD_5 is being effectively removed in the sandy soils, despite the thin unsaturated zone.

Phase II Total Organic Carbon (TOC): With the exception of TW-11 and TW-12, TOC concentrations were above background (4.3 mg/L) concentrations in groundwater obtained from all wellpoints installed at the six foot depth. Concentrations of TOC at the six foot level ranged from 5.6 mg/L in groundwater obtained from TW-3 to 26 mg/L in groundwater obtained from TW-1. Concentrations of TOC for all wellpoints at the 12 foot depth were generally at or below the 3.8 mg/L background level recorded at the 10 foot depth. Concentrations of TOC for all wellpoints at the 20 foot depth were generally very similar to the 1.3 mg/L background level recorded at the 15 foot depth.

Phase III Total Organic Carbon (TOC): Total organic carbon (TOC) concentrations during the phase III monitoring were above background (3.1 mg/L) concentrations in groundwater obtained from all wellpoints installed at the six foot depth. Concentrations ranged from 4.0 mg/L at TW18-6' to 12 mg/L in groundwater obtained from TW6-6' and TW8-6'. TOC concentrations have increased when compared to Phase II results at the 12' depths. Background concentrations of TOC at 10' bgs were 5.9 mg/L. The TOC concentrations in groundwater at 12' bgs obtained from TW-1, TW-3, TW-4, TW-5, TW-13, TW-14, TW-15, TW-16, TW-17, and TW-18 exceeded background concentrations. The highest TOC concentrations were measured at TW4-12' and TW5-12', at 13 mg/L and 14 mg/L, respectively.

Phase II Chloride: During Phase II monitoring, chloride concentrations were above background levels (13 mg/L) in groundwater obtained from all sample locations at the

was impacted by STE. Chloride concentrations at the 12 foot depth were generally much lower that the 6 foot depth, but than increased at the 20 foot depth. Background chloride concentrationsalso increased from the five foot depth to the deeper points. Groundwater from only one downgradient wellpoint (TW-3), installed at the 12 foot depth, had a chloride concentration above the 10 foot depth background level of 31 mg/L. Although the chloride concentrations obtained from groundwater at the 20 foot depths were elevated above the background level of 27 mg/L for that depth, the concentrations consistently ranged from 40 mg/L to 44 mg/L.

Phase III Chloride: Phase III chloride concentrations at six feet bgs are shown on Figure 4-4. Chloride concentrations in groundwater obtained during the Phase III study were above background (12 mg/L) at all wellpoints except TW-13, TW-14, and TW-15, which are furthest from the infiltration system. Chloride concentrations in groundwater obtained from all wellpoints at the 12 foot depth were above background (3 mg/L). With the exception of TW-1, chloride concentrations in groundwater obtained from wellpoints installed at the 20 foot depth were below background (32 mg/L). A chloride concentration of 230 mg/L was found in groundwater obtained from the wellpoint TW-1 at the 20 foot depth.

Phase II & III Sulfate: Although the average sulfate concentrations in STE from this study ranged only from 2.4 mg/L to 5 mg/L, sulfate concentrations in groundwater range from less than the method detection limit (2 mg/L) to 140 mg/L. Background concentrations range from 12 mg/L at 5 feet bgs to 120 mg/L at 20 feet bgs indicating a significant contribution of sulfate from a native source. No correlation between STE and sulfate in groundwater can be determined.

Phase II Nitrogen: Concentrations of ammonia nitrogen in groundwater samples obtained from the wellpoints at 6 feet bgs were consistently elevated. Groundwater obtained at the sample points TW-1, TW-4, TW-6, TW-7, TW-8, and TW-9 at 6 feet bgs contained NH_3-N concentrations greater than 20 mg/L. Nitrate-nitrite-nitrogen concentrations in the groundwater obtained were below detection limits at most sample points. These results appear to indicate anoxic conditions near the infiltration area which restricted nitrification of ammonia.

Ammonia nitrogen concentrations were either at or below background (0.10 mg/L) at the 12 foot depth. Ground water obtained at the 20 foot depth, however, contained NO_3-N concentrations that ranged from 2.1 mg/L to 2.9 mg/L at all locations except TW-5. This appears to indicate another source of niitrogen, but background concentrations were very low, refuting this theory.

Phase III Nitrogen: Figure 4-5 shows the ammonia nitrogen and nitrate-nitrite-nitrogen concentrations at six feet below ground surface during Phase III. NH_3-N concentrations are generally comparable to those encountered in the Phase II investigation. NH_3-N concentrations greater than 20 mg/L were found in groundwater obtained from samples points TW-2, TW-4, TW-5, TW-6, TW-7, TW-9 and TW-10 at 6 feet bgs. Background concentrations of NH_3-N at the 5 foot depth were 0.03 mg/L.

Nitrate-Nitrite-Nitrogen concentrations have increased in groundwater obtained from most wellpoints installed at 6 feet bgs. The highest concentrations of NO_3-N were encountered in groundwater obtained from beneath the infiltration system.

Groundwater obtained from sample points TW-16, TW-17, and TW-18 at the 6 foot depth were 59 mg/L, 52 mg/L and 50 mg/L, respectively. NO_3-N concentrations greater than 10 mg/L were observed in groundwater 25 feet downgradient of the infiltration system. Background concentrations of NO_3-N at the 5 foot depth were 0.17 mg/L. Figure 4-7 shows the estimated nitrate plume November 3 - 5, 1993.

Ammonia nitrogen concentrations were low (< 0.12 mg/L) at all 12' bgs locations during Phase III monitoring, except TW-13, 14, and 15. Ammonia nitrogen concentrations at these monitoring locations were 16 mg/L, 6.7 mg/L and 0.70 mg/L, respectively. Since these points are furthest from the OSDS, this suggests that the groundwater table was very high at the time this water was under the drainfield.

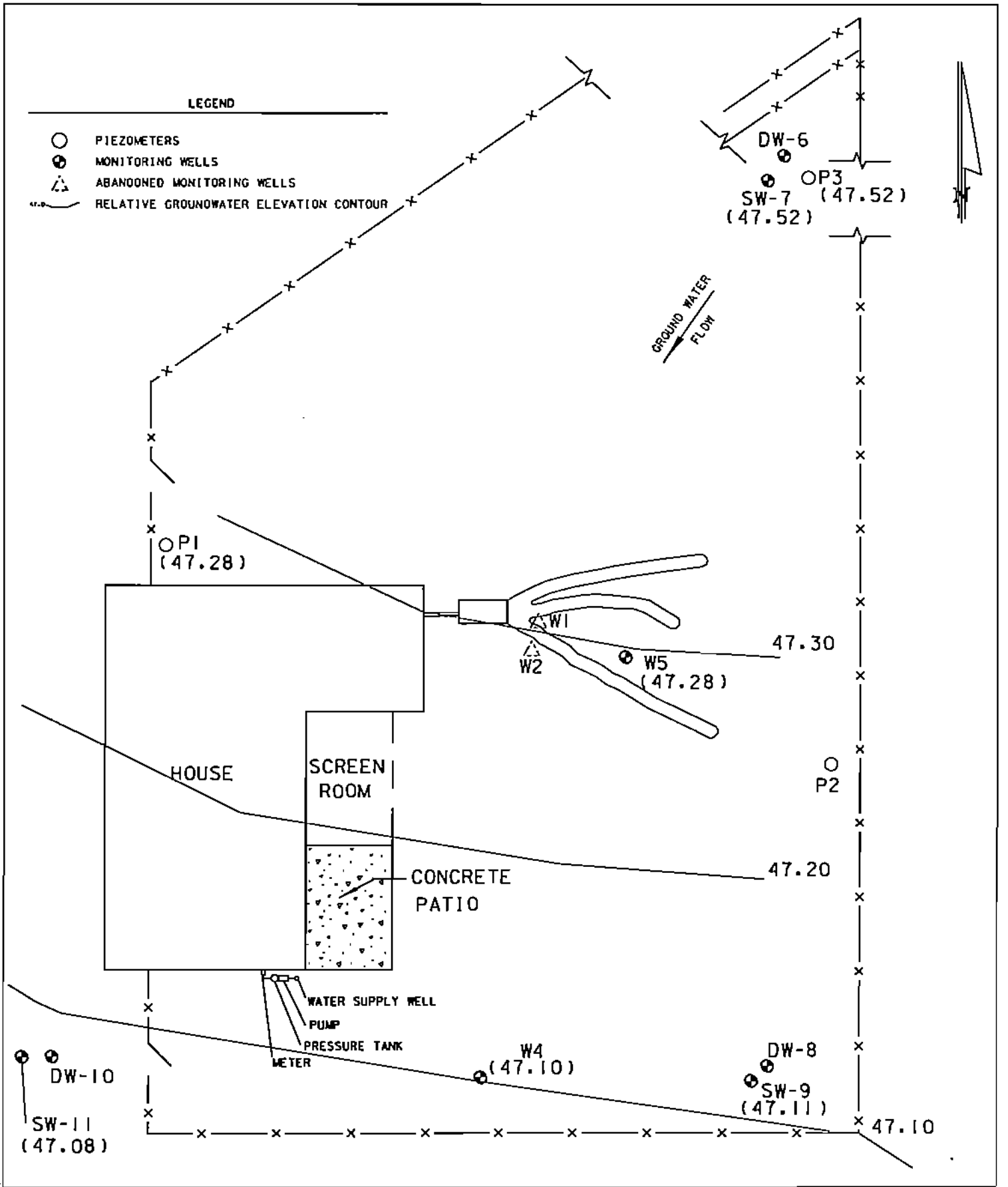
NO3-N concentration were elevated above background (<0.01 mg/L) in seven wellpoints located at 12 feet bgs. Sample points TW-1, TW-2, TW-3, TW-6, TW-16, TW-17 and TW-18 had NO3-N concentrations of 14.2 mg/L, 19.4 mg/L, 19.5 mg/L, 1.4 mg/L, 9.8 mg/L, 11.0 mg/L and 9.3 mg/L, respectively. With the exception of TW-6, these sample points are located adjacent to (within 5 feet) of the infiltration system. Concentrations of both ammonia and nitrate nitrogen were low at the 20' bgs depth except at TW-1, where NO3-N was measured at 3.1 mg/L.

Phase II Total Phosphorus: All groundwater obtained from the sample points located six feet bgs had concentrations of total phosphorus higher than background concentrations. Groundwater obtained from the sample points closest to the septic tank and Trench 1, TW-1 and TW-2, had total phosphorus concentrations similar to the STE sample obtained during the same sampling event indicating limited treatment or adsorption of phosphorus was occurring at the time of sampling. Previous studies (Stolt and Reneau, 1991; Cogger, et al. 1988) have shown that elevated water tables reduce phosphorus attenuation, especially in sandier soils that have less adsorptive capacity, initially. Total phosphorus concentrations in groundwater obtained from the 12 and 20 foot depths were less than 0.20 mg/L which was similar to the background concentrations at 10 feet (0.02 mg/L) and 15 feet (0.01 mg/L).

Phase III Total Phosphorus: Total phosphorus concentrations in groundwater obtained from 6 feet bgs during the Phase II investigation are shown in Figure 4-8. Total phosphorus concentrations remain elevated above background (<0.01 mg/L). The highest concentrations are found in groundwater obtained closest to the infiltration system. Total phosphorous concentrations are gradually reduced further downgradient. Total phosphorus concentrations at the 12 foot depth are elevated above background (<0.01 mg/L) in seven of the wellpoints (Figure 4-9). Wellpoints located adjacent to the infiltration area had the highest total phosphorous concentrations. Total phosphorous concentrations at 12 feet bgs in wellpoint TW-16, TW-3, TW-4, and TW-5 were 0.29 mg/L, 0.22 mg/L, 0.10 mg/L, and 0.18 mg/L, respectively. Groundwater colleted from the remaining three wellpoints (TW-18, TW-6, and TW-13) contained total phosphorus concentrations at less than 0.10 mg/L. Total phosphorus concentrations 20 feet bgs were generally near or at background.

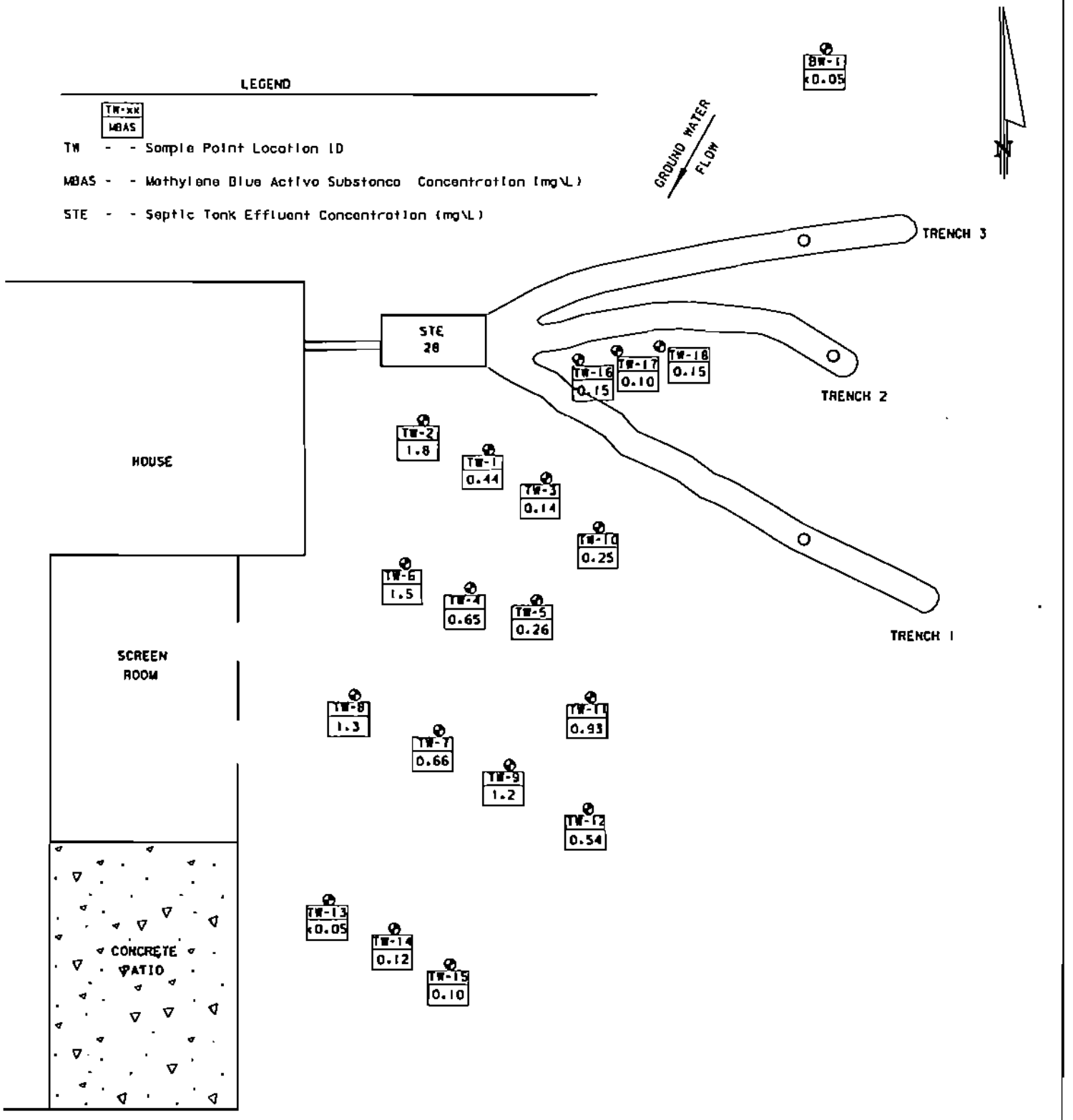
Summary: In summary, groundwater analytical results indicated that the extent of significantly impacted groundwater extends approximately 25 to 30 feet downgradient of the onsite wastewater treatment system. Several indicator substances, including

MBAS, were found in detectable quantities in groundwater located 35 to 40 feet from the infiltration area. Several STE parameters have also increased at the 12 foot depths indicating that groundwater carrying STE substances has moved vertically as well as horizontally.

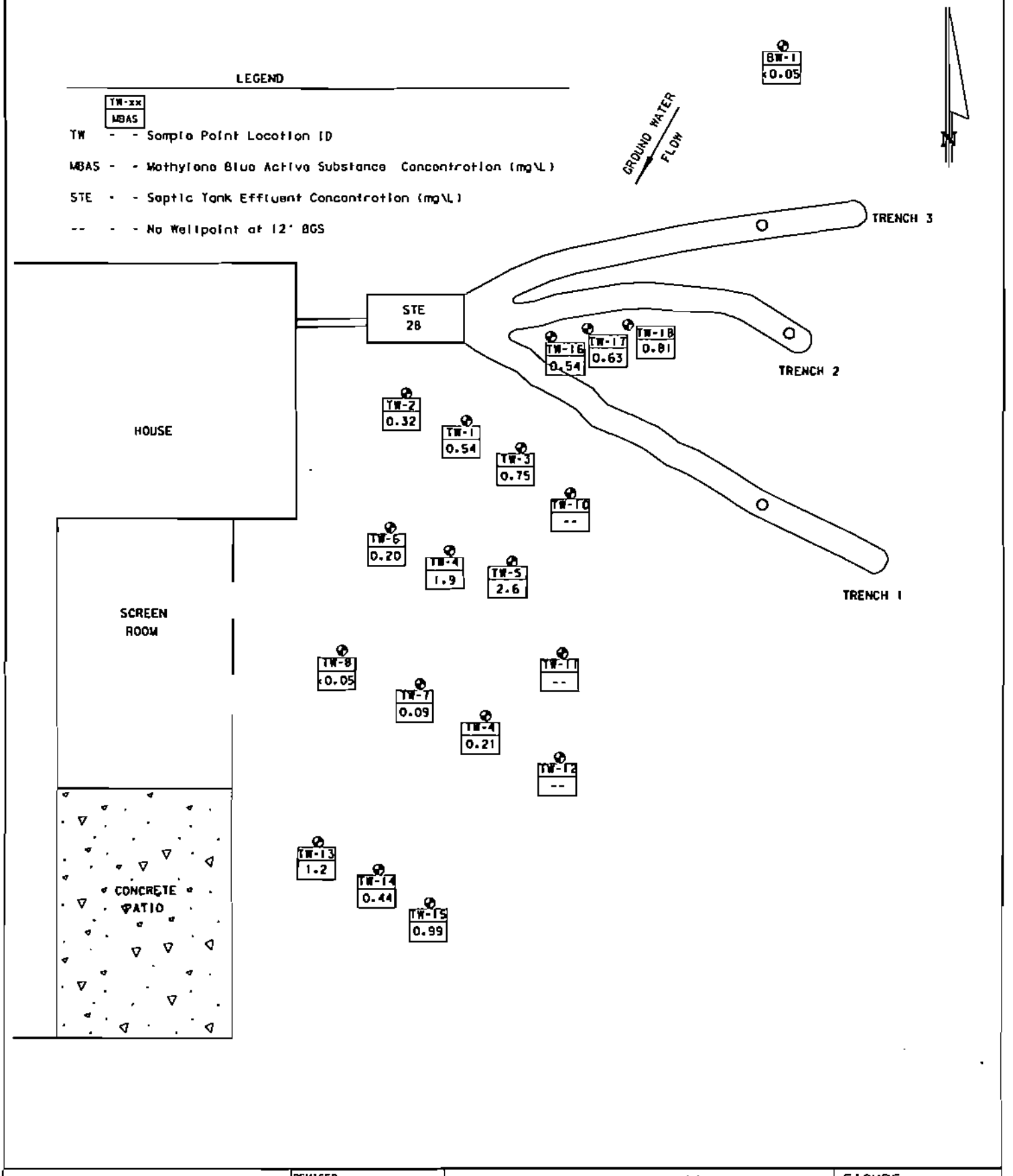


FILE: g:\anvir\00-4155\grnwater.dgn
DATE: 12-Apr-94 11:39

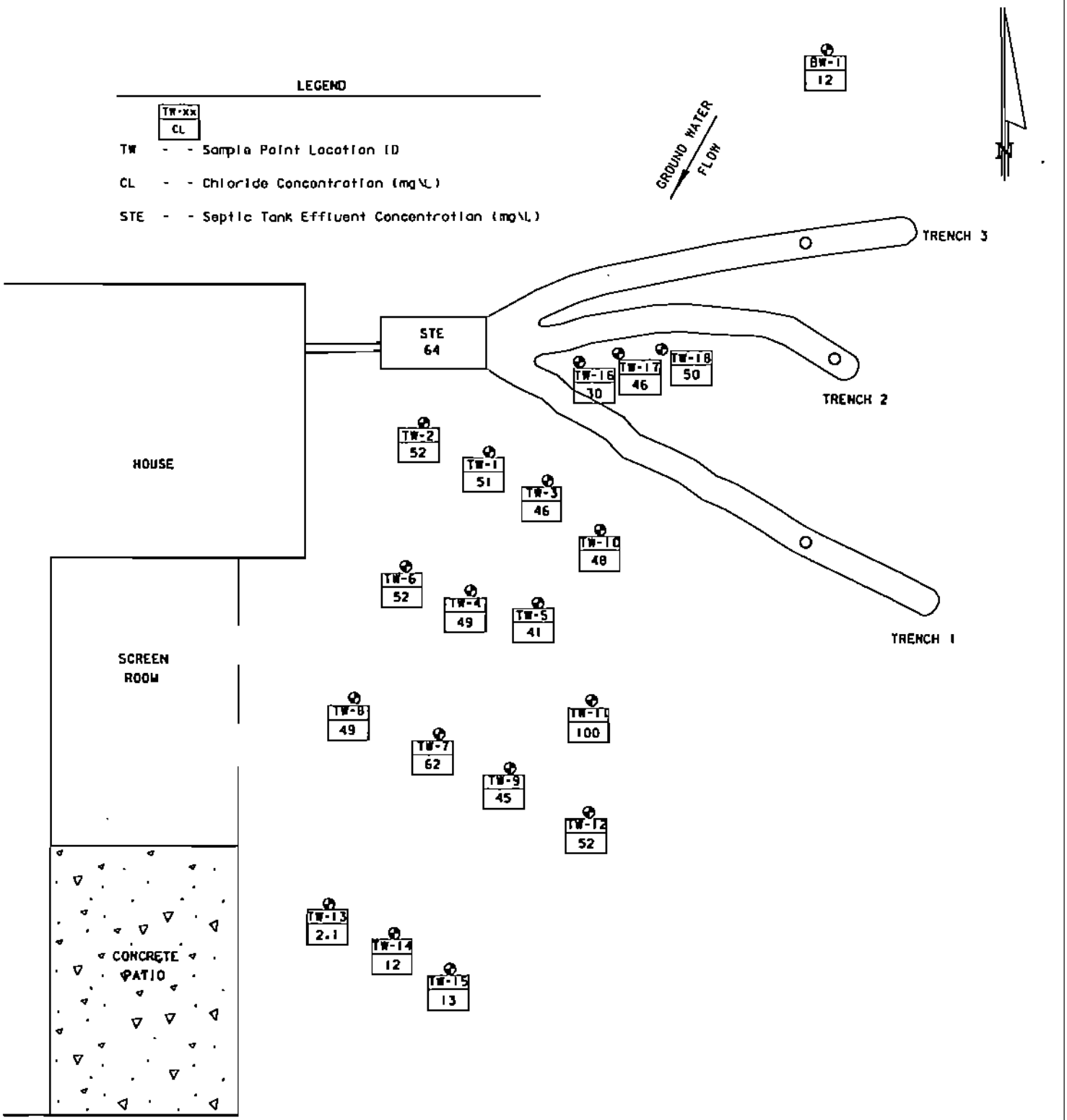
SCALE: SCALE: 1"=20'	REVISED:	SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT	FIGURE:
AYRES ASSOCIATES	DRAWN BY: MW DATE: 4/94	RELATIVE GROUNDWATER ELEVATION CONTOUR MAP (November 5, 1993)	4-1
	CHECKED BY: DATE:		
	APPROVED BY: DATE:		



SCALE: 1"=10'	REVISED	SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT MBAS CONCENTRATIONS (11/3-5/93) (6' BGS APPROX. 4' INTO THE WATER TABLE)	FIGURE: 4-2
AYRES ASSOCIATES	DRAWN BY: M.W. DATE: 4/94 CHECKED BY: DATE: APPROVED BY: DATE:		

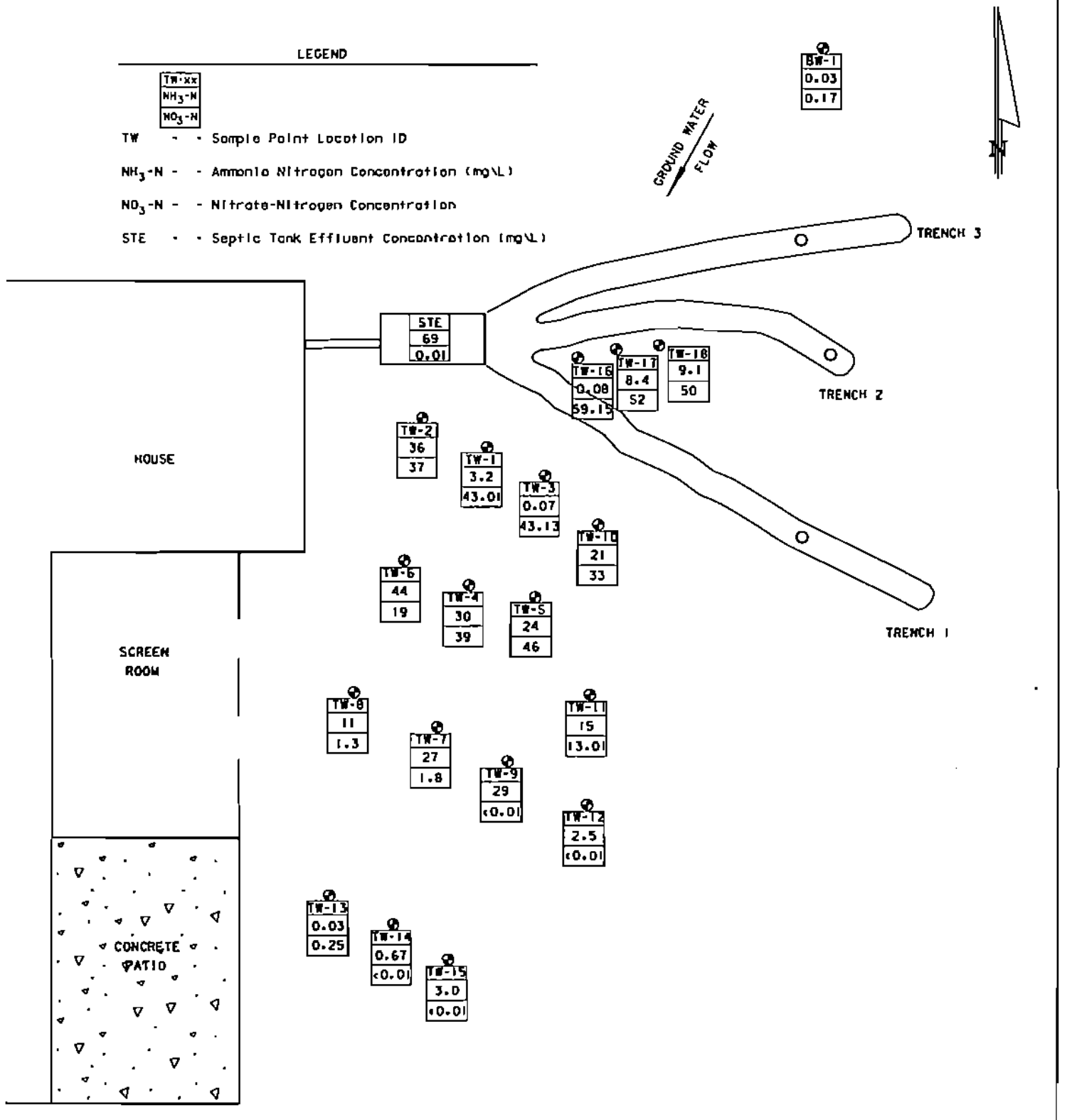


SCALE: 1"=10'	REVISED		SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT MBAS CONCENTRATIONS (11/3-5/93) (12' BGS approx. 10' INTO THE WATER TABLE)	FIGURE: 4-3
AYRES ASSOCIATES	DRAWN BY: M.W.	DATE: 4/94		
	CHECKED BY:	DATE:		
	APPROVED BY:	DATE:		

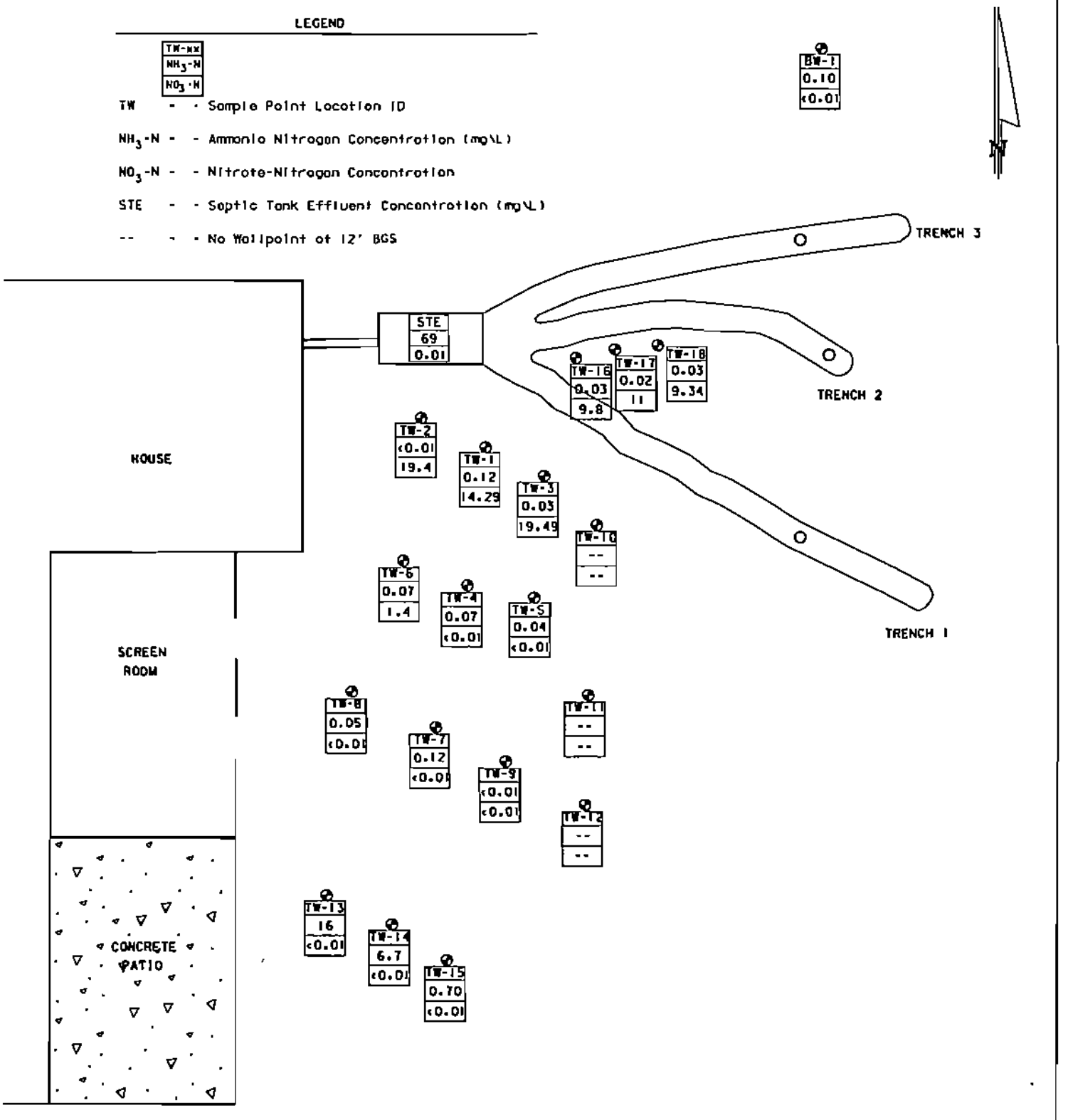


SCALE: 1"=10'	REVISED	SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT	FIGURE:
AYRES ASSOCIATES	DRAWN BY: M.W. DATE: 4/94	CHLORIDE CONCENTRATIONS (11/3-5/93)	4-4
	CHECKED BY: DATE:	(6' BGS APPROX. 4' INTO THE WATER TABLE)	
	APPROVED BY: DATE:		

TILE: chlor
DATE: 8-Apr-94 15:36

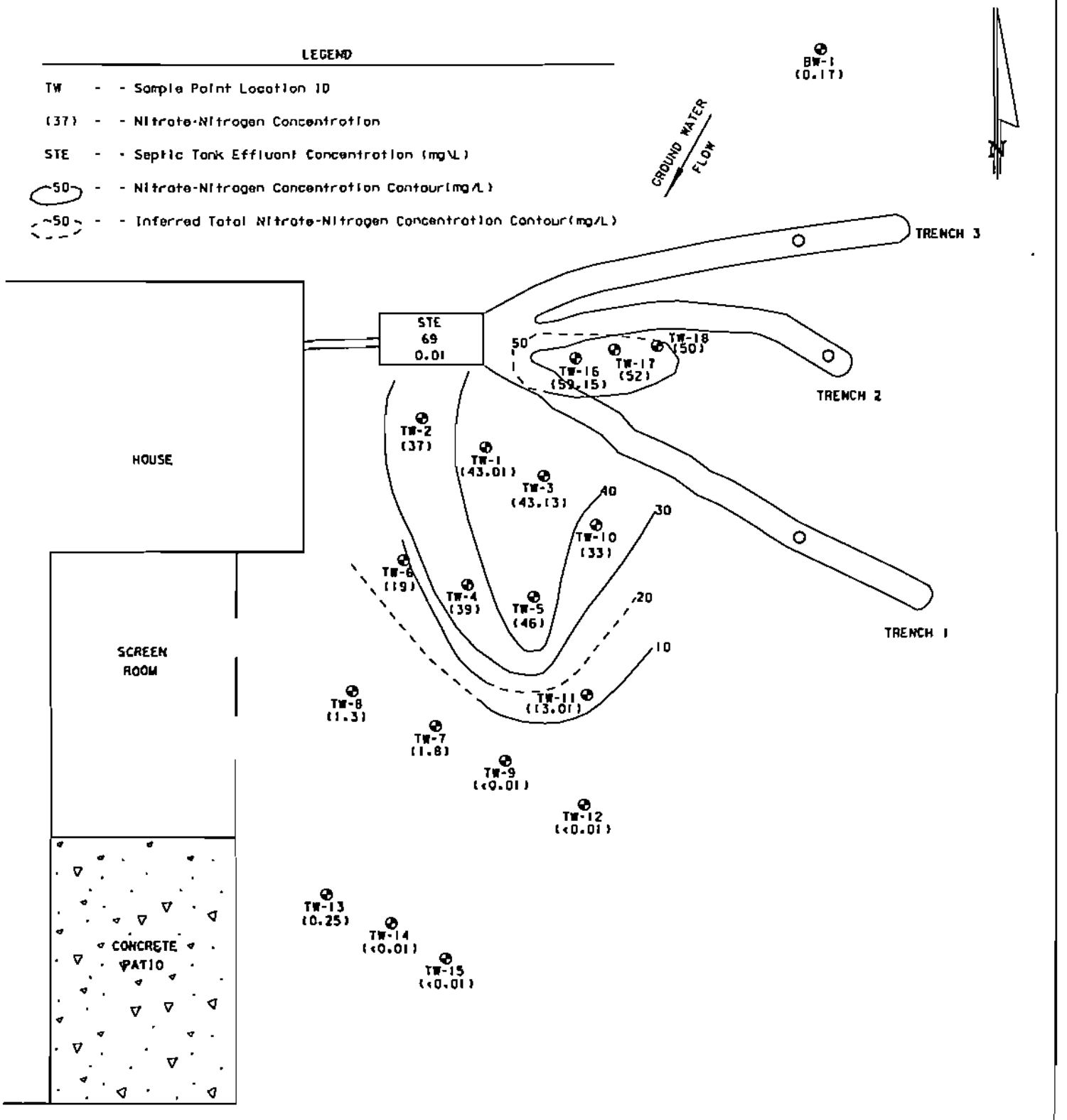


SCALE: 1"=10'	REVISED	SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT	FIGURE:
AYRES ASSOCIATES	DRAWN BY: M.W. DATE: 4/94	AMMONIA-NITROGEN & NITRATE-NITRITE-NITROGEN CONCENTRATIONS (11/3-5/93)	4-5
	CHECKED BY: DATE:	(6' BGS APPROX. 4' INTO THE WATER TABLE)	
	APPROVED BY: DATE:		



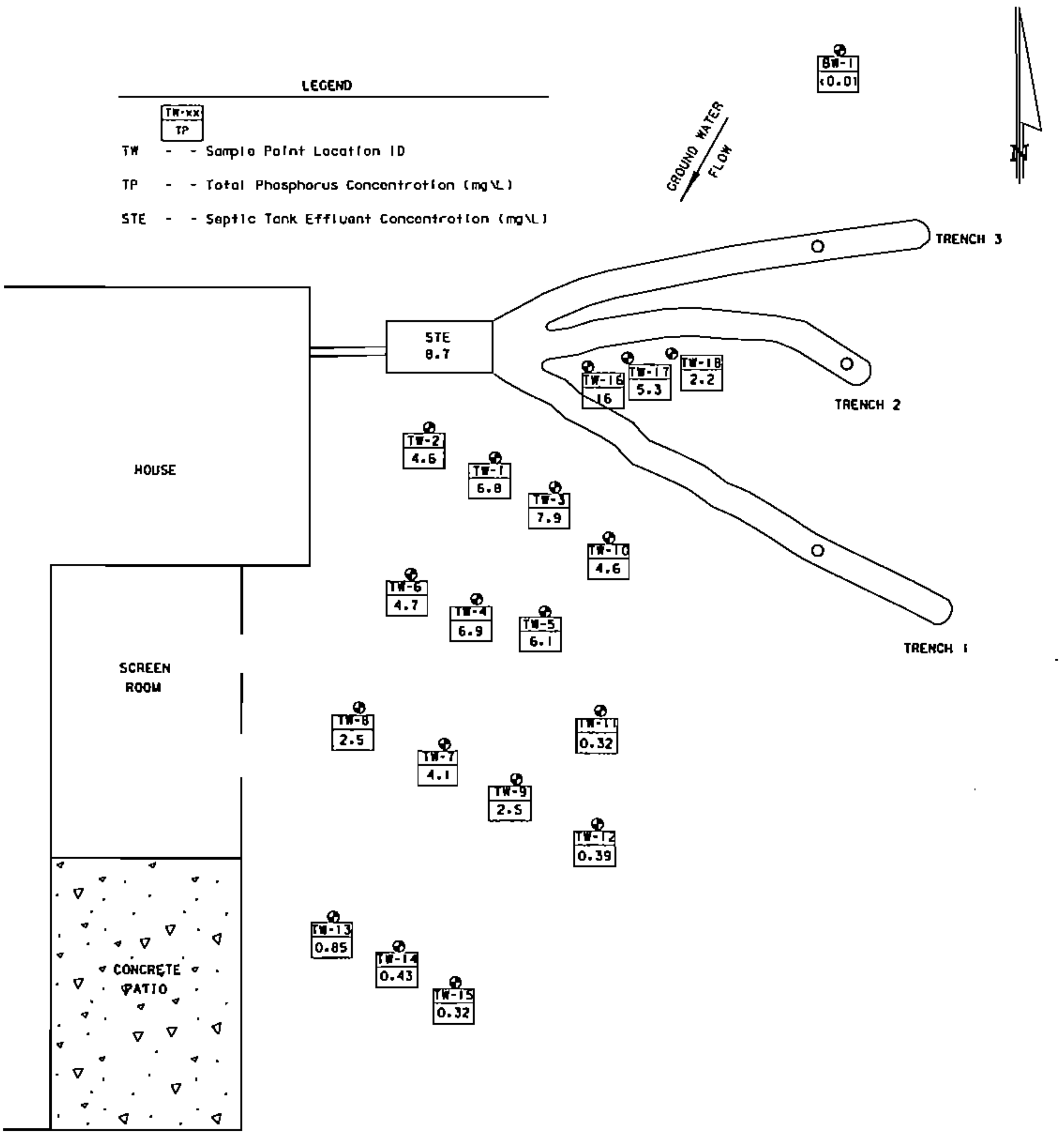
SCALE: 1"=10'	REVISED	SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT	FIGURE:
AYRES ASSOCIATES	DRAWN BY: M.W. DATE: 4/94	AMMONIA-NITROGEN & NITRATE-NITRITE-NITROGEN CONCENTRATIONS(11/3-5/93)	4-6
	CHECKED BY: DATE:	(12' BGS APPROX. 10' INTO THE WATER TABLE)	
	APPROVED BY: DATE:		

DATE: 13-Apr-94 07:23



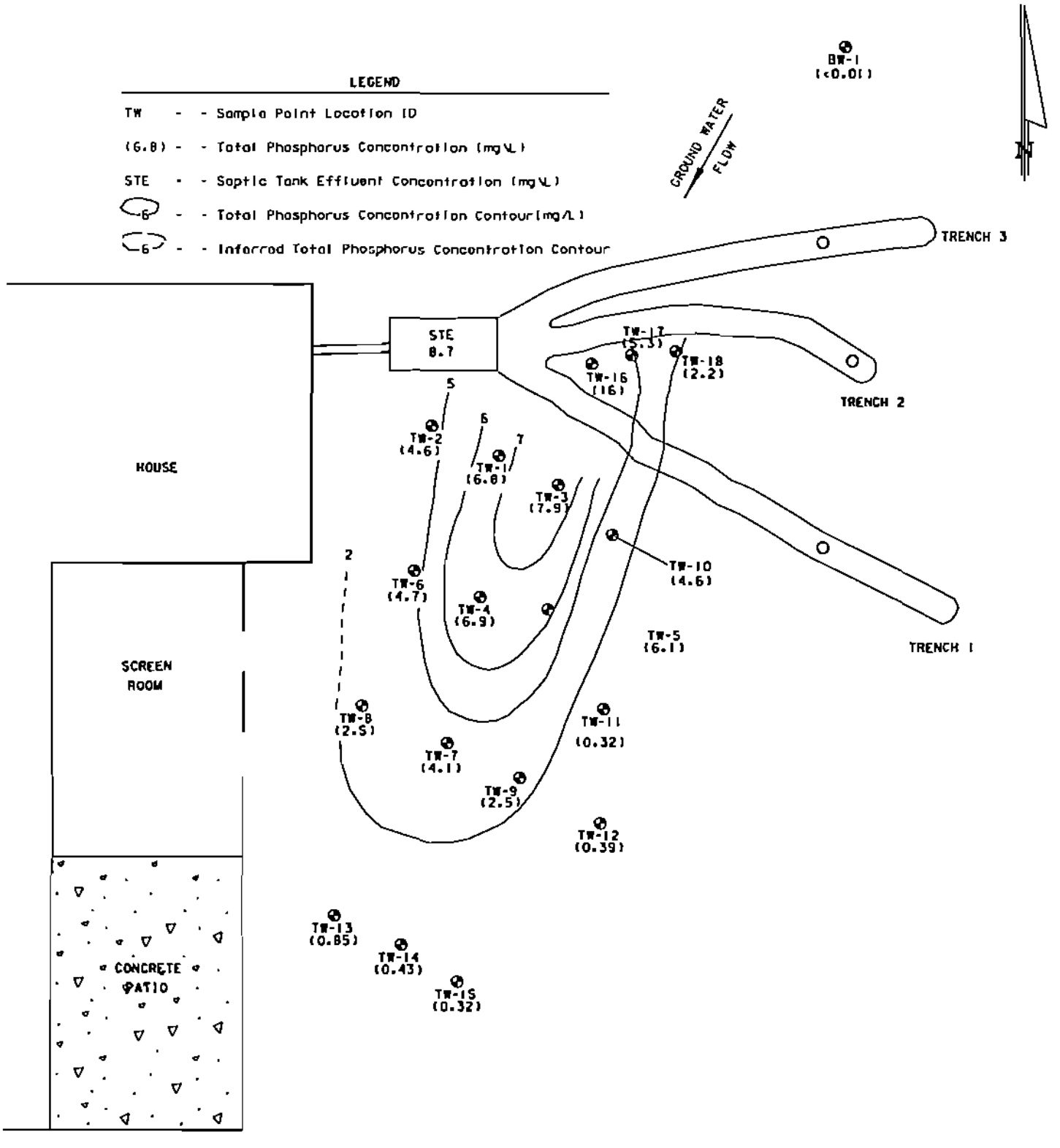
SCALE: 1"=10'	REVISED		SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT NITRATE-NITRITE-NITROGEN CONCENTRATION MAP (11/3-5/93) (6' BGS APPROX. 4' INTO THE WATER TABLE)
AYRES ASSOCIATES	DRAWN BY: M.W. DATE: 4/94		
	CHECKED BY: DATE:		
	APPROVED BY: DATE:		FIGURE: 4-7

ILE: DATE: 12-Apr-94 11:48



DATE: 6-Apr-94 15:23

SCALE: 1"=10'	REVISED	SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT	FIGURE:
AYRES ASSOCIATES	DRAWN BY: M.W. DATE: 4/94	TOTAL PHOSPHORUS CONCENTRATION MAP (11/3-5/93)	4-8
	CHECKED BY: DATE:	(6" BGS APPROX. 4" INTO THE WATER TABLE)	
	APPROVED BY: DATE:		



SCALE: 1"=10'	REVISED		SDA ONSITE WASTEWATER TREATMENT SYSTEM PROJECT TOTAL PHOSPHORUS CONCENTRATION MAP (11/3-5/93) (6' BGS APPROX. 4' INTO THE WATER TABLE)	FIGURE: 4-9
AYRES ASSOCIATES	DRAWN BY: M.W.	DATE: 4/94		
	CHECKED BY:	DATE:		
	APPROVED BY:	DATE:		

FILE:
DATE: 13-Apr-94 08:20 phosp

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

September 8, 1993
Project No. 05925

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 01 - Water, STE-1, sampled 8/15/93, 1700
02 - Water, STE-2, sampled 8/16/93, 1430
03 - Water, STE-3, sampled 8/17/93, 1445
04 - Water, STE-4, sampled 8/18/93, 1445
Date Received: 8/17 (01,02) 8/19/93 (03,04)

Parameter	Units	(01) STE-1	(02) STE-2	(03) STE-3	(04) STE-4
Chloride	mg/l	65	53	65	56
Sulfate	mg/l	4	< 2	< 2	< 2
Foaming Agents (MBAS)	mg/l	27	24	8.3	21
Total Suspended Solids	mg/l	42	36	36	46
Nitrate Nitrogen	mg/l N	0.05	0.02	0.03	0.02
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	54	57	67	68
Total Phosphorus	mg/l P	8.1	8.3	7.0	7.5
Total Organic Carbon	mg/l	78	79	81	79
BOD (5 Day @ 20°C)	mg/l	174	187	160	168
Ammonia Nitrogen	mg/l N	54	57	62	66
Organic Nitrogen	mg/l N	< 0.05	< 0.05	5.0	2.0
Total Hardness	mg/l $CaCO_3$	180	180	180	180

Francis I. Daniels
Laboratory Director

Environmental Lab No. E84129

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 05 - Water, STE-8, sampled 8/18/93, 1615
06 - Equipment Blank, sampled 8/18/93, 1445
07 - Spiked Blank, sampled 8/18/93, 1500
23 - Water, STE-5, sampled 8/19/93, 1400
Date Received: 8/19 (05-07) 8/20/93 (23)

Parameter	Units	(05) STE-8	(06) Equip. Blank	(07) Spiked Blank	(23) STE-5
Chloride	mg/l	55	< 1	--	41
Sulfate	mg/l	< 2	< 2	--	13
Foaming Agents (MBAS)	mg/l	23	< 0.05	17	16
Total Suspended Solids	mg/l	52	< 1	--	35
Nitrate Nitrogen	mg/l N	0.02	0.02	--	0.02
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	--	< 0.01
Total Kjeldahl Nitrogen	mg/l N	68	0.06	--	68
Total Phosphorus	mg/l P	7.7	< 0.01	--	6.9
Total Organic Carbon	mg/l	83	< 1	--	74
BOD (5 Day @ 20°C)	mg/l	171	< 1	--	166
Ammonia Nitrogen	mg/l N	66	< 0.01	--	61
Organic Nitrogen	mg/l N	2.0	0.06	--	7.0
Total Hardness	mg/l $CaCO_3$	180	< 2	--	170

Francis I. Daniels
Laboratory Director

Ayres Associates
RSE Group
3901 Coconut Palm Orive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 24 - Water, STE-4, Spiked Eff., sampled 8/18/93, 1740
25 - Water, STE-6, sampled 8/20/93, 1400
26 - Water, STE-6, Spiked Eff., sampled 8/20/93, 1430
27 - Water, STE-7, sampled 8/21/93, 1530
Date Received: 8/23/93

Parameter	Units	(24) STE-4 Spiked Eff.	(25) STE-6	(26) STE-6 Spiked Eff.	(27) STE-7	Method Blank
Chloride	mg/l	--	57	--	51	< 1
Sulfate	mg/l	--	< 2	--	< 2	< 2
Foaming Agents (MBAS)	mg/l	33	18	18	16	< 0.05
Total Suspended Solids	mg/l	--	30	--	28	< 1
Nitrate Nitrogen	mg/l N	--	0.01	--	0.01	< 0.01
Nitrite Nitrogen	mg/l N	--	< 0.01	--	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	--	78	--	77	< 0.05
Total Phosphorus	mg/l P	--	10	--	9.4	< 0.01
Total Organic Carbon	mg/l	--	190	--	184	< 1
BOD (5 Day @ 20°C)	mg/l	--	409	--	419	< 1
Ammonia Nitrogen	mg/l N	--	61	--	64	< 0.01
Organic Nitrogen	mg/l N	--	17	--	13	< 0.05
Total Hardness	mg/l $CaCO_3$	--	180	--	180	< 2

Francis I. Daniels
Laboratory Director

FCEL 96 JUN 9508-86

AYRES ASSOCIATES

Engineers/Environmental Scientists
3901 Coconut Palm Drive, Suite 100
Tampa, FL 33619
Telephone: (813) 628-0742

CHAIN OF CUSTODY RECORD

PROJECT CODE: 4151 | SAMPLED BY:

PROJECT NAME:

SAMPLE FIELD ID	LAB ID	COLLECTION DATE/TIME	SAMPLE MATERIAL	NUMBER OF CONTAINERS	FIELD READINGS PH	COND	TEMP	ANALYSES REQUESTED	COMMENTS
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME
[illegible]	8/16 1621	PDS	[illegible]	8/16 1625
RELINQUISHED BY (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME
[illegible]	8/16/93 1715	PDS	[illegible]	08/16/93 1715

REMARKS PDS ISOL 37184/1

PROJECT FILE COPY: WHITE CHAIN OF CUSTODY COPY: YELLOW LABORATORY FILE COPY: PINK LABORATORY CHECK IN COPY: GOLD

Laboratory: Please Return Gold Copy When Samples Are Checked In.

AUG 16 17 15

First Coast Environmental Laboratory, Inc.
Sample Receiving Report

Date Rec'd: 8/16/97 Lab ID No.: 9708-96

Client Name: Ayres & Associates Project Name: St Johns CDA

Received By: BCS 02320

How were the Samples delivered to the laboratory?

Client Cooler ✓ FCEL Cooler o Box o Other o

Hand Delivery ✓ Shipper ✓ Name: PDS ROL 37184/

Any Descrepancies in this section must be explained below and referred to a laboratory management individual for resolution

		YES	NO
1.	Were custody papers included with samples?	✓	o
2.	Were custody papers properly filled out? (ink, signed, labels match?)	✓	o
3.	Were samples in direct contact with Wet Ice?	✓	o
4.	Did all samples arrive intact/not leaking?	✓	o
5.	Were all bottle labels complete? (Sample #, Date, Station, Signed, Anal./Preserv.)	✓	o
6.	Were Correct containers used for requested analyses?	✓	o
7.	Were proper preservation techniques indicated?	✓	o
8.	Were samples received with adequate holding time?	o	o
9.	VOA/VOC Containers checked for bubbles?		o
	Present o Absent o NA o		
10.	Were samples accepted in lab?		
	Accepted ✓ Held for Management o Rejected o		

Comments: Samples to be sent to Holding time prior discussion with Jeff of Ayres & Assoc. To be done anyway (BCS)

Actions taken:

Lab Management notified: _____ Date/Time _____

Client Contacted: _____ By: _____

_____ _____

_____ _____

Final Resolution:

_____

_____

FIRST COAST ENVIRONMENTAL LABORATORY, INC.

August 19, 1993

Ayres Associates
Engineers / Environmental Scientists
3901 Coconut Palm Drive - Suite 100
Tampa, FL 33619

Attn: Jeff Rawles

Reference: FCEL Lab #9308-103
Sample collected 1455 hr. on 8-17-93
Sample received 1612 hr. on 8-17-93
(1) Project Code 4155.1

PARAMETER		# 1		DATE/TIME	ANALYST
Fecal Coliform	#/100 ml	1.2 x 10^6 **	Set/	8-18/1300	AWW
			Off	8-19/1330	AWW

Note: ** Samples to be out of holding time per prior dissussion with Jeff of Ayres & Assoc.
Samples should be done anyway.

Respectfully submitted:

Adolph W. Wollitz
Laboratory Director
FHRS Lab #E82102
FHRS Lab #82110
EPA #FL062
DER Comp QAPP # 870222G

AWW/tb

8818 Arlington Expressway • Jacksonville, Florida 32211
(904) 725-4847 • Fax (904) 725-2215

AYRES ASSOCIATES
Engineers/Environmental Scientists
3901 Coconut Palm Drive, Suite 100
Tampa, FL 33619
Telephone: (813) 628-0742

9308-103 First Coast Environmental

CHAIN OF CUSTODY RECORD

PROJECT CODE: 4155.10			SAMPLED BY: JAR/KGH					ANALYSES REQUESTED	
PROJECT NAME: SPA - St. Johns Co.									
SAMPLE FIELD ID	LAB ID	COLLECTION DATE/TIME	SAMPLE MATERIAL	NUMBER OF CONTAINERS	FIELD READINGS PH	COND	TEMP	Fecal Coli	COMMENTS
STE-3		8/17/93 1455	H_2O	3				✓	

RELINQUISHED BY (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME
[signature]	8/17/93 1525	PDS	[signature] (904)	8/17 1335
		PDS	[signature]	8/17 1612

REMARKS PDS BOL 372059

PROJECT FILE COPY: WHITE CHAIN OF CUSTODY COPY: YELLOW LABORATORY FILE COPY: PINK LABORATORY CHECK IN COPY: GOLD

Laboratory : Please Return Gold Copy When Samples Are Checked In.

AUG 19 1993

First Coast Environmental Laboratory, Inc.
Sample Receiving Report

Date Rec'd: 8-17-93 Lab ID No.: 938-108

Client Name: Ayres Assoc. Project Name: 4/100.10

Received By: [illegible]

02279

How were the Samples delivered to the laboratory?

Client Cooler ✓ FCEL Cooler o Box o Other o

Hand Delivery ✓ Shipper ✓ Name: PDS [illegible] 372059

Any Descrepancies in this section must be explained below and referred to a laboratory management individual for resolution

		YES	NO
1.	Were custody papers included with samples?	✓	o
2.	Were custody papers properly filled out? (ink, signed, labels match?)	✓	o
3.	Were samples in direct contact with Wet Ice?	✓	o
4.	Did all samples arrive intact/not leaking?	✓	o
5.	Were all bottle labels complete? (Sample #, Date, Station, Signed, Anal./Preserv.)	✓	o
6.	Were Correct containers used for requested analyses?	✓	o
7.	Were proper preservation techniques indicated?	✓	o
8.	Were samples received with adequate holding time?	✓ (circled)	o
9.	VOA/VOC Containers checked for bubbles? Present o Absent o	o N/A	o
10.	Were samples accepted in lab? Accepted ✓ Held for Management o Rejected o		

Comments: Sample holding time not observed per Jeff of Ayres Assoc. [illegible] 8/18/93 [illegible]

Actions taken:

Lab Management notified: ____________ Date/Time ____________

Client Contacted: ____________ By: ____________

Final Resolution:

FIRST COAST ENVIRONMENTAL LABORATORY, INC.

August 20, 1993

Ayres Associates
Engineers / Environmental Scientists
3901 Coconut Palm Drive - Suite 100
Tampa, FL 33619

Attn: Jeff Rawles

Reference: FCEL Lab #9308-121
Sample collected 1445 hr. on 8-18-93
Sample received 1040 hr. on 8-19-93
Project Code 4155.1
(1) Equipment Blank
(2) STE- 4
(3) STE -8

PARAMETER		# 1	# 2	# 3		DATE/TIME	ANALYST
Fecal Coliform	#/100 ml	8	3.0×10^4	6.8×10^3	Set/	8-19/1330	AWW
					Off	8-20/1330	AWW

Note: ** Samples to be out of holding time per prior dissussion with Jeff of Ayres & Assoc. Samples should be done anyway.

Respectfully submitted:

Adolph W. Wollitz
Laboratory Director
FHRS Lab #E82102
FHRS Lab #82110
EPA #FL062
OER Comp QAPP # 870222G

AWW/tb

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AYRES ASSOCIATES

Engineers/Environmental Scientists
3901 Coconut Palm Drive, Suite 100
Tampa, FL 33619
Telephone: (813) 628-0742

First Coast Environmental

CHAIN OF CUSTODY RECORD

9308-121
(1-3)

PROJECT CODE: 415110 | SAMPLED BY: CGV. JAZ

PROJECT NAME: SDA - St. Johns Co.

SAMPLE FIELD ID	LAB ID	COLLECTION DATE/TIME	SAMPLE MATERIAL	NUMBER OF CONTAINERS	FIELD READINGS PH	COND	TEMP	ANALYSES REQUESTED (Fecal)	COMMENTS
Equipment Blank		8/18 1445	H2O	3	7.1	1050	28°C		
STE-4		8/18 1445	H2O	3	7.1	1050	28°C		
STE-9		8/18 1445	H2O	3	7.1	1050	28°C		

RELINQUISHED BY (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME
[signature]	8/19 0730			
RELINQUISHED BY (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME

REMARKS

PROJECT FILE COPY: WHITE CHAIN OF CUSTODY COPY: YELLOW LABORATORY FILE COPY: PINK LABORATORY CHECK IN COPY: GOLD

Laboratory : Please Return Gold Copy When Samples Are Checked In.

AUG 10 1993

First Coast Environmental Laboratory, Inc.
Sample Receiving Report

Date Rec'd: 2-19 [illegible] Lab ID No.: [illegible]-131

Client Name: [illegible] Project Name: ______

Received By: DW

02342

How were the Samples delivered to the laboratory?

Client Cooler ✓ FCEL Cooler o Box o Other o

Hand Delivery o Shipper o Name: ______

Any Descrepancies in this section must be explained below and referred to a laboratory management individual for resolution

		YES	NO
1.	Were custody papers included with samples?	✓	o
2.	Were custody papers properly filled out? (ink, signed, labels match?)	✓	o
3.	Were samples in direct contact with Wet Ice?	✓	o
4.	Did all samples arrive intact/not leaking?	✓	o
5.	Were all bottle labels complete? (Sample #, Date, Station, Signed, Anal./Preserv.)	✓	o
6.	Were Correct containers used for requested analyses?	✓	o
7.	Were proper preservation techniques indicated?	✓	o
8.	Were samples received with adequate holding time?	✓	o
9.	VOA/VOC Containers checked for bubbles? Present o Absent o	o	o
10.	Were samples accepted in lab? Accepted ✓ Held for Management o Rejected o		

Comments: ______

Actions taken:

Lab Management notified: ______ Date/Time ______

Client Contacted: ______ By: ______

Final Resolution: ______

FIRST COAST ENVIRONMENTAL LABORATORY, INC.

August 20, 1993

Ayres Associates
Engineers / Environmental Scientists
3901 Coconut Palm Drive - Suite 100
Tampa, FL 33619

Attn: Jeff Rawles

Reference: FCEL Lab #9308-132
Sample collected 1400 hr. on 8-19-93
Sample received 1548 hr. on 8-19-93
(1) Project Code 4155.1

PARAMETER		# 1		DATE/TIME	ANALYST
Fecal Coliform	#/100 ml	1.3×10^{6}	Set/	8-19/1330	AWW
			Off	8-20/1300	AWW

Respectfully submitted:

Adolph W. Wollitz

Adolph W. Wollitz
Laboratory Director
FHRS Lab #E82102
FHRS Lab #82110
EPA #FL062
DER Comp QAPP # 870222G

AWW/tb

? #1, #2, #3
why order of mag. between 11 & 8 - 10^6 - 10^5

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AYRES ASSOCIATES

1308-132

First Coast Environmental

Engineers/Environmental Scientists
3901 Coconut Palm Drive, Suite 100
Tampa, FL 33619
Telephone: (813) 628-0742

CHAIN OF CUSTODY RECORD

PROJECT CODE: 4155.10 | SAMPLED BY: JAR/LGH

PROJECT NAME: SDA - St. Johns Co

SAMPLE FIELD ID	LAB ID	COLLECTION DATE/TIME	SAMPLE MATERIAL	NUMBER OF CONTAINERS	FIELD READINGS PH	COND	TEMP	ANALYSES REQUESTED (FCAC)	COMMENTS
STE-5		8/19-1400	H_2O	2	7.3	1050	28°C		

RELINQUISHED BY (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME
[signature]	8/19/93 1430			
RELINQUISHED BY (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME

REMARKS

PROJECT FILE COPY: WHITE · CHAIN OF CUSTODY COPY: YELLOW · LABORATORY FILE COPY: PINK · LABORATORY CHECK IN COPY: GOLD

Laboratory : Please Return Gold Copy When Samples Are Checked In.

15 of 15

First Coast Environmental Laboratory, Inc.
Sample Receiving Report

Date Rec'd: _____ Lab ID No.: _____

Client Name: _____ Project Name: _____

Received By: _____ 02353

How were the Samples delivered to the laboratory?

Client Cooler ○ FCEL Cooler ○ Box ○ Other ○

Hand Delivery ○ Shipper ○ Name: _____

Any Descrepancies in this section must be explained below and referred to a laboratory management individual for resolution

	YES	NO
1. Were custody papers included with samples?	○	○
2. Were custody papers properly filled out? (ink, signed, labels match?)	○	○
3. Were samples in direct contact with Wet Ice?	○	○
4. Did all samples arrive intact/not leaking?	○	○
5. Were all bottle labels complete? (Sample #, Date, Station, Signed, Anal./Preserv.)	○	○
6. Were Correct containers used for requested analyses?	○	○
7. Were proper preservation techniques indicated?	○	○
8. Were samples received with adequate holding time?	○	○
9. VOA/VOC Containers checked for bubbles?	○	○

Present ○ Absent ○

10. Were samples accepted in lab?

Accepted ○ Held for Management ○ Rejected ○

Comments: _____

Actions taken:

Lab Management notified: _____ Date/Time _____

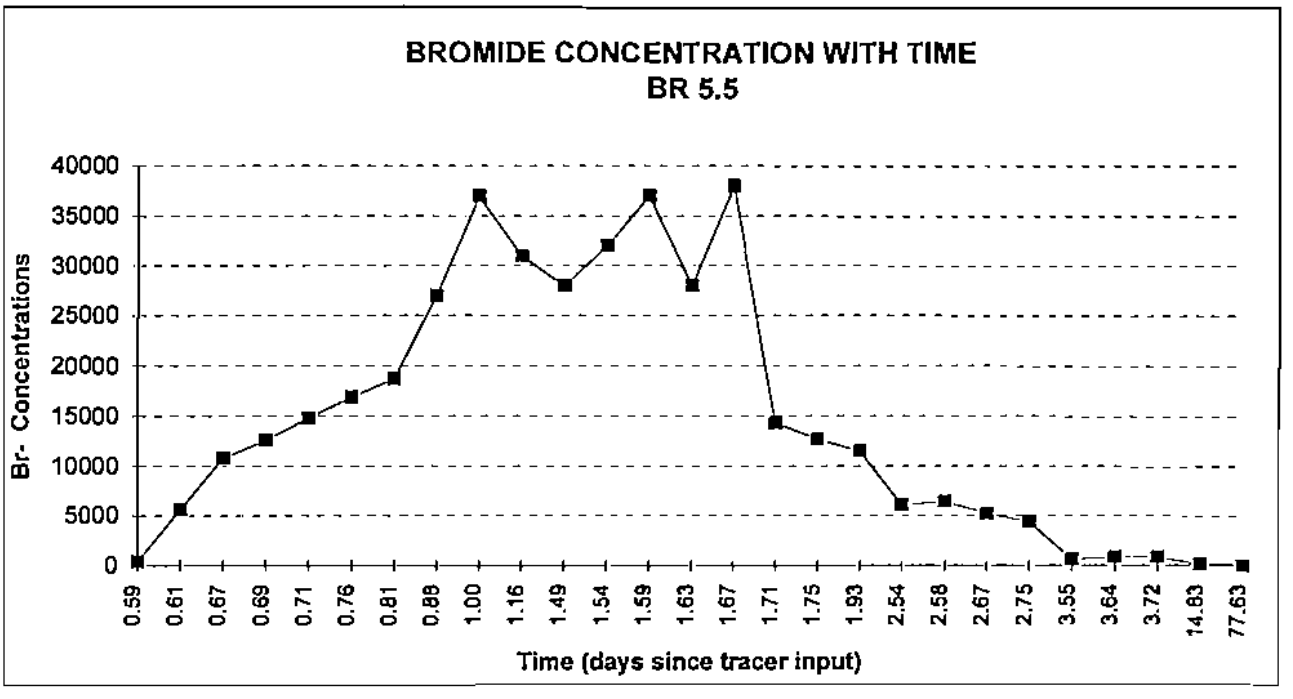
Client Contacted: _____ By: _____

Final Resolution: _____

APPENDIX B

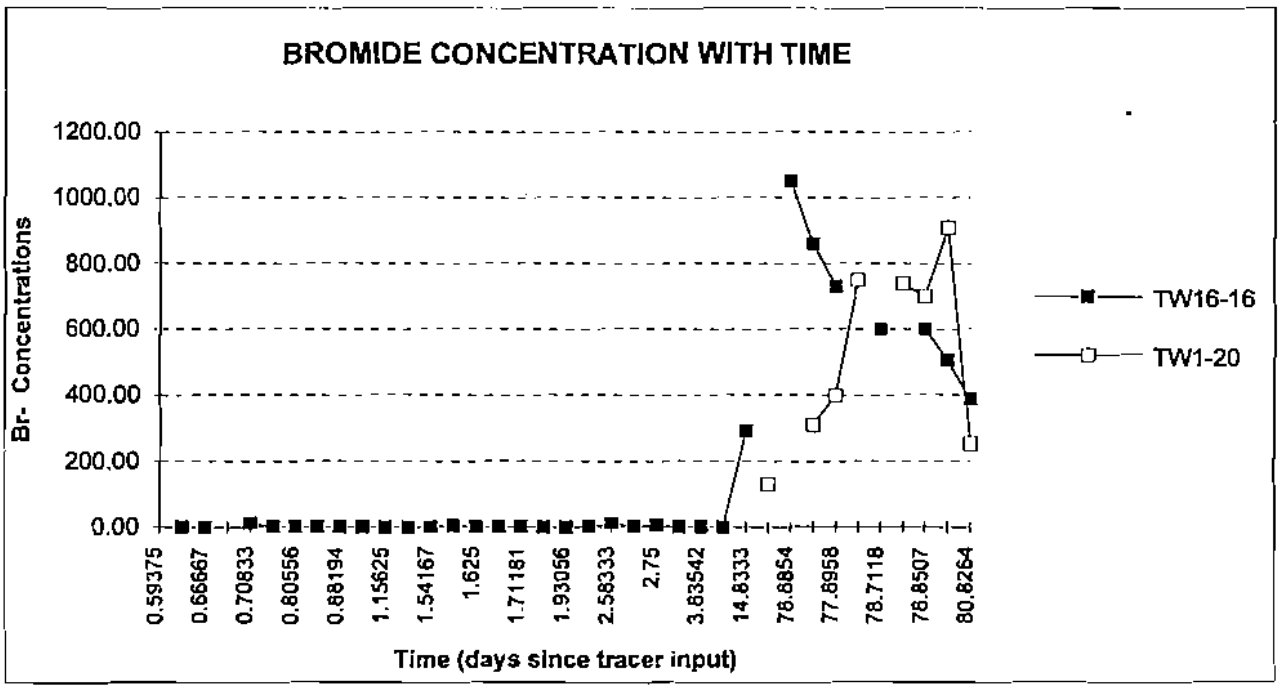
Bromide Tracer Analytical Results

FIGURE B-1. BROMIDE CONCENTRATION CURVE BELOW INPUT POINT (BR 5.5)



BROM5-5.XLC

FIGURE B-2. BROMIDE CONCENTRATION CURVES AT TW16-6' AND TW1-20



BRCON2.XLC

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

September 30, 1993
Project No. 06010

LABORATORY REPORT

Project Description: Ayres Proj. SDA - Bromide Tracer
Sample Description: 01 - Bromide Tracer
02 - Bromide Tracer Duplicate
Date Received: 9/15/93

Parameter	Units	(01) Bromide Tracer	(02) Bromide Tracer Dup.	Method Blank
Bromide	mg/l	400,000	420,000	< 0.1

Francis I. Daniels
Laboratory Director

Environmental Lab No. E84129

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Proj. SDA - Bromide Tracer

Parameter	Method	Detection Limit		Analysis Date
Bromide	SM 4500-Br B	0.1	mg/l	9/30/93

Francis I. Daniels
Laboratory Director

APPENDIX C

Groundwater and Wastewater Analytical Results
November 3 - 5, 1993

FIRST COAST ENVIRONMENTAL LABORATORY, INC.

August 18, 1993

Ayres Associates
Engineers / Environmental Scientists
3901 Coconut Palm Drive - Suite 100
Tampa, FL 33619

Attn: Jeff Rawles

Reference: FCEL Lab #9308-96
Sample collected 1430 hr. on 8-16-93
Sample received 1715 hr. on 8-16-93
(i) Project Code 4155.1

PARAMETER		# 1		DATE/TIME	ANALYST
Fecal Coliform	#/100 ml	6.6×10^6 **	Set/	8-17/1310	AWW
			Dff	8-18/1300	AWW

Note: ** Samples to be out of holding time per prior dissussion with Jeff of Ayres & Assoc.
Samples should be done anyway.

Respectfully submitted:

Adolph W. Wollitz
Laboratory Director
FHRS Lab #E82102
FHRS Lab #82110
EPA #FL062
DER Comp QAPP # 870222G

AWW/tb

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SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

November 30, 1993
Project No. 06174

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 01 - Water, STE-9, sampled 11/3/93, 1245
02 - Water, Tap/SDA, sampled 11/3/93, 1630
03 - Water, TW13-20, sampled 11/3/93, 1700
04 - Water, TW14-6, sampled 11/3/93, 1630
Date Received: 11/4/93, 1035

Parameter	Units	(01) STE-9	(02) Tap/SDA	(03) TW13-20	(04) TW14-6	Method Blank
Chloride	mg/l	64	9.5	10	12	< 1
Sulfate	mg/l	4	< 2	38	4	< 2
Foaming Agents (MBAS)	mg/l	28	< 0.05	< 0.05	0.12	< 0.05
Total Suspended Solids	mg/l	32	--	--	--	< 1
Nitrate Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nitrite Nitrogen	mg/l N	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	75	0.10	0.16	1.1	< 0.05
Total Phosphorus	mg/l P	8.7	0.05	< 0.01	0.43	< 0.01
Total Organic Carbon	mg/l	82	< 1	1.5	6.1	< 1
BOD (5 Day @ 20°C)	mg/l	199	--	--	--	< 1
Ammonia Nitrogen	mg/l N	69	0.09	0.12	0.67	< 0.01
Organic Nitrogen	mg/l N	6	< 0.05	< 0.05	0.43	< 0.05
Total Hardness	mg/l $CaCO_3$	160	160	99	35	< 2

Francis I. Daniels
Laboratory Director

Environmental Lab No. E84129

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 05 - Water, TW14-12, sampled 11/3/93, 1600
06 - Water, TW14-20, sampled 11/3/93, 1545
07 - Water, TW15-6, sampled 11/3/93, 1515
08 - Water, TW15-12, sampled 11/3/93, 1445
Date Received: 11/4/93, 1035

Parameter	Units	(05) TW14-12	(06) TW14-20	(07) TW15-6	(08) TW15-12
Chloride	mg/l	16	11	13	43
Sulfate	mg/l	< 2	29	25	17
Foaming Agents (MBAS)	mg/l	0.44	< 0.05	0.10	0.99
Nitrate Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	< 0.01
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	7.4	0.13	3.6	0.83
Total Phosphorus	mg/l P	0.01	0.01	0.32	< 0.01
Total Organic Carbon	mg/l	6.2	1.6	11	10
Ammonia Nitrogen	mg/l N	6.7	0.08	3.0	0.70
Organic Nitrogen	mg/l N	0.7	0.05	0.60	0.13
Total Hardness	mg/l $CaCO_3$	89	93	69	200

Francis I. Daniels
Laboratory Director

Ayres Associates
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Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 09 - Water, TW15-20, sampled 11/3/93, 1345
10 - Water, TW6-6, sampled 11/4/93, 1630
11 - Water, TW6-12, sampled 11/4/93, 1600
12 - Water, TW6-20, sampled 11/4/93, 1530
Date Received: 11/4, 1035 (09), 11/5/93, 1015 (10-12)

Parameter	Units	(09) TW15-20	(10) TW6-6	(11) TW6-12	(12) TW6-20
Chloride	mg/l	13	52	36	26
Sulfate	mg/l	23	84	< 2	60
Foaming Agents (MBAS)	mg/l	< 0.05	1.5	0.20	< 0.05
Nitrate Nitrogen	mg/l N	< 0.01	19	1.2	< 0.01
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	0.21	< 0.01
Total Kjeldahl Nitrogen	mg/l N	0.12	45	0.39	0.19
Total Phosphorus	mg/l P	< 0.01	4.7	0.06	< 0.01
Total Organic Carbon	mg/l	1.3	12	5.8	1.2
Ammonia Nitrogen	mg/l N	0.08	44	0.07	0.11
Organic Nitrogen	mg/l N	< 0.05	1.0	0.32	0.08
Total Hardness	mg/l $CaCO_3$	99	120	130	75

Francis I. Daniels
Laboratory Director

Ayres Associates
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Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 13 - Water, TW7-6, sampled 11/4/93, 1500
14 - Water, TW7-12, sampled 11/4/93, 1430
15 - Water, TW7-20, sampled 11/4/93, 1400
16 - Water, TW11-6, sampled 11/4/93, 1700
Date Received: 11/5/93, 1015

Parameter	Units	(13) TW7-6	(14) TW7-12	(15) TW7-20	(16) TW11-6
Chloride	mg/l	62	20	16	100
Sulfate	mg/l	83	< 2	57	140
Foaming Agents (MBAS)	mg/l	0.66	0.09	< 0.05	0.93
Nitrate Nitrogen	mg/l N	1.8	< 0.01	< 0.01	13
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	0.01
Total Kjeldahl Nitrogen	mg/l N	27	0.24	0.14	17
Total Phosphorus	mg/l P	4.1	< 0.01	0.03	0.32
Total Organic Carbon	mg/l	9.8	5.1	< 1	7.9
Ammonia Nitrogen	mg/l N	27	0.12	0.07	15
Organic Nitrogen	mg/l N	< 0.05	0.12	0.07	2.0
Total Hardness	mg/l $CaCO_3$	80	100	59	310

Francis I. Daniels
Laboratory Director

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 17 - Water, TW8-6, sampled 11/4/93, 1330
18 - Water, TW8-12, sampled 11/4/93, 1300
19 - Water, TW8-20, sampled 11/4/93, 1145
20 - Water, TW9-6, sampled 11/4/93, 1115
Date Received: 11/5/93, 1050

Parameter	Units	(17) TW8-6	(18) TW8-12	(19) TW8-20	(20) TW9-6
Chloride	mg/l	49	9.8	24	45
Sulfate	mg/l	50	< 2	66	19
Foaming Agents (MBAS)	mg/l	1.3	< 0.05	< 0.05	1.2
Nitrate Nitrogen	mg/l N	1.3	< 0.01	< 0.01	< 0.01
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	11	0.14	0.30	29
Total Phosphorus	mg/l P	2.5	0.01	0.01	2.5
Total Organic Carbon	mg/l	12	2.9	1.2	11
Ammonia Nitrogen	mg/l N	11	0.05	0.10	29
Organic Nitrogen	mg/l N	< 0.05	0.09	0.20	< 0.05
Total Hardness	mg/l $CaCO_3$	110	75	83	120

Francis I. Daniels
Laboratory Director

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 21 - Water, TW9-12, sampled 11/4/93, 1050
22 - Water, TW9-20, sampled 11/4/93, 1020
23 - Water, TW12-6, sampled 11/4/93, 0950
24 - Water, TW13-6, sampled 11/4/93, 0900
Date Received: 11/5/93, 1050

Parameter	Units	(21) TW9-12	(22) TW9-20	(23) TW12-6	(24) TW13-6
Chloride	mg/l	16	18	52	2.1
Sulfate	mg/l	< 2	22	< 2	4
Foaming Agents (MBAS)	mg/l	0.21	< 0.05	0.54	< 0.05
Nitrate Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	0.25
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	0.16	0.16	2.5	0.86
Total Phosphorus	mg/l P	< 0.01	< 0.01	0.39	0.85
Total Organic Carbon	mg/l	5.2	1.3	9.9	4.6
Ammonia Nitrogen	mg/l N	< 0.01	0.07	2.5	0.03
Organic Nitrogen	mg/l N	0.16	0.09	< 0.05	0.83
Total Hardness	mg/l $CaCO_3$	100	47	240	45

Francis I. Daniels
Laboratory Director

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Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 25 - Water, TW13-12, sampled 11/4/93, 0825
26 - Water, WP6-6, sampled 11/4/93, 1145
27 - Water, TW1-6, sampled 11/5/93, 1400
28 - Water, TW1-12, sampled 11/5/93, 1330
Date Received: 11/5, 1050 (25,26), 11/6/93, 0915 (27,28)

Parameter	Units	(25) TW13-12	(26) WP6-6	(27) TW1-6	(28) TW1-12
Chloride	mg/l	37	49	51	250
Sulfate	mg/l	10	20	54	36
Foaming Agents (MBAS)	mg/l	1.2	1.3	0.44	0.54
Nitrate Nitrogen	mg/l N	< 0.01	< 0.01	43	14
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	0.01	0.29
Total Kjeldahl Nitrogen	mg/l N	15	31	2.6	0.36
Total Phosphorus	mg/l P	0.09	2.3	6.8	< 0.01
Total Organic Carbon	mg/l	11	9.9	5.7	6.1
BOD (5 Day @ 20°C)	mg/l	--	--	< 1	--
Ammonia Nitrogen	mg/l N	16	30	3.2	0.12
Organic Nitrogen	mg/l N	< 0.05	1.0	< 0.05	0.24
Total Hardness	mg/l $CaCO_3$	100	93	210	260

Francis I. Daniels
Laboratory Director

Ayres Associates
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3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 29 - Water, TW1-20, sampled 11/5/93, 1330
30 - Water, TW2-6, sampled 11/5/93, 1245
31 - Water, TW2-12, sampled 11/5/93, 1315
32 - Water, TW2-20, sampled 11/5/93, 1340
Date Received: 11/6/93 , 0915

Parameter	Units	(29) TW1-20	(30) TW2-6	(31) TW2-12	(32) TW2-20
Chloride	mg/l	230	52	40	21
Sulfate	mg/l	91	110	36	100
Foaming Agents (MBAS)	mg/l	< 0.05	1.8	0.32	< 0.05
Nitrate Nitrogen	mg/l N	3.1	37	17	< 0.01
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	2.4	< 0.01
Total Kjeldahl Nitrogen	mg/l N	0.32	36	0.61	0.21
Total Phosphorus	mg/l P	< 0.01	4.6	< 0.01	0.02
Total Organic Carbon	mg/l	2.1	11	4.7	2.3
BOD (5 Day @ 20°C)	mg/l	--	6.2	--	--
Ammonia Nitrogen	mg/l N	0.22	36	< 0.01	0.14
Organic Nitrogen	mg/l N	0.10	< 0.05	0.61	0.07
Total Hardness	mg/l $CaCO_3$	130	220	210	85

Francis I. Daniels
Laboratory Director

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 33 - Water, TW3-6, sampled 11/5/93, 1300
34 - Water, TW3-12, sampled 11/5/93, 1200
35 - Water, TW3-20, sampled 11/5/93, 1130
36 - Water, TW4-6, sampled 11/5/93, 1030
Date Received: 11/6/93, 0915

Parameter	Units	(33) TW3-6	(34) TW3-12	(35) TW3-20	(36) TW4-6
Chloride	mg/l	46	44	24	49
Sulfate	mg/l	38	52	100	95
Foaming Agents (MBAS)	mg/l	0.14	0.75	< 0.05	0.65
Nitrate Nitrogen	mg/l N	43	19	< 0.01	39
Nitrite Nitrogen	mg/l N	0.13	0.49	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	0.59	0.76	0.25	29
Total Phosphorus	mg/l P	7.9	0.22	< 0.01	6.9
Total Organic Carbon	mg/l	4.6	8.0	2.5	6.0
BOD (5 Day @ 20°C)	mg/l	< 1	--	--	--
Ammonia Nitrogen	mg/l N	0.07	0.03	0.13	30
Organic Nitrogen	mg/l N	0.52	0.73	0.12	< 0.05
Total Hardness	mg/l $CaCO_3$	180	130	83	160

Francis I. Daniels
Laboratory Director

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3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 37 - Water, TW4-12, sampled 11/5/93, 1000
38 - Water, TW4-20, sampled 11/5/93, 0930
39 - Water, TW5-6, sampled 11/5/93, 0900
40 - Water, TW5-12 sampled 11/5/93, 0830
Date Received: 11/6/93, 0915

Parameter	Units	(37) TW4-12	(38) TW4-20	(39) TW5-6	(40) TW5-12
Chloride	mg/l	46	23	41	46
Sulfate	mg/l	15	66	56	25
Foaming Agents (MBAS)	mg/l	1.9	< 0.05	0.26	2.6
Nitrate Nitrogen	mg/l N	< 0.01	< 0.01	46	< 0.01
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	0.35	0.21	24	0.35
Total Phosphorus	mg/l P	0.10	< 0.01	6.1	0.18
Total Organic Carbon	mg/l	13	1.6	4.8	14
Ammonia Nitrogen	mg/l N	0.07	0.11	24	0.04
Organic Nitrogen	mg/l N	0.28	0.10	< 0.05	0.31
Total Hardness	mg/l $CaCO_3$	180	43	140	170

Francis I. Daniels
Laboratory Director

Ayres Associates
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Sabal Industrial Park - Suite 100
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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 41 - Water, TW5-20, sampled 11/5/93, 0800
42 - Water, TW10-6, sampled 11/5/93, 1100
43 - Water, TW16-6, sampled 11/5/93, 1210
44 - Water, TW16-12, sampled 11/5/93, 1200
Date Received: 11/6/93, 0915

Parameter	Units	(41) TW5-20	(42) TW10-6	(43) TW16-6	(44) TW16-12
Chloride	mg/l	11	48	300	41
Sulfate	mg/l	2	45	47	44
Foaming Agents (MBAS)	mg/l	< 0.05	0.25	0.15	0.54
Nitrate Nitrogen	mg/l N	< 0.01	33	59	7.1
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	0.15	2.7
Total Kjeldahl Nitrogen	mg/l N	0.11	22	1.0	0.52
Total Phosphorus	mg/l P	0.05	4.6	16	0.29
Total Organic Carbon	mg/l	1.9	4.7	8.9	6.8
BOD (5 Day @ 20°C)	mg/l	--	--	< 1	--
Ammonia Nitrogen	mg/l N	0.04	21	0.08	0.03
Organic Nitrogen	mg/l N	0.07	1.0	0.92	0.49
Total Hardness	mg/l $CaCO_3$	22	120	120	100

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 45 - Water, TW16-20, sampled 11/5/93, 1125
46 - Water, TW17-6, sampled 11/5/93, 1055
47 - Water, TW17-12, sampled 11/5/93, 1025
48 - Water, TW17-20, sampled 11/5/93, 1005
Date Received: 11/6/93, 0915

Parameter	Units	(45) TW16-20	(46) TW17-6	(47) TW17-12	(48) TW17-20
Chloride	mg/l	28	46	38	29
Sulfate	mg/l	120	49	39	130
Foaming Agents (MBAS)	mg/l	< 0.05	0.10	0.63	< 0.05
Nitrate Nitrogen	mg/l N	< 0.01	52	8.9	0.02
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	2.1	< 0.01
Total Kjeldahl Nitrogen	mg/l N	0.14	7.1	0.56	0.11
Total Phosphorus	mg/l P	< 0.01	5.3	< 0.01	< 0.01
Total Organic Carbon	mg/l	1.6	4.4	6.4	1.4
BOD (5 Day @ 20°C)	mg/l	--	< 1	--	--
Ammonia Nitrogen	mg/l N	0.04	8.4	0.02	0.02
Organic Nitrogen	mg/l N	0.10	< 0.05	0.54	0.09
Total Hardness	mg/l $CaCO_3$	110	180	67	110

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SOA, St. Johns County
Sample Description: 49 - Water, TW18-6, sampled 11/5/93, 0935
50 - Water, TW18-12, sampled 11/5/93, 0910
51 - Water, TW18-20, sampled 11/5/93, 0845
52 - Water, WP10-6, sampled 11/5/93, 1100
Date Received: 11/6/93, 0915

Parameter	Units	(49) TW18-6	(50) TW18-12	(51) TW18-20	(52) WP10-6
Chloride	mg/l	50	40	28	50
Sulfate	mg/l	36	44	130	90
Foaming Agents (MBAS)	mg/l	0.15	0.81	< 0.05	0.52
Nitrate Nitrogen	mg/l N	50	8.7	< 0.01	37
Nitrite Nitrogen	mg/l N	< 0.01	0.64	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	7.3	0.54	0.11	28
Total Phosphorus	mg/l P	2.2	0.02	< 0.01	6.3
Total Organic Carbon	mg/l	4.0	7.1	1.5	5.9
BOD (5 Day @ 20°C)	mg/l	< 1	--	--	--
Ammonia Nitrogen	mg/l N	9.1	0.03	0.04	30
Organic Nitrogen	mg/l N	< 0.05	0.51	0.07	< 0.05
Total Hardness	mg/l $CaCO_3$	190	91	110	160

Francis I. Daniels
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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 53 - Water, WP7-12, sampled 11/5/93, 1230
54 - Water, WP8-12, sampled 11/5/93, 1400
55 - Water, WP9-12, sampled 11/5/93, 1400
56 - Water, BW1-5, sampled 11/5/93, 1455
Date Received: 11/6/93, 0915

Parameter	Units	(53) WP7-12	(54) WP8-12	(55) WP9-12	(56) BW1-5
Chloride	mg/l	38	40	250	12
Sulfate	mg/l	38	35	38	12
Foaming Agents (MBAS)	mg/l	0.57	0.27	0.46	< 0.05
Nitrate Nitrogen	mg/l N	8.9	18	15	0.17
Nitrite Nitrogen	mg/l N	2.1	2.4	0.03	< 0.01
Total Kjeldahl Nitrogen	mg/l N	0.59	0.49	0.37	0.16
Total Phosphorus	mg/l P	0.17	< 0.01	< 0.01	< 0.01
Total Organic Carbon	mg/l	6.3	4.6	7.0	3.1
Ammonia Nitrogen	mg/l N	0.02	0.03	0.12	0.03
Organic Nitrogen	mg/l N	0.57	0.46	0.25	0.13
Total Hardness	mg/l $CaCO_3$	73	210	260	22

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 57 - Water, BW1-10, sampled 11/5/93, 1440
58 - Water, BW1-15, sampled 11/5/93, 1425
59 - Water, BW1-20, sampled 11/5/93, 1415
60 - Equipment Blank, sampled 11/5/93, 0730
Date Received: 11/6/93, 0915

Parameter	Units	(57) BW1-10	(58) BW1-15	(59) BW1-20	(60) Equip. Blank 11/5, 0730
Chloride	mg/l	3	29	32	< 1
Sulfate	mg/l	16	56	120	< 2
Foaming Agents (MBAS)	mg/l	< 0.05	< 0.05	< 0.05	< 0.05
Nitrate Nitrogen	mg/l N	< 0.01	< 0.01	0.33	< 0.01
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	0.29	0.18	0.10	< 0.05
Total Phosphorus	mg/l P	< 0.01	< 0.01	< 0.01	< 0.01
Total Organic Carbon	mg/l	5.9	1.6	1.4	< 1
Ammonia Nitrogen	mg/l N	0.10	0.04	0.06	0.02
Organic Nitrogen	mg/l N	0.19	0.14	0.04	< 0.05
Total Hardness	mg/l $CaCO_3$	35	65	110	< 2

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
Sample Description: 61 - Equipment Blank, sampled 11/5/93, 1600
62 - Equipment Blank A, sampled 11/5/93, 1615
63 - Spiked Blank, sampled 11/5/93, 1500
Date Received: 11/6/93, 0915

Parameter	Units	(61) Equip. Blank 11/5, 1600	(62) Equip. Blank A	(63) Spiked Blank	Method Blank
Chloride	mg/l	< 1	< 1	--	< 1
Sulfate	mg/l	< 2	< 2	--	< 2
Foaming Agents (MBAS)	mg/l	< 0.05	< 0.05	0.28	< 0.05
Total Suspended Solids	mg/l	--	--	--	< 1
Nitrate Nitrogen	mg/l N	< 0.01	< 0.01	--	< 0.01
Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	--	< 0.01
Total Kjeldahl Nitrogen	mg/l N	< 0.05	< 0.05	--	< 0.05
Total Phosphorus	mg/l P	< 0.01	< 0.01	--	< 0.01
Total Organic Carbon	mg/l	< 1	< 1	--	< 1
BOD (5 Day @ 20°C)	mg/l	--	--	--	< 1
Ammonia Nitrogen	mg/l N	0.02	0.01	--	< 0.01
Organic Nitrogen	mg/l N	< 0.05	< 0.05	--	< 0.05
Total Hardness	mg/l $CaCO_3$	< 2	< 2	--	< 2

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County

Parameter	Method	Detection Limit		Analysis Date
Chloride	EPA 325.2	1	mg/l	11/8/93 (01-09,M/B) 11/11/93 (10-26) 11/12/93 (27-49) 11/17/93 (50-62)
Sulfate	EPA 375.4	2	mg/l	11/9/93 (01-09,M/B) 11/10/93 (10-32) 11/11/93 (33-62)
Foaming Agents (MBAS)	SM 5540 C	0.05	mg/l	11/5/93 (01-26,M/B) 11/6/93 (27-63)
Total Suspended Solids	EPA 160.2	1	mg/l	11/9/93
Nitrate-Nitrite Nitrogen	EPA 353.2	0.01	mg/l N	11/5/93 (01-26,M/B) 11/10/93 (27-62)
Nitrite Nitrogen	EPA 354.1	0.01	mg/l N	11/5/93 (01-16,M/B) 11/6/93 (17-62)
Total Kjeldahl Nitrogen	EPA 351.2	0.05	mg/l N	11/9/93 (01-14,M/B) 11/16/93 (15-29) 11/23/93 (30-62)
Total Phosphorus	EPA 365.2	0.01	mg/l P	11/10/93 (01-14,M/B) 11/18/93 (15-29) 11/23/93 (30-62)

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County

Parameter	Method	Detection Limit		Analysis Date
Total Organic Carbon	EPA 415.1	1	mg/l	11/9/93 (01-54,M/B) 11/10/93 (55-62)
BOD	SM 5210	1	mg/l	11/4/93 (01,M/B) 11/6/93 (27,30,33,43, 46,49)
Ammonia Nitrogen	EPA 350.1	0.01	mg/l N	11/18/93 (01-24,M/B) 11/22/93 (25-62)
Organic Nitrogen	Calc.	0.05	mg/l N	11/18/93 (01-24,M/B) 11/22/93 (25-29) 11/23/93 (30-62)
Total Hardness	SM 2340 C	2	mg/l $CaCO_3$	11/16/93 (01-26,M/B) 11/18/93 (27-42) 11/19/93 (43-60) 11/22/93 (61,62)

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
QC Description: Matrix Spike/Matrix Spike Duplicate Recoveries

Parameter	Sample No. Spiked	Accuracy Mean ± R	Precision RPD	QC Control Limits Accuracy	Precision
Chloride	06174-02	100	1	82-116	0-5
	06174-12	94	0	82-116	0-5
	06174-21	90	0	82-116	0-5
	06174-32	91	1	82-116	0-5
	06174-38	96	2	82-116	0-5
	06174-53	101	1	82-116	0-5
Sulfate	06174-02	110	2	78-131	0-9
	06174-11	117	4	78-131	0-9
	06174-18	118	6	78-131	0-9
	06174-34	103	3	78-131	0-9
	06174-42	116	3	78-131	0-9
	06174-58	79	2	78-131	0-9
Foaming Agents (MBAS)	06174-03	98	1	77-121	0-16
	06174-12	97	1	77-121	0-16
	06174-22	100	1	77-121	0-16
	06174-34	101	2	77-121	0-16
	06174-44	105	5	77-121	0-16
	06174-54	99	2	77-121	0-16
	06174-59	101	1	77-121	0-16
Total Suspended Solids	06174-01	94	3	76-113	0-8
Nitrate Nitrogen	06174-08	105	0	72-128	0-14
	06174-11	105	0	72-128	0-14
	06174-12	95	0	72-128	0-14
	06174-32	104	1	72-128	0-14
	06174-48	101	0	72-128	0-14
	06174-56	105	0	72-128	0-14

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
QC Description: Matrix Spike/Matrix Spike Duplicate Recoveries

Parameter	Sample No. Spiked	Accuracy Mean % R	Precision RPD	QC Control Limits Accuracy	Precision
Nitrite Nitrogen	06174-03	98	0	78-114	0-6
	06174-12	98	1	78-114	0-6
	06174-22	98	0	78-114	0-6
	06174-35	98	0	78-114	0-6
	06174-45	100	0	78-114	0-6
	06174-59	96	0	78-114	0-6
	06174-56	95	2	78-114	0-6
Total Kjeldahl Nitrogen	06174-03	92	4	76-114	0-16
	06174-26	98	3	76-114	0-16
	06174-45	101	1	76-114	0-16
	06174-48	98	4	76-114	0-16
	06174-58	95	0	76-114	0-16
Total Phosphorus	06174-03	83	3	77-118	0-17
	06174-26	100	5	77-118	0-17
	06174-45	95	0	77-118	0-17
	06174-48	93	4	77-118	0-17
	06174-58	91	0	77-118	0-17
Total Organic Carbon	06174-09	95	2	83-109	0-4
	06174-19	96	1	83-109	0-4
	06174-29	92	3	83-109	0-4
	06174-39	95	4	83-109	0-4
	06174-48	99	1	83-109	0-4
	06174-59	98	2	83-109	0-4
BOD (5 Day @ 20°C)	IS02359(11/4)	87	11	63-111	0-41
	06170-03	--	12	63-111	0-41
	IS02370(11/6)	89	1	63-111	0-41
	06177-01	--	6	63-111	0-41

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.10 - SDA, St. Johns County
QC Description: Matrix Spike/Matrix Spike Duplicate Recoveries

Parameter	Sample No. Spiked	Accuracy Mean % R	Precision RPD	QC Control Limits Accuracy	Precision
Ammonia Nitrogen	06174-06	97	0	78-125	0-4
	06174-15	98	0	78-125	0-4
	06174-24	98	1	78-125	0-4
	06174-28	94	1	78-125	0-4
	06174-37	91	0	78-125	0-4
	06174-47	94	1	78-125	0-4
	06174-58	95	2	78-125	0-4
Total Hardness	06174-05	96	1	87-115	0-4
	06174-12	95	0	87-115	0-4
	06174-25	93	2	87-115	0-4
	06174-31	99	1	87-115	0-4
	06174-38	110	0	87-115	0-4
	06174-47	97	0	87-115	0-4
	06174-57	100	2	87-115	0-4

Francis I. Daniels
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SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

CHAIN of CUSTODY RECORD No 7259

Pg. ____ of ____

Client Name AYRES ASSOC.	Phone
Project Name / Location BROMIDE TRACER	Client Proj. No.
Samplers: (Signature)	PARAMETER / CONTAINER DESCRIPTION

SAL Use Only 06010 Proj. No.

Sample Nos.	Sample Description	Date	Time	Matrix (Water, Soil, Other)	Grab or Composite	1 GAL. PLASTIC BROMIDE							No. of Containers (Total each Location)
01	TRACER	—	—	—	—	1							1
Number of Containers (Total each aliquot)						1							1
Item No.						1	2	3	4	5	6	7	8	Total Number of Containers Rec'd.

Item No.	Prepared Containers Relinquished By: Date: Time:	Received: Date: Time:	Seal Intact? Yes No N/A
1	Relinquished: Cycle Air Date: Time:	Received: AIR WHERE AT Date: Time:	Seal Intact? Yes No N/A
1	Relinquished: AIR WHERE AT Date: Time:	Received: B. Butler Date: 9/15/93 Time: 1435	Seal Intact? Yes No (N/A)
	Relinquished: Date: Time:	Received: Date: Time:	Seal Intact? Yes No N/A

Instructions / Remarks
NO C.OF C. RECD W/SAMPLE.

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

CHAIN of CUSTODY RECORD No 8101

Pg ____ of ____

Client Name: Ayres Associates

Phone: 813 628 0742

Project Name / Location: SDA St Johns County

Client Proj. No.: 4155.10

Samplers: (Signature)

PARAMETER / CONTAINER DESCRIPTION

SAL Use Only: C6174

Proj. No.

Sample Nos.	Sample Description	Date	Time	Matrix (Water, Soil, Other)	Grab or Composite	Misc Parameters	Nutrients	TOC						No. of Containers (Total each Location)
29	TW1-20	11/5/93	1330	W		1	1	1						
28	TW1-12	11/5/93	1330	W		1	1	1						
27	TW1-6	11/5/93	1400	W		1	1	1						
55	WP9-12	11/5/93	1400	W		1	1	1						
32	TW2-20	11/5/93	1340	W		1	1	1						
54	WP8-12	11/5/93	1400	W		1	1	1						
59	BW1-20	11/5/93	1415	W		1	1	1						
58	BW1-15	11/5/93	1425	W		1	1	1						
57	BW1-10	11/5/93	1440	W		1	1	1						
56	BW1-5	11/5/93	1455	W		1	1	1						
61	EQUIPMENT BLANK	11/5/93	1600	W		1	1	1						
62	EQUIPMENT BLANK PA	11/5/93	1615	W		1	1	1						
Number of Containers (Total each aliquot)														
Item No.						1	2	3	4	5	6	7	8	Total Number of Containers Rec'd.

Item No.	Relinquished / Prepared Containers Relinquished By:	Received:	Seal Intact?	Instructions / Remarks
PL8455	Kimberly Anderson Date: 10/29/93 Time: 11:35	Date: Time:	Yes No N/A	
1-3	Relinquished: Fastway Courier Date: Time:	Received: Date: Time:	Seal Intact? Yes No N/A	
1-3	Relinquished: Date: 11/6/93 Time: 0915	Received: Date: 11/6/93 Time: 0915	Seal Intact? Yes No (N/A)	
	Relinquished: Date: Time:	Received: Date: Time:	Seal Intact? Yes No N/A	

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

CHAIN of CUSTODY RECORD Nº 8189
Pg ____ of ____

Client Name: Ayres Associates
Phone: (813) 628-0742
Project Name / Location: SDA - St. Johns Co.
Client Proj. No. 4155.10
Samplers: (Signature) [signature]

SAL Use Only: 06174
Proj. No.

PARAMETER / CONTAINER DESCRIPTION

Sample Nos.	Sample Description	Date	Time	Matrix (Water, Soil, Other)	Grab or Composite	Misc. Inorganic	Nutrients	TOC					No. of Containers (Total each Location)
51	TW 18.20	11/5/93	0845	H2O	G	1	1	1					
50	TW 18.12	11/5/93	0910	W		1	1	1					
49	TW 18.6	11/5/93	0935	W		1	1	1					
48	TW 17.20	11/5/93	1005	W		1	1	1					
47	TW 17.12	11/5/93	1025	W		1	1	1					
46	TW 17.6	11/5/93	1055	W		1	1	1					
45	TW 16.20	11/5/93	1125	W		1	1	1					
44	TW 16.12	11/5/93	1200	W		1	1	1					
43	TW 16.6	11/5/93	1210	W		1	1	1					
53	WP 7.12	11/5/93	1230	W		1	1	1					
30	~~TW 6~~ TW 2.6	11/5/93	1245	W		1	1	1					
31	TW 2.12	11/5/93	1315	W		1	1	1					
Number of Containers (Total each aliquot)													
Item No.						1	2	3	4	5	6	7	8	Total Number of Containers Rec'd.

Item No.	Relinquished	Received	Seal Intact?
PL8544	Prepared Containers Relinquished By: Linda F. Johnson Date: 10/29/93 Time: 10:35	Received: Bestway Courier Date: Time:	Yes No N/A
1-3	Relinquished: Bestway Courier Date: Time:	Received: Ayres [illegible] Date: Time:	Yes No N/A
1-3	Relinquished: [signature] Date: 11/6/93 Time: 0915	Received: B. Beddler Date: 11/6/93 Time: 0915	Yes No (N/A circled)
	Relinquished: Date: Time:	Received: Date: Time:	Yes No N/A

Instructions / Remarks

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

CHAIN of CUSTODY RECORD № 8192
Pg.____ of ____

Client Name: Ayres Associates
Phone: 813 628 0742
Project Name / Location: SDA St Johns County
Client Proj. No. 4155.16
Samplers: (Signature)
SAL Use Only: C6174
Proj. No.

PARAMETER / CONTAINER DESCRIPTION

Sample Nos.	Sample Description	Date	Time	Matrix (Water, Soil, Other)	Grab or Composite	Misc Inorganics	Nutrients	TOC						No. of Containers (Total each Location)
60	EQUIPMENT BLANK	11/5/93	0730	W		1	1	1						3
40	TWS-20	11/5/93	0800	W		1	1	1						3
40 39	TWS-12	11/5/93	0830	W		1	1	1						3
38	TW 5-6	11/5/93	0900	W		1	1	1						3
38	TW 4-20	11/5/93	0930	W		1	1	1						3
30	TW4-12	11/5/93	1000	W		1	1	1						3
36	TW4-6	11/5/93	1030	W		1	1	1						3
52	WP 6-6 ☆	11/5/93	1100	W		1	1	1						3
42	TW 10-6	11/5/93	1100	W		1	1	1						3
35	TW 3-20	11/5/93	1130	W		1	1	1						3
34	TW 3-12	11/5/93	1200	W		1	1	1						3
33	TW 3-6	11/5/93	1300	W		1	1	1						3
Number of Containers (Total each aliquot)														
Item No.						1	2	3	4	5	6	7	8	Total Number of Containers Rec'd.

Item No.	Relinquished	Received	Seal Intact?
PL8455	Prepared Containers Relinquished By: Linda R Olson Date: 10/29/93 Time: 1435	Received: [signature] Date: Time:	Yes No N/A
1-3	Relinquished: [signature] Date: 11/6/93 Time: 0915	Received: B. Budden Date: 11/6/93 Time: 0915	Yes No (N/A)
	Relinquished: Date: Time:	Received: Date: Time:	Yes No N/A
	Relinquished: Date: Time:	Received: Date: Time:	Yes No N/A

Instructions / Remarks
☆ PER CLAYTON 11/8 - CHANGE WP 6-6 TO WP 10-6.

Cooler #33, 61, 116, 78

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

CHAIN of CUSTODY RECORD № 8193
Pg.____ of ____

Client Name: SDA ST JOHNS COUNT	Phone:
Project Name / Location: 4155.00	Client Proj. No.:
Samplers: (Signature) JMSW / DWZ	

SAL Use Only: 06174
Proj. No.

PARAMETER / CONTAINER DESCRIPTION

Sample Nos.	Sample Description	Date	Time	Matrix (Water, Soil, Other)	Grab or Composite	1 MSC. ORGANIC	2 NUTRIENTS	3 TOC	4	5	6	7	8	No. of Containers (Total each Location)
09	TW 15-20	11/3/93	1345	W	G	1	1	1						
08	TW 15-12	"	1445	W	G	1	1	1						
07	TW 15-6	"	1515	W	G	1	1	1						
06	TW 14-20	"	1545	W	G	1	1	1						
05	TW 14-12	"	1600	W	G	1	1	1						
04	TW 14-6	"	1630	W	G	1	1	1						
01	STE-9	"	1245	W	G	1	1	1		RUN	BOD5	on	STE	ONLY
02	TAPWATER/SDA	"	1630	W	G	1	1	1						
03	TW 13-20	"	1700	W	G	1	1	1						
Number of Containers (Total each aliquot)														
Item No.						1	2	3	4	5	6	7	8	Total Number of Containers Rec'd.

Item No.	Relinquished	Received	Seal Intact?
PL9455	Prepared Containers Relinquished By: Kimberly Anderson Date: 10/29/93 Time: 11:35	Received: Date: Time:	Yes No N/A
1-3	Relinquished: Bestway Courier Date: Time:	Received: [signature] Date: 10/29/93 Time: 1500	Seal Intact? (Yes) No N/A
1-3	Relinquished: [signature] Date: 11/3/93 Time: 1750	Received: [signature] Date: Time:	Seal Intact? Yes No N/A
1-3	Relinquished: Fed. Overnight Date: Time:	Received: B. Budden Date: 11/4/93 Time: 1035	Seal Intact? (Yes) No N/A

Instructions / Remarks
Cooler #59

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

CHAIN of CUSTODY RECORD No 8[illegible]
Pg. ____ of ____

Client Name: Ayres Associates	Phone: 813 628 0742
Project Name / Location: SDA St Johns Co	Client Proj. No.: 455.16
Samplers: (Signature)	PARAMETER / CONTAINER DESCRIPTION

SAL Use Only: 06174
Proj. No.

Sample Nos.	Sample Description	Date	Time	Matrix (Water, Soil, Other)	Grab or Composite	GAL. NUMBER JCC							No. of Containers (Total each Location)
63	[illegible]	11/3/93	1500	W		1							1
Number of Containers (Total each aliquot)						1							1
Item No.						1	2	3	4	5	6	7	8	Total Number of Containers Rec'd.

Item No.	Prepared Containers Relinquished By:	Received:	Seal Intact?	Instructions / Remarks
FL 8455	Date: 10/24/93 Time: 1135	Date: 11/6/93 Time: 0915	Yes No N/A	
1	Relinquished: Fastway courier Date: Time:	Received: Date: Time:	Seal Intact? Yes No N/A	
1	Relinquished: Date: 11/6/93 Time: 0915	Received: B. Butler Date: 11/6/93 Time: 0915	Seal Intact? Yes No (N/A)	
	Relinquished: Date: Time:	Received: Date: Time:	Seal Intact? Yes No N/A	

AVRES ASSOCIATES

Engineers/Environmental Scientists
3901 Coconut Palm Drive, Suite 100
Tampa, FL 33619
Telephone: (813) 628-0742

CHAIN OF CUSTODY RECORD

0674

PROJECT CODE: 4155.10 | SAMPLED BY: CLH

PROJECT NAME: SDA St Johns Co.

	SAMPLE FIELD ID	LAB ID	COLLECTION DATE/TIME	SAMPLE MATERIAL	NUMBER OF CONTAINERS	FIELD READINGS PH	COND	TEMP	Misc Inorganics	TOC	Nutrients	COMMENTS
25	TW13-12		11/4/93 0925	GW	3				1	1	1	
24	TW13-6		11/4/93 0900	GW	3				1	1	1	
23	TW12-6		11/9/93 0950	GW	3				1	1	1	
22	TW9-20		11/9/93 1020	GW	3				1	1	1	
21	TW9-12		11/9/93 1050	GW	3				1	1	1	
20	TW9-6		11/9/93 1115	GW	3				1	1	1	
19	TW8-20		11/9/93 1145	GW	3				1	1	1	
18	TW8-12		11/9/93 1300	GW	3				1	1	1	
17	TW8-6		11/9/93 1330	GW	3				1	1	1	
26	MW-9-6*		11/9/93 1145	GW	3				1	1	1	
	~~TW7-20~~		~~11/9/93 1400~~	~~GW~~	~~3~~				~~1~~	~~1~~	~~1~~	CLH 11/4/93

RELINQUISHED BY (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME
	11/4/93	FDS	DJ-M1	11-4 1571
RELINQUISHED BY (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME
			B. Bullock	11/5/93 1050

REMARKS * PER CLAYTON 11/4 1410 - SHOULD BE MW 6-6

PROJECT FILE COPY: WHITE CHAIN OF CUSTODY COPY: YELLOW LABORATORY FILE COPY: PINK LABORATORY CHECK IN COPY: GOLD

Laboratory : Please Return Gold Copy When Samples Are Checked In.

Cont. #46

AYRES ASSOCIATES

Engineers/Environmental Scientists
3901 Coconut Palm Drive, Suite 100
Tampa, FL 33619
Telephone: (813) 628-0742

CHAIN OF CUSTODY RECORD

06114-

PROJECT CODE: 4155.10 SAMPLED BY: CGH / JAR

PROJECT NAME: SDA St Johns Co

ANALYSES REQUESTED: Misc Indicators - 1L P; Nutrients - 500 mL P; TOC

	SAMPLE FIELD ID	LAB ID	COLLECTION DATE/TIME	SAMPLE MATERIAL	NUMBER OF CONTAINERS	PH	COND	TEMP	Misc Indicators	Nutrients	TOC	COMMENTS
15	TW7-20		11/4/93 1400	GW	3				1	1	1	
14	TW7-12		11/4/93 1430	GW	3				1	1	1	
13	TW7-6		11/4/93 1500	GW	3				1	1	1	
12	TW6-20		11/4/93 1530	GW	3				1	1	1	
11	TW6-12		11/4/93 1600	GW	3				1	1	1	
10	TW6-6		11/4/93 1630	GW	3				1	1	1	
16	TW4-6		11/4/93 1700	GW	3				1	1	1	

RELINQUISHED BY (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME
[signature]	11/4/93	FED/EX AM	B. Buddler	11/5/93 1015
RELINQUISHED BY (SIGNATURE)	DATE/TIME	CARRIER	RECEIVED BY	DATE/TIME

REMARKS

PROJECT FILE COPY: WHITE CHAIN OF CUSTODY COPY: YELLOW LABORATORY FILE COPY: PINK LABORATORY CHECK IN COPY: GOLD

Laboratory : Please Return Gold Copy When Samples Are Checked In.

Cooler #41

APPENDIX A

HOMEOWNER'S SURVEY

The Soap and Detergent Association
Septic Tank System Research Project
HOMEOWNER'S QUESTIONNAIRE

The following questionnaire is designed to give us more information about your home so that we can better characterize the results of our study here. Please answer the questions honestly and to the best of your knowledge. Return the completed questionnaire to the following address at your earliest convenience:

Fredenhagen
Tangerine Dr.
Cove, FL 32259

Mr. Damann L. Anderson
Ayres Associates
3901 Coconut Palm Drive, Suite 100
Tampa, Florida 33619
Telephone: (813) 628-0742

Please return within two (2) weeks.

1. How long have you lived in your present home? Since 4 (month), 1982 (year)

2. When was your home constructed? _____ (month) 1977 (year)

3. How many persons live in your home? 1___ 2___ 3___ 4 X 5___ 6___ 7___ 8___

4. Please list age of each occupant: 42/40/10/5 yrs

5. What water-using fixtures and appliances are in your home? List number if more than 1.

Kitchen:	Sink	one	Bathroom(s):	Sink(s)	TWO
	Dishwasher	one		Shower(s)	TWO
	Garbage Disposal	NONE		Tub(s)	ONE
				Toilet(s)	TWO
Laundry:	Clotheswasher	ONE	Other:	Water Softener	NONE
	Sink(s)	NONE			

6. Automatic Dishwashing
   (a) Approximately how many loads of dishes are washed in the automatic dishwashing machine per week? Use Very Rarely - once Every 2-3 mos
   (b) What brands of automatic dishwashing detergents do you use, in order of more to less frequent use?
   Liquid Brands: Cascade Liq Gel
   Powder Brands: NONE
   (c) Are any rinse aids or other products used in your dishwasher?
   Yes ____ No X If so, please identify:
   _____

7. Hand Dishwashing
   (a) Approximately how many loads of dishes are washed by hand per week? 7-10
   (b) What brands of detergents do you use, in order of more to less frequent use?
   Liquid Brands: Palmolive / Sunlight / Joy
   Powder Brands: NONE

8. Clothes Washing
   (a) Approximately how many loads of laundry are washed per week? 4-5
   (b) What brands of laundry detergents do you use, in order of more to less frequent use?
   Liquid Brands: Dynamo 2
   _____

APPENDIX B

MONITORING WELL AND PIEZOMETER CONSTRUCTION SPECIFICATIONS AND NOVEMBER, 1992 WELL COMPLETION DIAGRAMS

MONITORING WELL CONSTRUCTION
SPECIFICATIONS
INDIVIDUAL HOME IN
ST. JOHNS COUNTY

WELL I.D.	TOP OF CASING ELEVATION (ft. NGVD)	BOTTOM OF WELL ELEVATION (ft. NGVD)	SCREENED INTERVAL (ft. NGVD)	DATE OF INSTALLATION
W1	49.64	39.64	39.64 - 44.64	1/28/90
W2	49.66	40.31	40.31 - 45.31	1/28/90
W4	49.28	40.96	40.96 - 45.96	1/28/90
W5	49.58	40.38	40.38 - 45.38	1/28/90
P1	49.87	42.47	42.47 - 47.47	1/28/90
P2*	49.75	39.75	39.75 - 44.75	1/28/90
P3	52.76	42.51	42.51 - 47.51	1/28/90
DW-6	53.62	1.44	1.44 - 3.94	11/23/92
SW-7	52.46	42.26	42.26 - 47.26	11/23/92
DW-8	48.94	-0.81	-0.81 - 1.69	11/24/92
SW-9	48.88	41.56	41.56 - 46.56	11/24/92
DW-10	49.71	-0.89	-0.89 - 1.61	11/24/92
SW-11	49.58	42.16	42.16 - 47.16	11/24/92

* All wells constructed of 2" diameter Schedule 40 PVC solid riser coupled to 2" Schedule 40 PVC 0.010" slotted screen. With the exception of P2 which was constructed of 1.25" diameter Schedule 40 PVC solid riser coupled to 1.25" diameter Schedule 40 PVC 0.010" slotted screen.

a:\4155.welspec.wp

WELL COMPLETION LOG

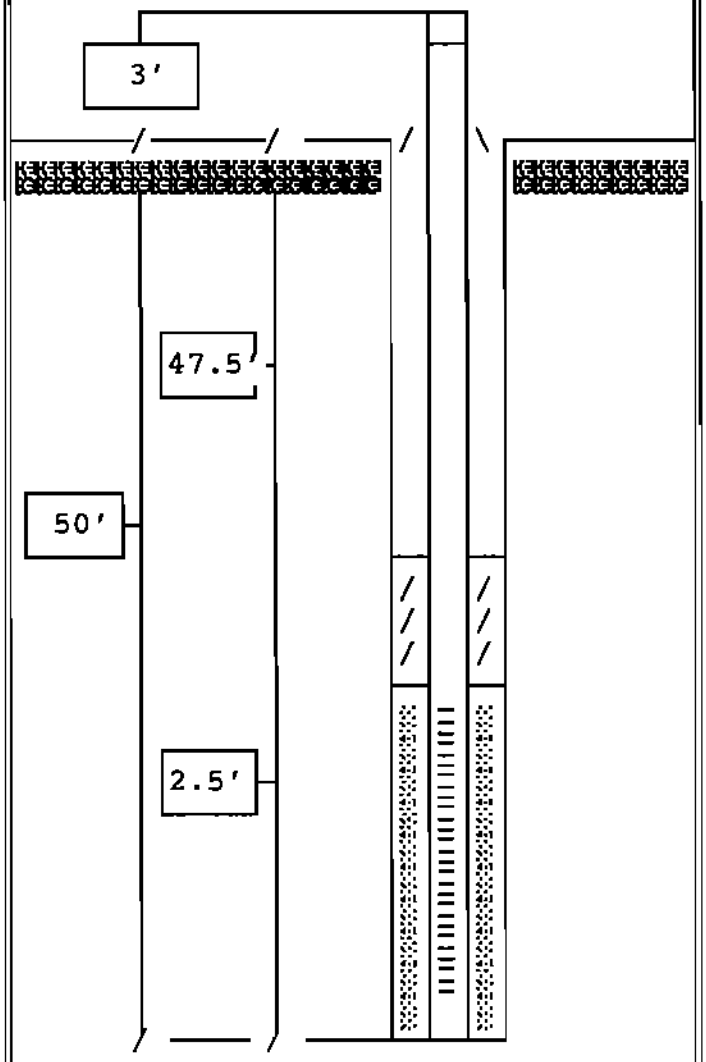
LOCATION: MR. FREDENHAGEN'S HOUSE WORK ORDER # 4287

ADDRESS: 1291 TANGERINE DR. FRUIT COVE, FLORIDA

CLIENT: AYRES & ASSOCIATES DATE

WELL NUMBER: DW-6 CONTACT: JENNIFER MCNEILLIE

INSTALLED BY: GEORGE LEEPER



FLUSH MANHOLE

X ABOVE GRADE PROTECTOR

NONE

GROUT 1/2 BAG

RISER - TYPE PVC

RISER - SIZE 2"

BENTONITE

FINE SAND X

SCREEN - TYPE PVC

SCREEN - SIZE 2" .010 SLOT

FILTER TYPE 20/30 SILICA SAND

2 X 50 LB BAGS

DEVELOPMENT: BAILED PUMPED X AIR LIFT SURGE SWAB NONE

TOTAL TIME: 30 MINUTES TOTAL GALLONS:

WATER APPEARANCE: START SILTY FINISH CLEAR

WELL COMPLETION LOG

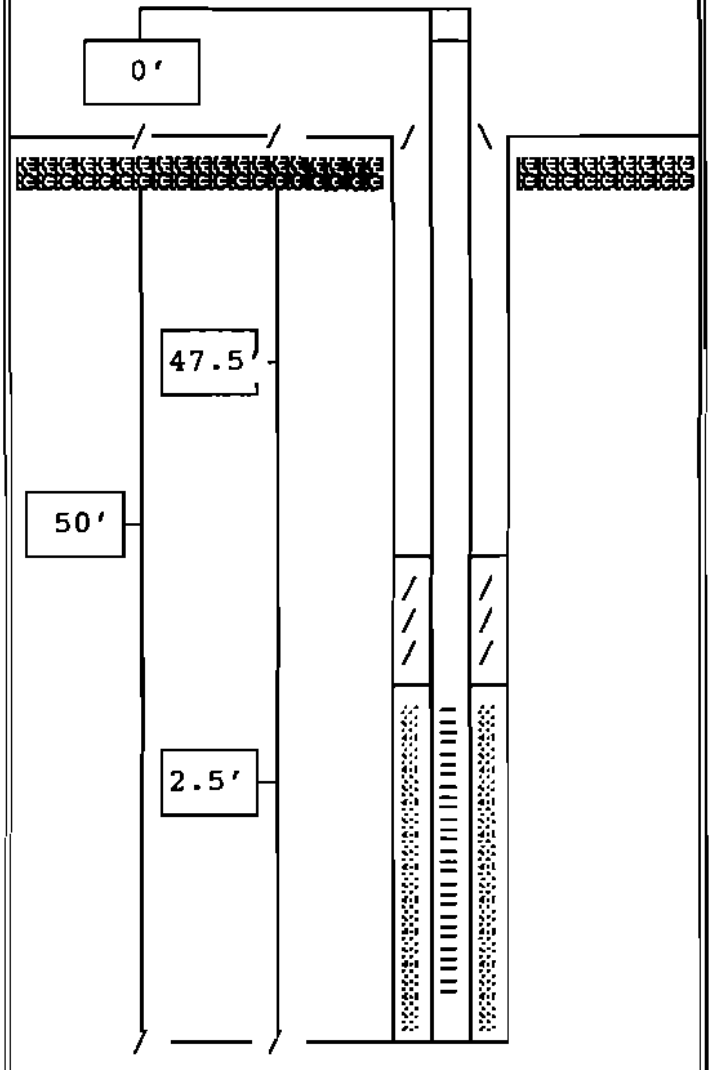
LOCATION: MR. FREDENHAGEN'S HOUSE WORK ORDER # 4287

ADDRESS: 1291 TANGERINE DR. FRUIT COVE, FLORIDA

CLIENT: AYRES & ASSOCIATES DATE

WELL NUMBER: DW-8 CONTACT: JENNIFER MCNEILLIE

INSTALLED BY: GEORGE LEEPER



X FLUSH MANHOLE

ABOVE GRADE PROTECTOR

NONE

GROUT 1 BAG

RISER - TYPE PVC

RISER - SIZE 2"

BENTONITE

FINE SAND X

SCREEN - TYPE PVC

SCREEN - SIZE 2" .010 SLOT

FILTER TYPE 20/30 SILICA SAND

2 X 50 LB BAGS

DEVELOPMENT: BAILED PUMPED X AIR LIFT SURGE SWAB NONE

TOTAL TIME: 30 MINUTES TOTAL GALLONS:

WATER APPEARANCE: START SILTY FINISH CLEAR

WELL COMPLETION LOG

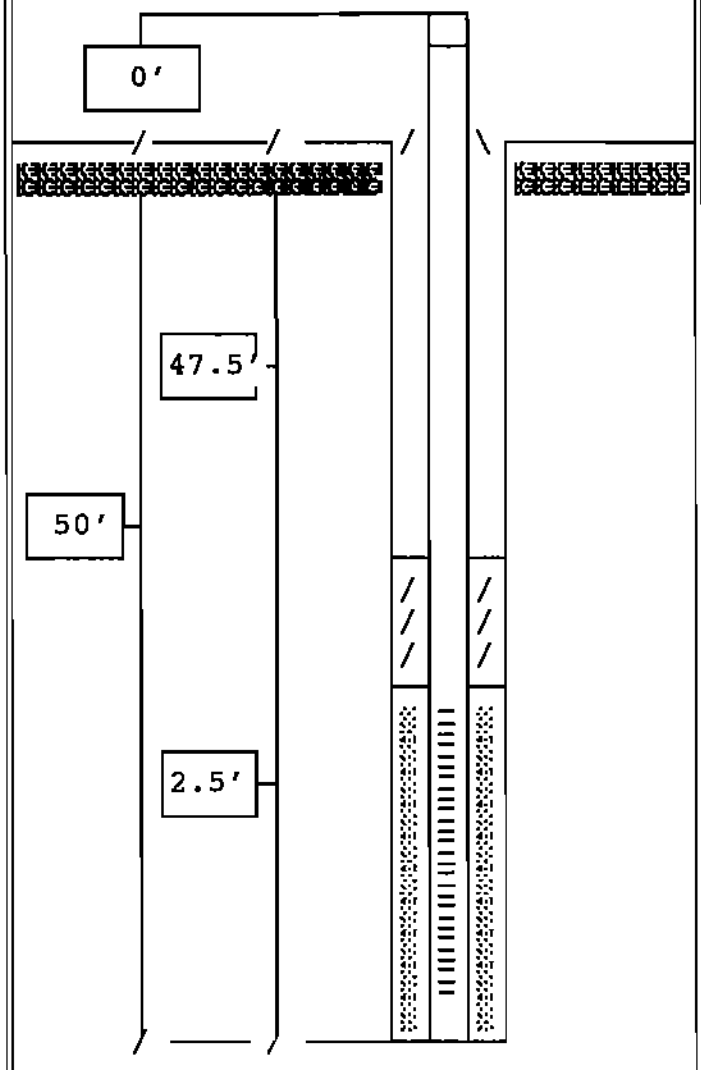
LOCATION: MR. FREDENHAGEN'S HOUSE WORK ORDER # 4287

ADDRESS: 1291 TANGERINE DR. FRUIT COVE, FLORIDA

CLIENT: AYRES & ASSOCIATES DATE

WELL NUMBER: DW-10 CONTACT: JENNIFER MCNEILLIE

INSTALLED BY: GEORGE LEEPER



X FLUSH MANHOLE

ABOVE GRADE PROTECTOR

NONE

GROUT 1 BAG

RISER - TYPE PVC

RISER - SIZE 2"

BENTONITE

FINE SAND X

SCREEN - TYPE PVC

SCREEN - SIZE 2" .010 SLOT

FILTER TYPE 20/30 SILICA SAND

2 X 50 LB BAGS

DEVELOPMENT: BAILED PUMPED X AIR LIFT SURGE SWAB NONE

TOTAL TIME: 30 MINUTES TOTAL GALLONS:

WATER APPEARANCE: START FINISH

WELL COMPLETION LOG

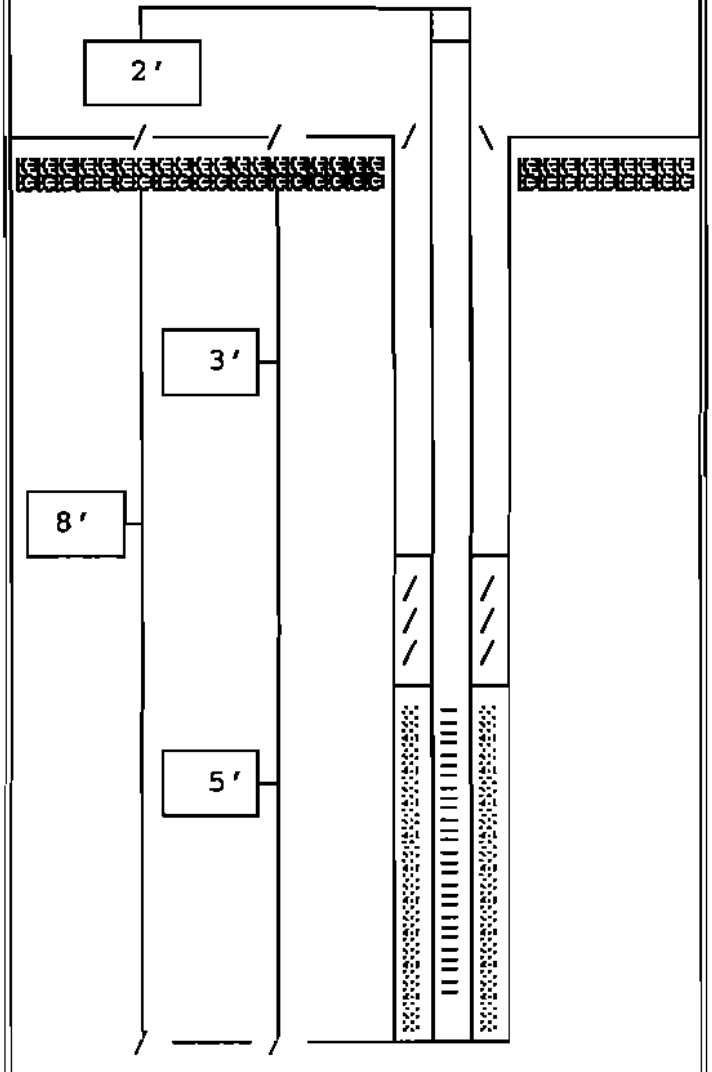
LOCATION: MR. FREDENHAGEN'S HOUSE WORK ORDER # 4287

ADDRESS: 1291 TANGERINE DR. FRUIT COVE, FLORIDA

CLIENT: AYRES & ASSOCIATES DATE

WELL NUMBER: SW-7 CONTACT: JENNIFER MCNEILLIE

INSTALLED BY: GEORGE LEEPER



	FLUSH MANHOLE
X	ABOVE GRADE PROTECTOR
	NONE
GROUT	1/2 BAG
RISER - TYPE	PVC
RISER - SIZE	2"
BENTONITE	X
FINE SAND	
SCREEN - TYPE	PVC
SCREEN - SIZE	2" .010 SLOT
FILTER TYPE	20/30 SILICA SAND
	4 X 50 LB BAGS

DEVELOPMENT: BAILED PUMPED X AIR LIFT SURGE SWAB NONE

TOTAL TIME: 15 MINUTES TOTAL GALLONS:

WATER APPEARANCE: START CLOUDY FINISH CLEAR

WELL COMPLETION LOG

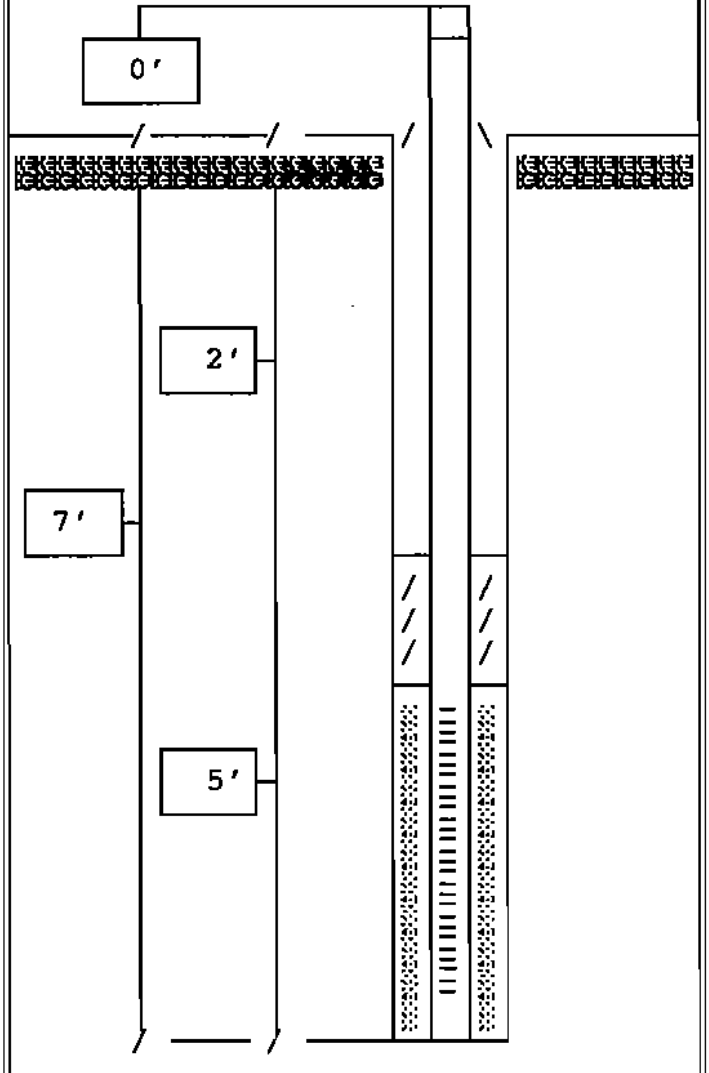
LOCATION: MR. FREDENHAGEN'S HOUSE WORK ORDER # 4287

ADDRESS: 1291 TANGERINE DR. FRUIT COVE, FLORIDA

CLIENT: AYRES & ASSOCIATES DATE

WELL NUMBER: SW-9 CONTACT: JENNIFER MCNEILLIE

INSTALLED BY: GEORGE LEEPER



X FLUSH MANHOLE

ABOVE GRADE PROTECTOR

NONE

GROUT 1/2 BAG

RISER - TYPE PVC

RISER - SIZE 2"

BENTONITE X

FINE SAND

SCREEN - TYPE PVC

SCREEN - SIZE 2" .010 SLOT

FILTER TYPE 20/30 SILICA SAND

4 X 50 LB BAGS

DEVELOPMENT: BAILED PUMPED X AIR LIFT SURGE SWAB NONE

TOTAL TIME: 15 MINUTES TOTAL GALLONS:

WATER APPEARANCE: START SILTY FINISH CLEAR

WELL COMPLETION LOG

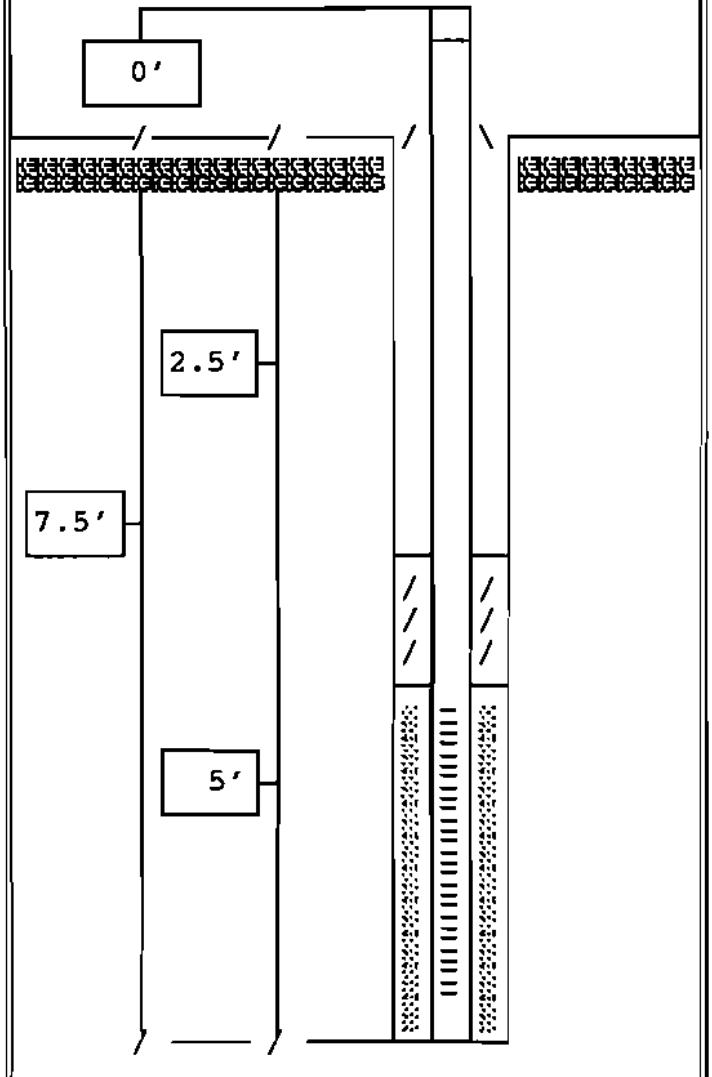
LOCATION: MR. FREDENHAGEN'S HOUSE WORK ORDER # 4287

ADDRESS: 1291 TANGERINE DR. FRUIT COVE, FL

CLIENT: AYRES & ASSOCIATES DATE

WELL NUMBER: SW-11 CONTACT: JENNIFER MCNEILEE

INSTALLED BY: GEORGE LEEPER



X FLUSH MANHOLE

ABOVE GRADE PROTECTOR

NONE

GROUT 1/2 BAG

RISER - TYPE PVC

RISER - SIZE 2"

BENTONITE X

FINE SAND

SCREEN - TYPE PVC

SCREEN - SIZE 2" .010 SLOT

FILTER TYPE 20/30 SILICA SAND

4 X 50 LB. BAGS

DEVELOPMENT: BAILED PUMPED X AIR LIFT SURGE SWAB NONE

TOTAL TIME: 15 MINUTES TOTAL GALLONS:

WATER APPEARANCE: START FINISH CLEAR

APPENDIX C

SOIL BORING LOGS

MONITORING WELL NO.:DW-6

DATE COMPLETED: 11/23/92
DRILLING METHOD: Hollow-Stem Auger
SAMPLE METHOD: Split-Spoon
WELL MATERIAL: PVC
SCREENED INTERVAL: 47.5-50.0 ft. BGS
SCREEN SLOT SIZE: 0.01"
STATIC WATER TABLE DEPTH: 3-4 ft. BGS
MANHOLE TYPE: N/A

DRILLING CO.: Groundwater Protection
GEOLOGIST: J. McNeillie

DEPTH IN FEET	WELL COMPLETION SUMMARY	STANDARD PENETRATION TEST (SPT)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) SYMBOL	LITHOLOGY	DESCRIPTION
0					
-2					
-4	GROUT		sp		Very Dark Gray (10YR 3/1) Fine-Grained Quartz Sand With Roots with <5% Fines
-6		4/6 10/10	SP		Medium Dense Light Gray (10YR 7/2) Fine-Grained Quartz Sand with Thin Layer of Gray Brown Clay at 8.0'
-8		7/4 3/3			
-10		6/4 3/10			
-12		2/3 6/10	sp		Medium Dense Light Brownish Gray (10YR 6/2) With Dark Gayish Brown (10YR 4/2) Mottling Fine-Grained Quartz Sand
-14		3/6 6/10			
-16		12/17 28/30	SP		Very Dense Light Gray (10YR 7/1) to White (10YR 8/2) Fine-Grained Quartz Sand With Some Gray Streaks of Clay
-18		7/12 26/25			
-20		21/30 29/25			
-22	BACKFILL	12/15 20/22			
-24		8/13 19/23			
-26		5/13 14/21	SP		Dense Light Gray (10YR 7/1) to Light Brownish Gray Fine-Grained Quartz Sand
-28		10/20 20/30	SP		Dense Dark Grayish Brown (10YR 3/2) Fine-Grained Quartz Sand
-30		6/14 20/30			
-32		12/15 18/25	sp		Dense Gray (10YR 5/1) Fine-Grained Sand
-34		26/17 19/21	sp		Dense Dark Gray (10YR 4/1) Fine-Grained Quartz Sand
-36		8/9 20/22	SP		Dense Gray (10YR 5/1) Fine-Grained Quartz Sand
-38		9/10 20/35			
-40		5/8 14/22			
-42		7/8 10/12	sp		Medium Dense Yellow (10YR 7/8) Fine-Grained Quartz Sand
-44		9/6 8/12	sp		Medium Dense Light Gray and Pale Brown Fine-Grained Sand
-46		7/7 13/15	sp		Grayish Brown to Gray Fine-Grained Quartz Sand
-48	SILICA SAND* SCREEN	7/5 10/16	SP		Medium Dense Gray (10YR 5/1) Fine-Grained Quartz Sand
-50		6/10 18/19			

*NOTE: One (1) Foot of Fine Sand Above Silica Sand Pack
SP = Grain size determined by grain size analysis
sp = Grain size visually determined

AYRES ASSOCIATES

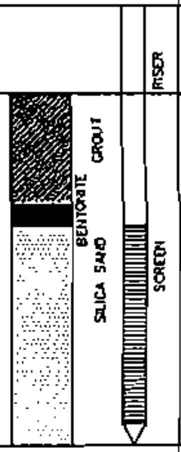
GEOLOGIC WELL LOG DW-6
PRIVATE RESIDENCE
ST. JOHNS COUNTY,
FLORIDA

SCALE:	DRAWN BY:
As Shown	CGH
DATE:	PROJECT No.:
4-7-93	4155.00

MONITORING WELL NO.: SW-7

DATE COMPLETED: 11/23/92
ORILLING METHOD: Hollow-Stem Auger
SAMPLE METHOD: Auger Cuttings
WELL MATERIAL: PVC
SCREENED INTERVAL: 3.0-8.0 ft. BGS
SCREEN SLOT SIZE: 0.01"
STATIC WATER TABLE OEPTH: 3-4 ft. BGS
MANHOLE TYPE: N/A

DRILLING CO.: Groundwater Protection
CEOLOGIST: J. McNeillie



DEPTH IN FEET	WELL COMPLETION SUMMARY	STANDARD PENETRATION TEST (SPT)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) SYMBOL	LITHOLOGY	DESCRIPTION
2 to 0					
0 to -4			sp		Very Dark Gray (1DYR 3/1) Fine-Grained Quartz Sand
-4 to -8			sp		Light Gray (10YR 7/1) Fine-Groined Quartz Sand
-8 to -20					

Depth scale: 2, -1-, -0-, -1-, -2-, -3-, -4-, -5-, -6-, -7-, -8-, -9-, -10-, -11-, -12-, -13-, -14-, -15-, -16-, -17-, -18-, -19-, -20-

SP = Groin size determined by groin size onalysis
sp = Groin size visuolly determined

AYRES ASSOCIATES

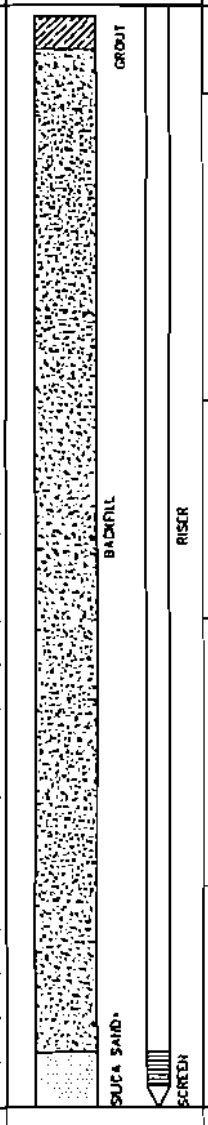
GEOLOGIC WELL LOG SW-7
PRIVATE RESIDENCE
ST. JOHNS COUNTY,
FLORIDA

SCALE:	DRAWN BY:
As Shown	CGH
DATE:	PROJECT No.:
4-7-93	4155.00

MONITORING WELL NO.:DW-8

DATE COMPLETED: 11/24/92
DRILLING METHOD: Hollow-Stem Auger
SAMPLE METHOD: Auger Cuttings
WELL MATERIAL: PVC
SCREENED INTERVAL: 47.5-50.0 ft. BGS
SCREEN SLOT SIZE: 0.01"
STATIC WATER TABLE DEPTH: 2-3 ft. BGS
MANHOLE TYPE: Flush Mounted

DRILLING CO.: Groundwater Protection
GEOLOGIST: J. McNeillie



STANDARD PENETRATION TEST (SPT)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) SYMBOL	LITHOLOGY	
	SP/SM		Dark Gray Fine Grained Quartz Sand With Roots, Organic Material
	SP		Light Gray to White Fine-Grained Quartz Sand With Some Gray Streaks of Clay
	SP		Brown Fine-Grained Quartz Sand
	SP		Light Gray to Light Brownish Gray Fine-Grained Quartz Sond
	SP		Light Grayish Brown Sand With Dark Gray Slightly Silty Fine-Grained Quartz Sond

*NOTE: One (1) Foot of Fine Sand Above Silica Sand
SP = Grain size determined by grain size analysis
sp = Grain size visually determined

AYRES ASSOCIATES

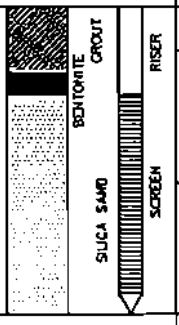
GEOLOGIC WELL LOG DW-8
PRIVATE RESIDENCE
ST. JOHNS COUNTY,
FLORIDA

SCALE:	DRAWN BY:
As Shown	CGH
DATE:	PROJECT No.:
4-1-93	4155.00

MONITORING WELL NO.: SW-9

DATE COMPLETED: 11/24/92
DRILLING METHOD: Hollow-Stem Auger
SAMPLE METHOD: Auger Cuttings
WELL MATERIAL: PVC
SCREENED INTERVAL: 2.0-7.0 ft. BGS
SCREEN SLOT SIZE: 0.01"
STATIC WATER TABLE DEPTH: 2-3 ft. BGS
MANHOLE TYPE: N/A

DRILLING CO.: Groundwater Protection
GEOLOGIST: J. McNeillie

DEPTH IN FEET	WELL COMPLETION SUMMARY	STANDARD PENETRATION TEST (SPT)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) SYMBOL	LITHOLOGY	DESCRIPTION
1-2-3-4-5-6-7-			sp		Dark Gray Fine-Grained Quartz Sand
			sp		Light Grayish Brown Fine-Grained Quartz Sand
			sp		Gray Fine-Grained Quartz Sand
8-9-10-11-12-13-14-15-16-17-18-19-20-					
					SP = Grain size determined by grain size analysis sp = Grain size visually determined

AYRES ASSOCIATES

GEOLOGIC WELL LOG SW-9

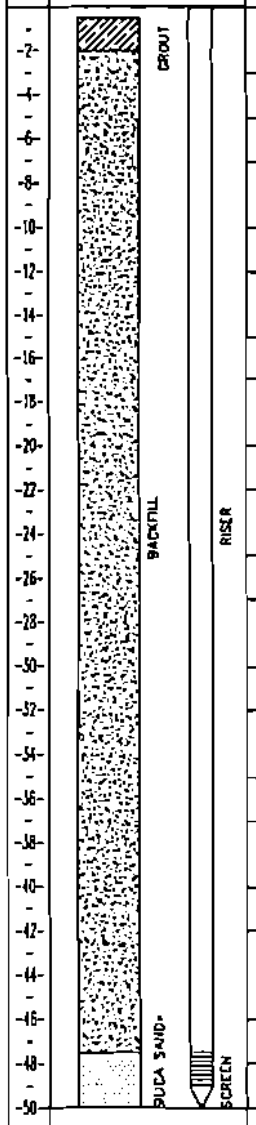
PRIVATE RESIDENCE
ST. JOHNS COUNTY,
FLORIDA

SCALE:	DRAWN BY:
As Shown	CGH
DATE:	PROJECT No.:
4-7-93	4155.00

MONITORING WELL NO.:DW-10

DATE COMPLETED: 11/24/92
DRILLING METHOD: Hollow-Stem Auger
SAMPLE METHOD: Split-Spoon
WELL MATERIAL: PVC
SCREENED INTERVAL: 47.5-50.0 ft. BGS
SCREEN SLOT SIZE: 0.01"
STATIC WATER TABLE DEPTH: 3-4 ft. BGS
MANHOLE TYPE: N/A

DRILLING CO.: Groundwater Protection
GEOLOGIST: J. McNeillie



STANDARD PENETRATION TEST (SPT)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) SYMBOL	LITHOLOGY	
	sp		Very Pale Brown (10YR 7/4) Fine-Grained Quartz Sand
2/2 2/2	SP		Very Loose Dark Brown Fine-Grained Quartz Sand
3/7 12/20	SP		Dense Light Gray (10YR 7/1) Fine-Grained Quartz Sand
7/16 16/16	SP		Dense Very Dark Brown (10YR 2/2) Fine-Grained Quartz Sand
3/10 13/20	sp		Dense Very Pale Brown (10YR 7/4) Fine-Grained Quartz Sand
2/5 10/12	sp		Medium Dense White Fine-Grained Quartz Sand Turning Grey At 26.5 Feet BGS.
6/13 18/25	SP		Dense Dark Gray Fine-Grained Quartz Sand
5/11 18/23 14/16 17/22 9/16 21/18 11/8 21/25	sp		Dense Gray Fine-Grained Quartz Sand

*NOTE: One (1) Foot of Fine Sand Above Silica Sand
SP = Grain size determined by grain size analysis
sp = Grain size visually determined

AYRES ASSOCIATES

GEOLOGIC WELL LOG DW-10
PRIVATE RESIDENCE
ST. JOHNS COUNTY, FLORIDA

SCALE:	DRAWN BY:
As Shown	CGH
DATE:	PROJECT No.:
4-7-93	4155.00

MONITORING WELL NO.: SW-11

DATE COMPLETED: 11/24/92
DRILLING METHOD: Hollow-Stem Auger
SAMPLE METHOD: Auger Cuttings
WELL MATERIAL: PVC
SCREENED INTERVAL: 2.5-7.5 ft. BGS
SCREEN SLOT SIZE: 0.01"
STATIC WATER TABLE DEPTH: 3-4 ft. BGS
MANHOLE TYPE: Flush Mounted

DRILLING CO.: Groundwater Protection
GEOLOGIST: J. McNeillie

DEPTH IN FEET	WELL COMPLETION SUMMARY	STANDARD PENETRATION TEST (SPT)	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) SYMBOL	LITHOLOGY	
0			sp		Dark Gray Fine-Grained Quartz Sand
1-7	BENTONITE GROUT; SILICA SAND; RISER; SCREEN		sp		Pale Brown Fine-Grained Quartz Sand
7-8			sp		Light Gray To White Fine-Grained Quartz Sand
8-20					

SP = Grain size determined by grain size analysis
sp = Grain size visually determined

AYRES ASSOCIATES

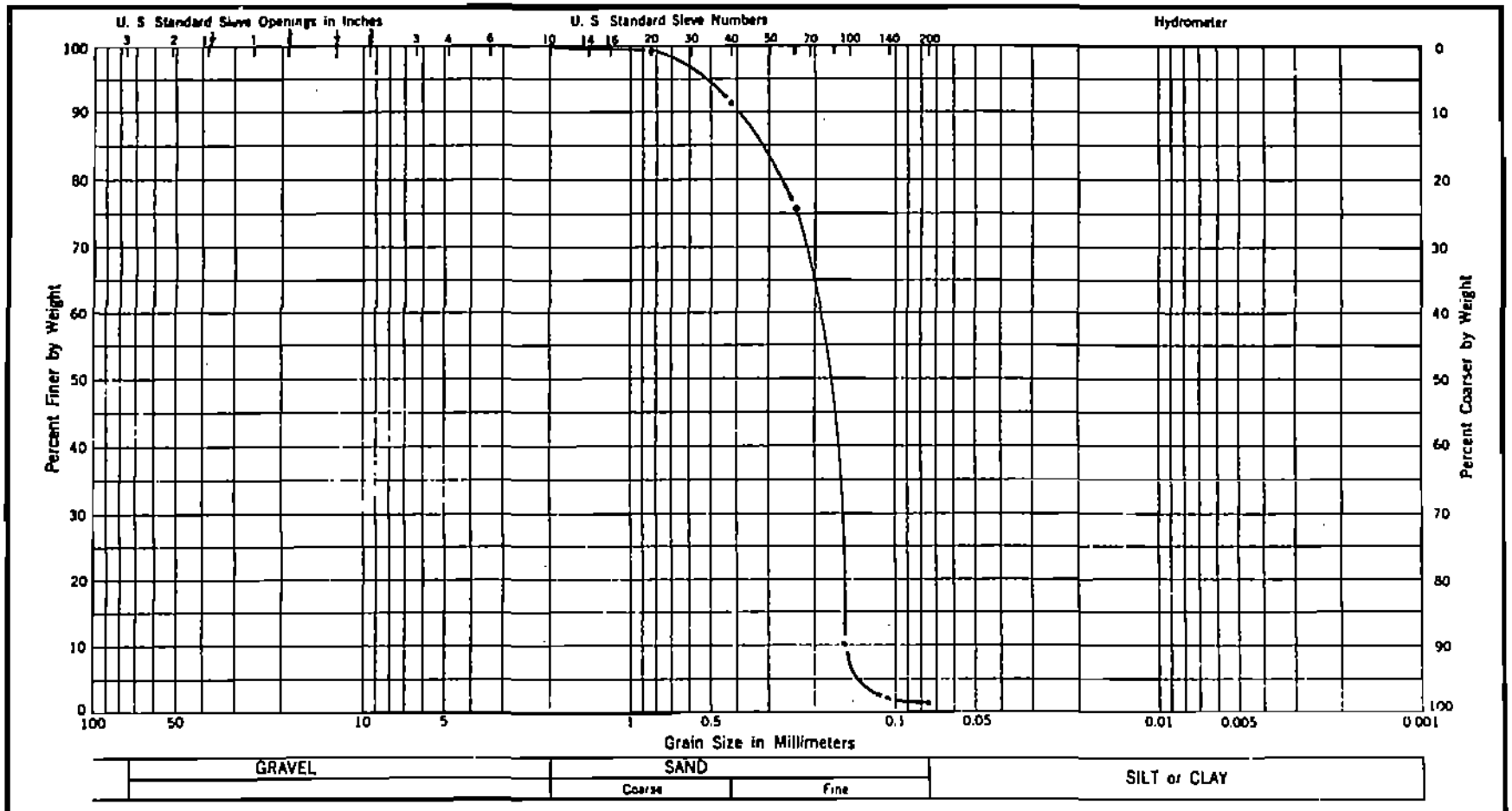
GEOLOGIC WELL LOG SW-11
PRIVATE RESIDENCE
ST. JOHNS COUNTY, FLORIDA

SCALE:	DRAWN BY:
As Shown	CGH
DATE:	PROJECT No.:
4-7-93	4155.00

APPENDIX D

GRAINSIZE DATA SUMMARY
GRAINSIZE DISTRIBUTION CURVES

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



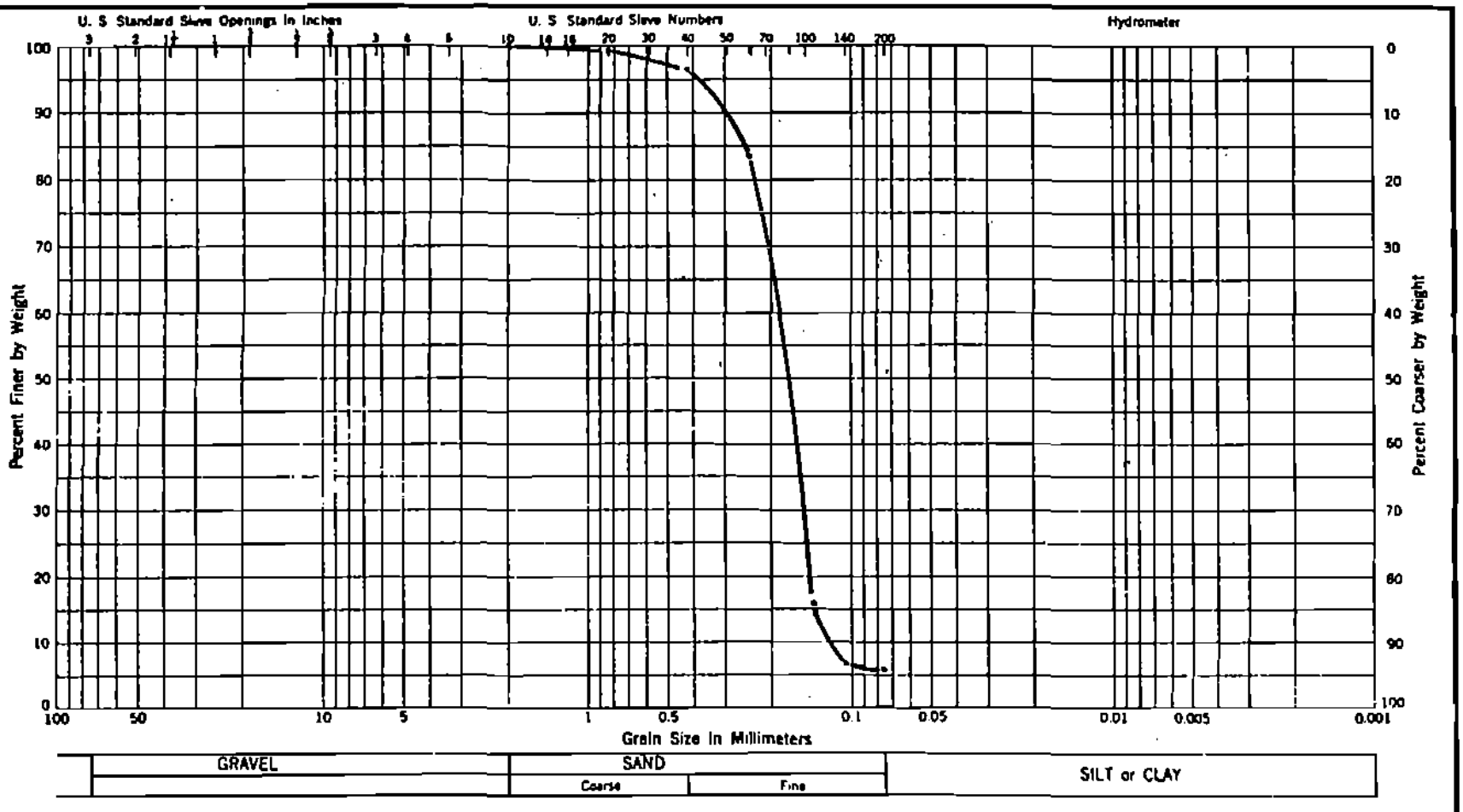
Number	Depth	Natural Moisture	L L	P. L	P. I.	Classification
DW-10	30' - 32'		N/O	N/P		Gray and brown Fine SAND
						% Passing -200 Sieve = 1.5%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



Number	Depth	Natural Moisture	L L	P. L	P. I.	Classification
DW-10	50' - 52'		N/O	N/P		Gray and brown slightly silty
						Fine SAND (SP-SM)
						% Passing -200 Sieve = 5.6%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

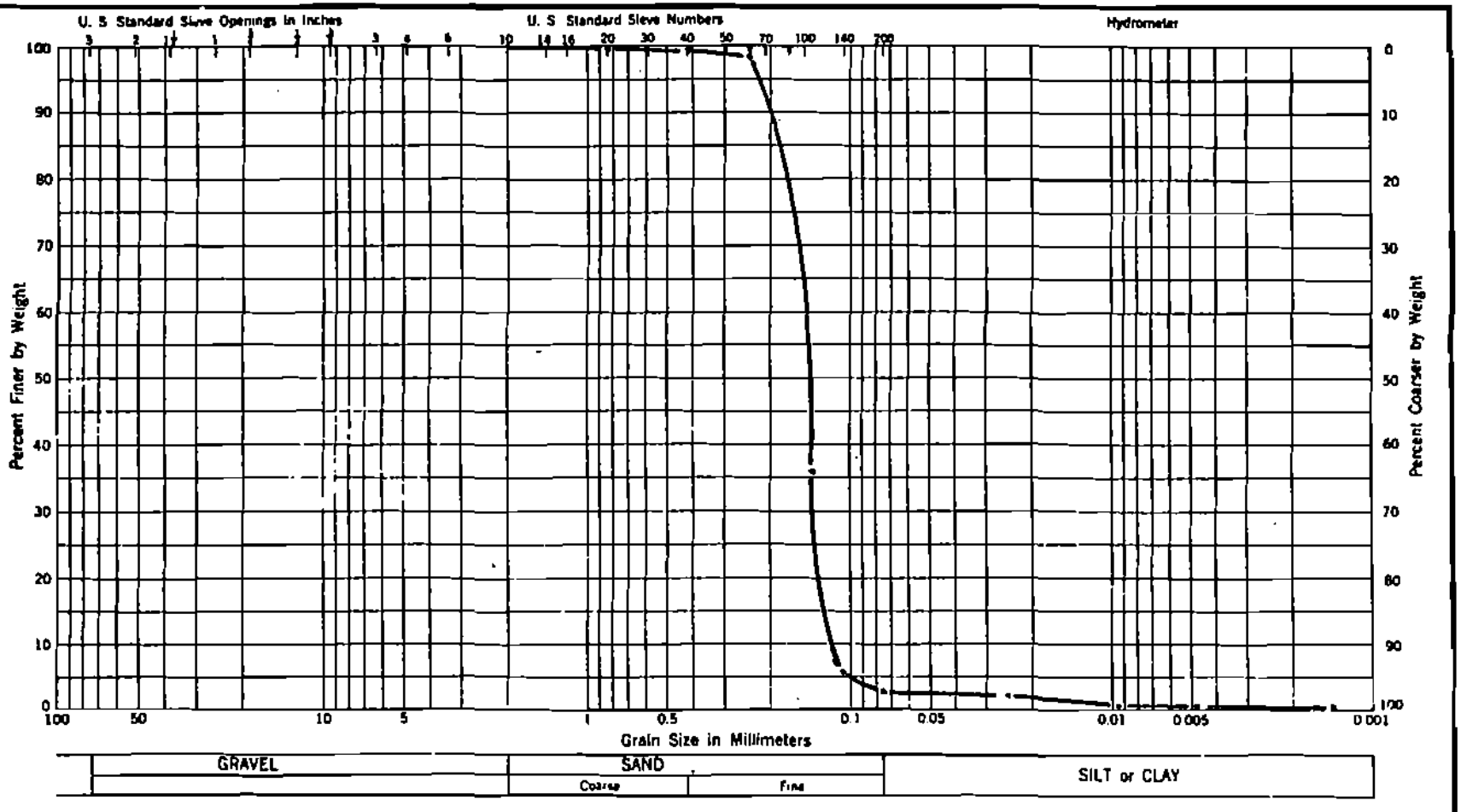
CLIENT: Ayres Associates

GRAINSIZE DATA SUMMARY

Sample No.	Depth (FT.)	Visual Description	Unified Classifcation	Percent Passing 200 Sieve
DW-6	4- 6'	Gray Fine SAND	SP	2.8%*
DW-6	14-16'	Gray Fine SAND	SP	2.7%
DW-6	27'	Gray and brown Fine SAND	SP	5.0%
DW-6	36-38'	Gray and brown Fine SAND	SP	3.8%
DW-6	48-50'	Gray Fine SAND	SP	4.6%
DW-8	3- 4'	Dark gray Fine SAND with trace of finely divided organic material	SP-SM	6.0%*
DW-8	10-12'	Grayish brown Fine SAND	SP	1.0%
DW-8	25-27'	Brown Fine SAND	SP	1.4%
DW-8	48-50'	Gray and brown Fine SAND	SP	1.1%
DW-10	3- 4'	Dark brown Fine SAND	SP	4.2%*
DW-10	10-12'	Tan Fine SAND	SP	0.9%
DW-10	15-17'	Dark brown Fine SAND	SP	3.0%
DW-10	30-32'	Gray and brown Fine SAND	SP	1.5%
DW-10	50-52	Gray and brown slighty silty Fine SAND	SPSM	5.6%

* Hydrometer Test Performed.

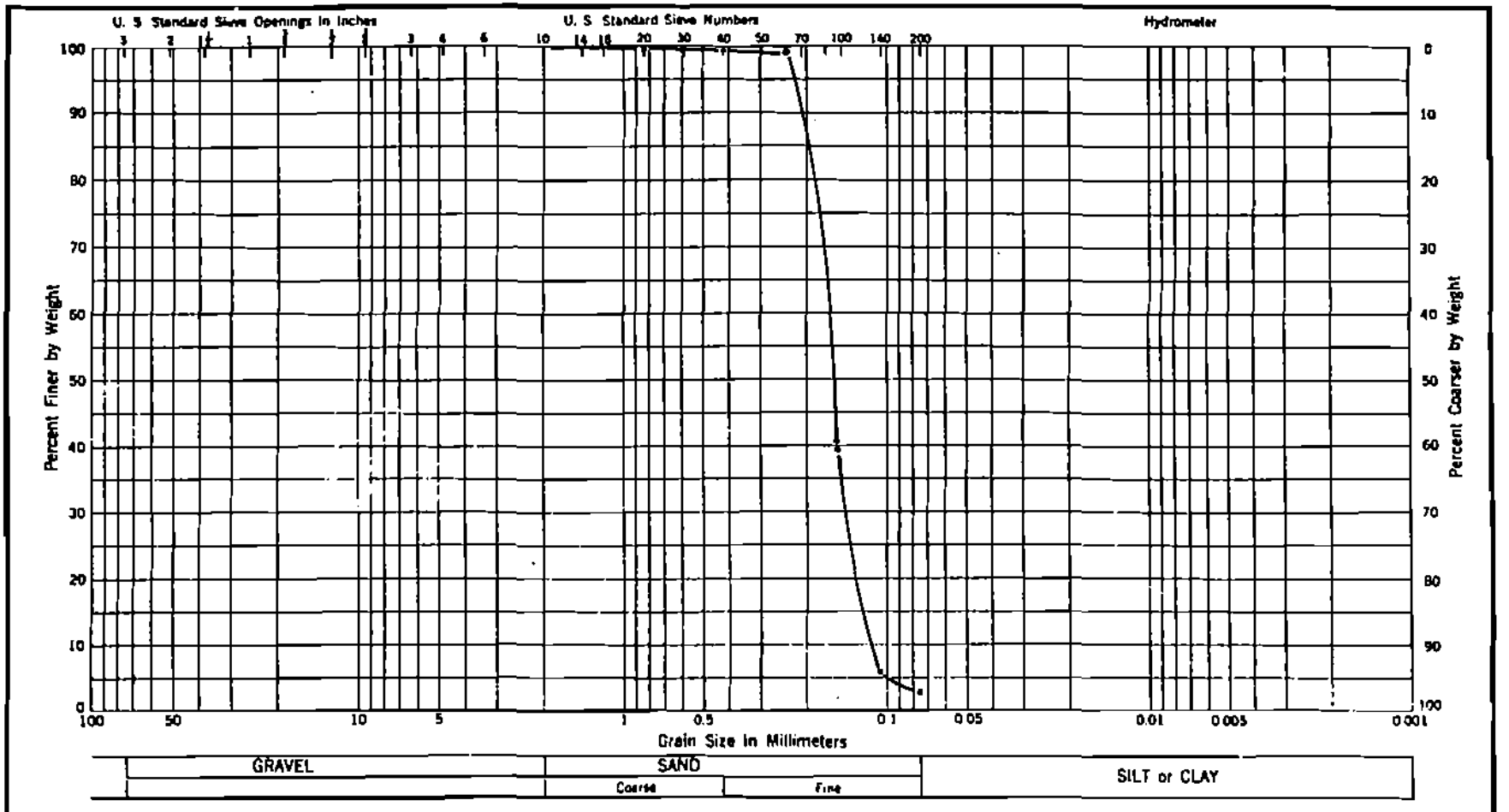
DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



Number	Depth	Natural Moisture	L.L.	P.L.	P.I.	Classification
DW-6	4' - 6'		N/O	N/P		Gray Fine SAND (SP)
						% Passing -200 Sieve = 2.8%

FILE: L933057 REPORT: 1
PROJECT: SDA - St. Johns
CLIENT: Ayres Associates

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



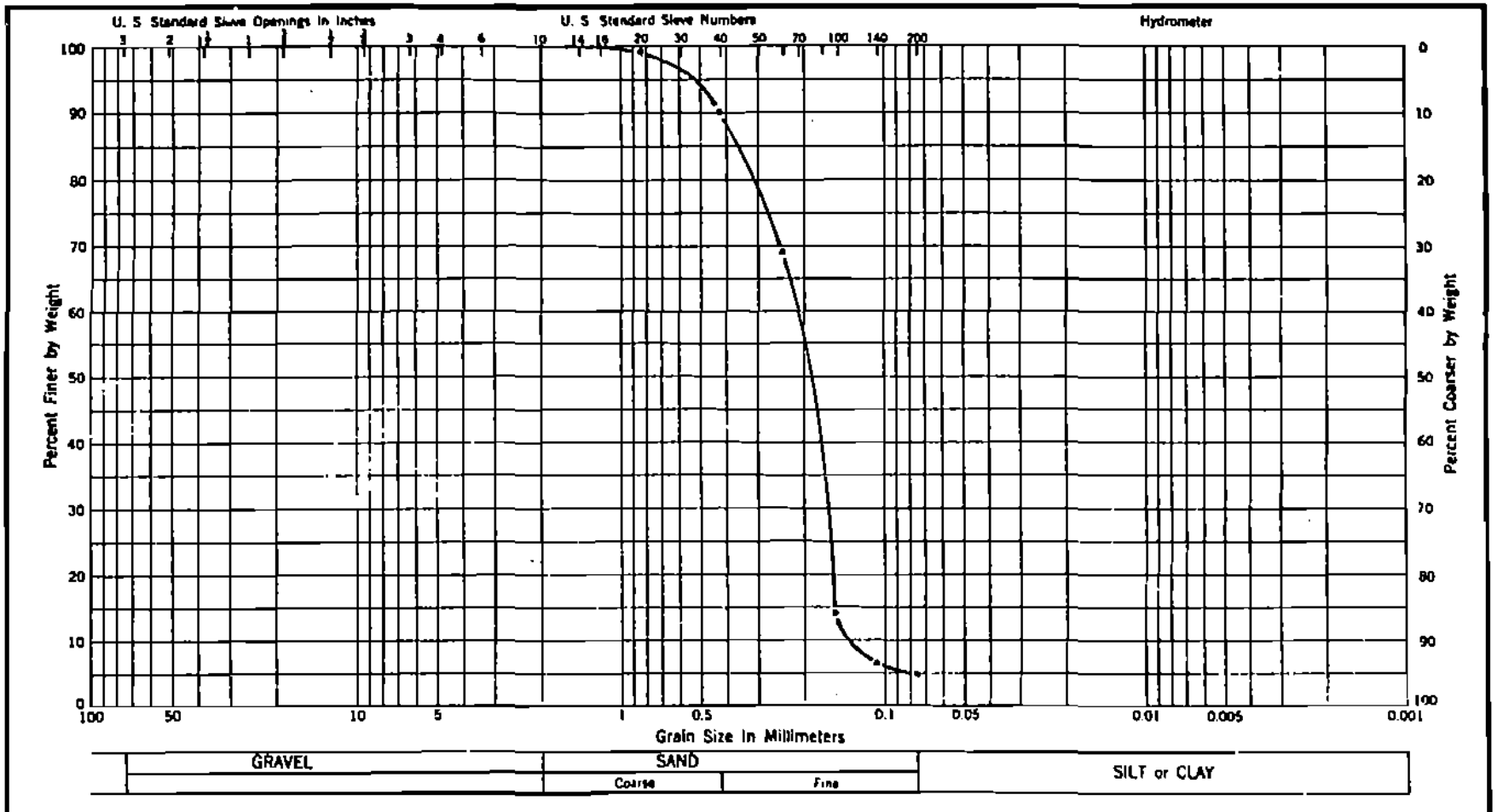
Number	Depth	Natural Moisture	L.L.	P.L.	P.I.	Classification
DW-6	14' - 16'		N/O	N/P		Gray Fine SAND (SP)
						% Passing -200 Sieve = 2.7%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



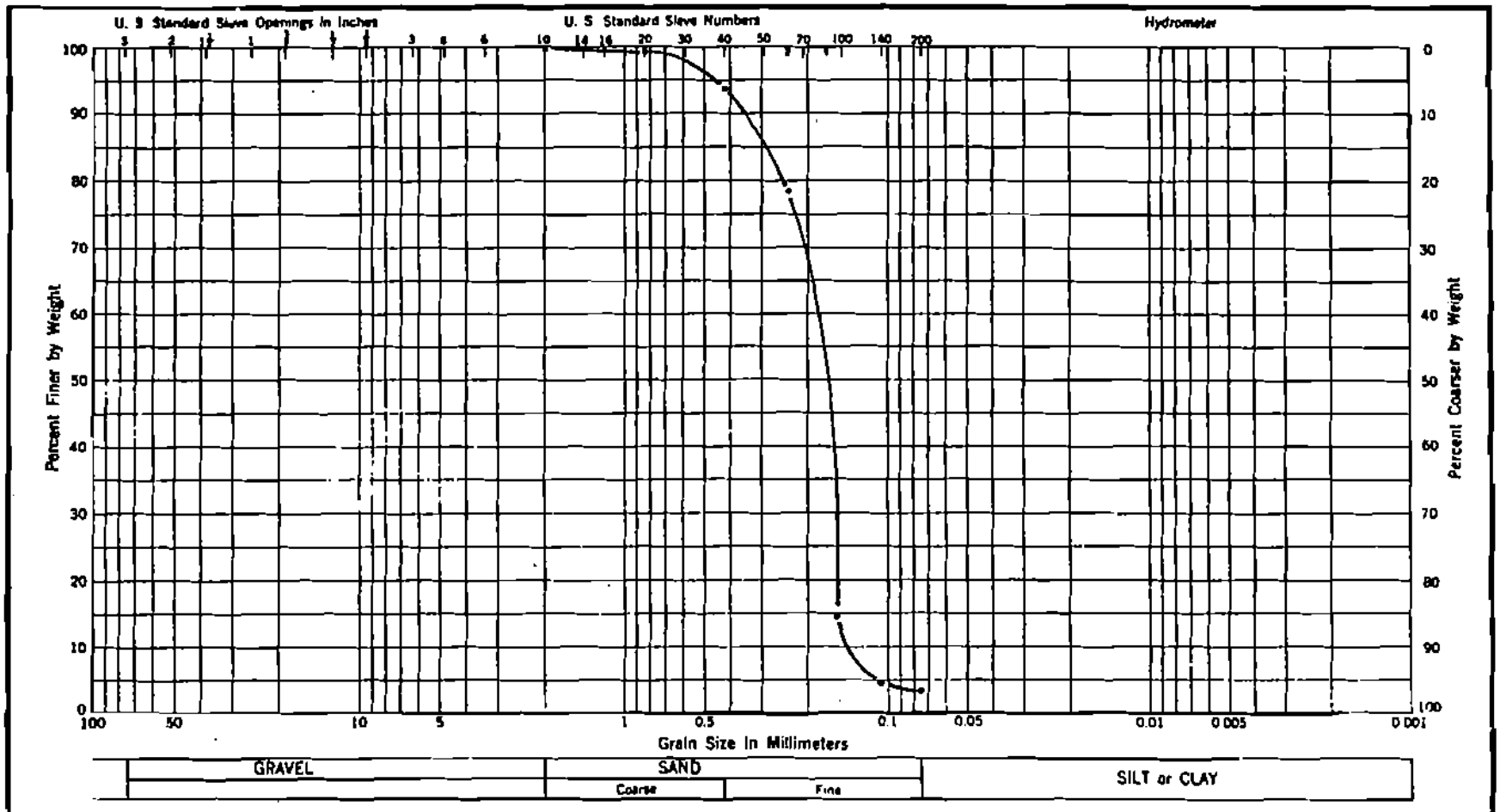
Number	Depth	Natural Moisture	L L	P. L	P. I.	Classification
DW-6	27'		N/O	N/P		Gray and brown Fine SAND (SP)
						% Passing -200 Sieve = 5.0%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



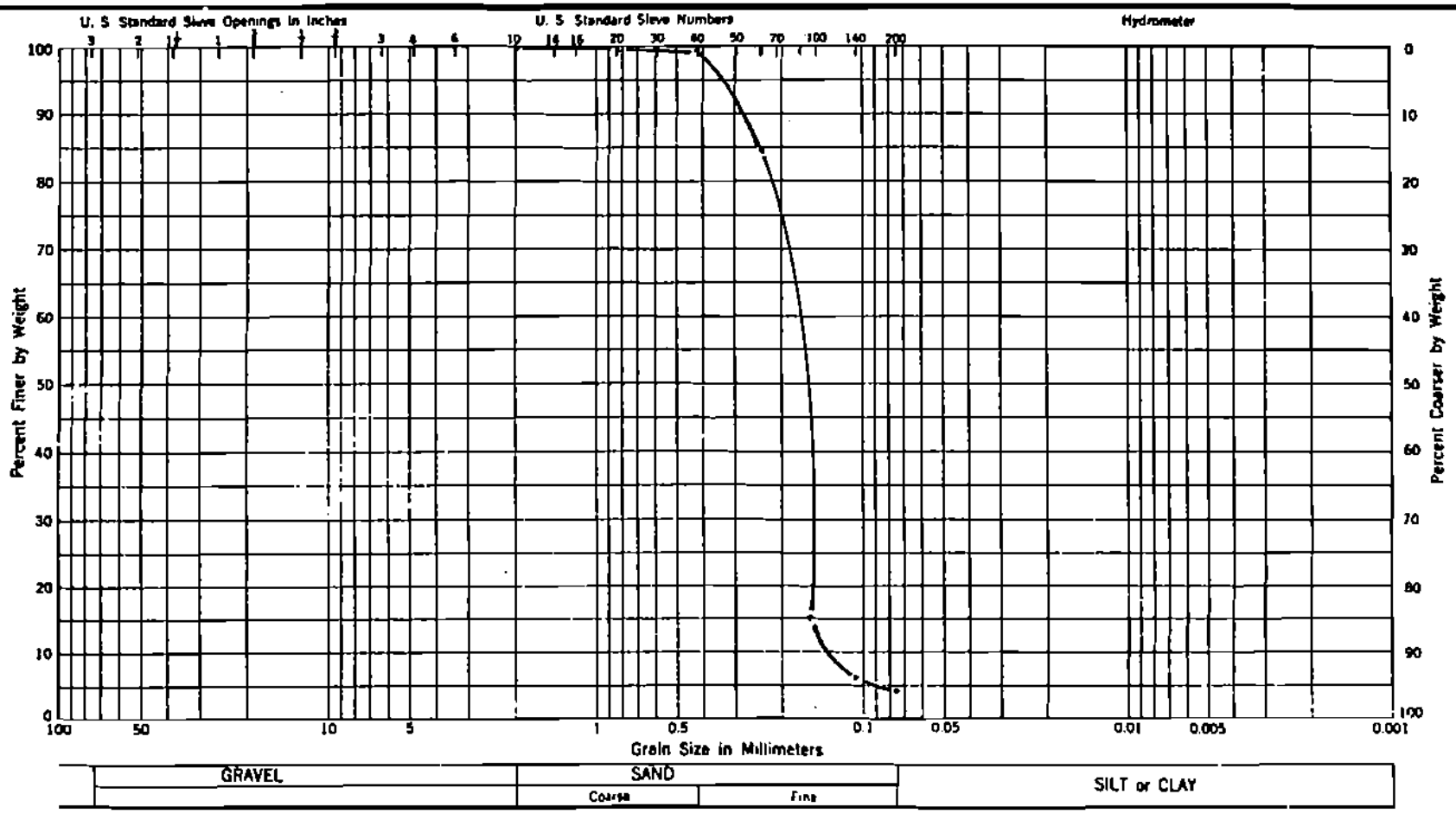
Number	Depth	Natural Moisture	L L	P. L	P. I.	Classification
DW-6	36' - 38'		N/O	N/P		Gray and brown Fine SAND (SP)
						% Passing -200 Sieve = 3.8%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



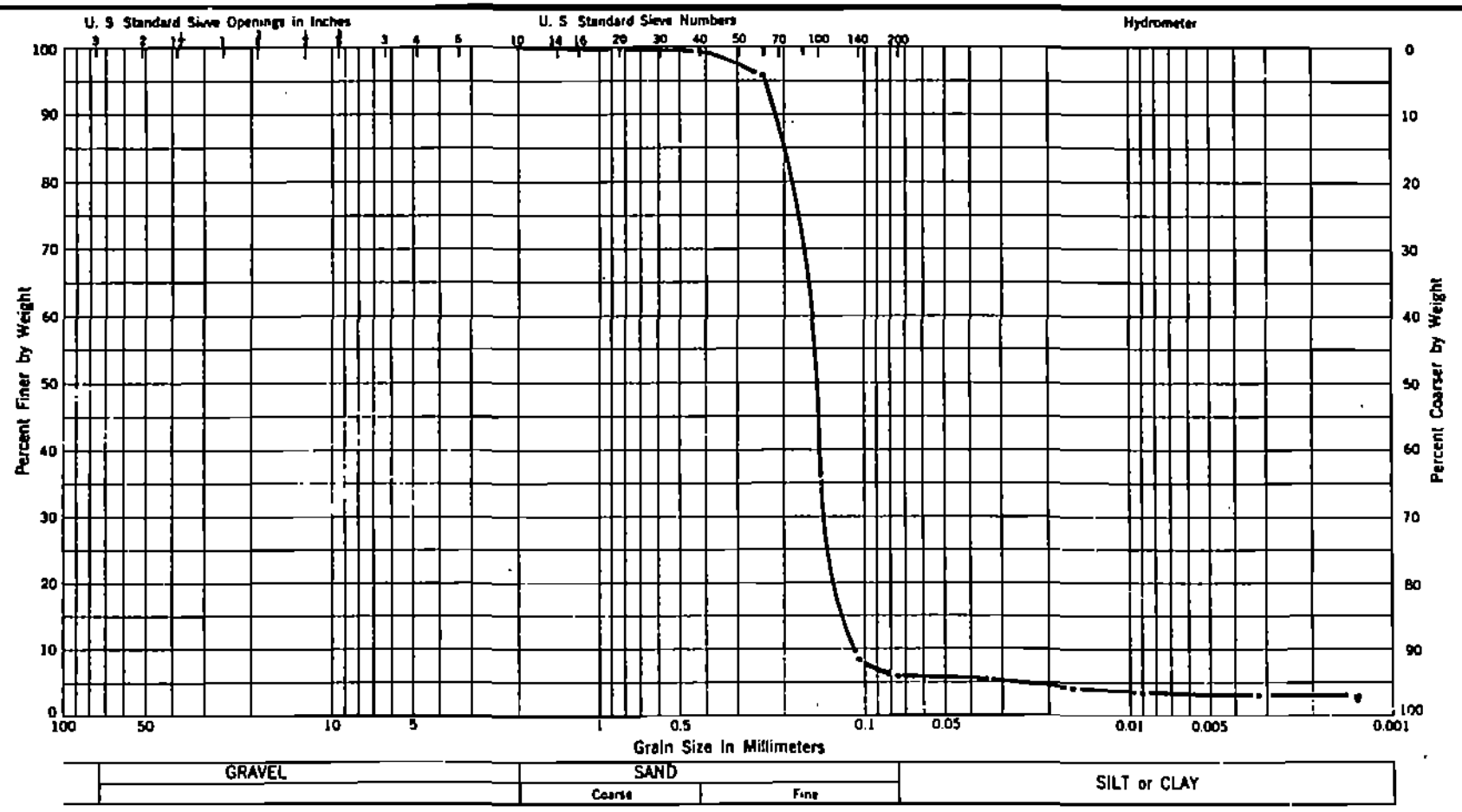
Number	Depth	Natural Moisture	L L	P. L	P. I.	Classification
DW-6	48' - 50'		N/O	N/P		Gray Fine SAND (SP)
						% Passing -200 Sieve = 4.6%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



Number	Depth	Natural Moisture	L L	P. L	P. I.	Classification
DW-8	3' - 4'		N/O	N/P		Dark gray Fine SAND with trace
						of finely divided organic
						material (SP-SM)

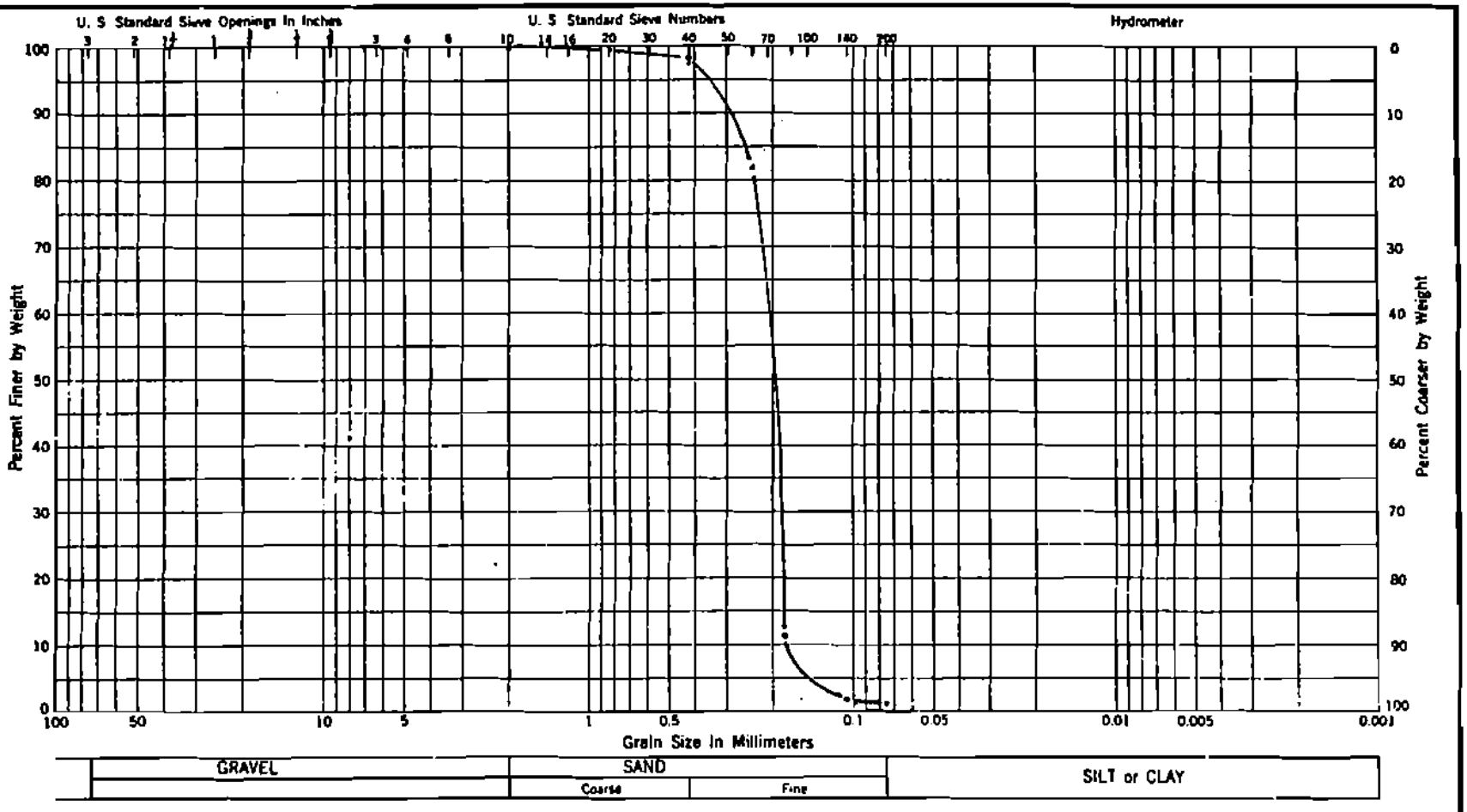
FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

% Passing -200 Sieve = 6.0%

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



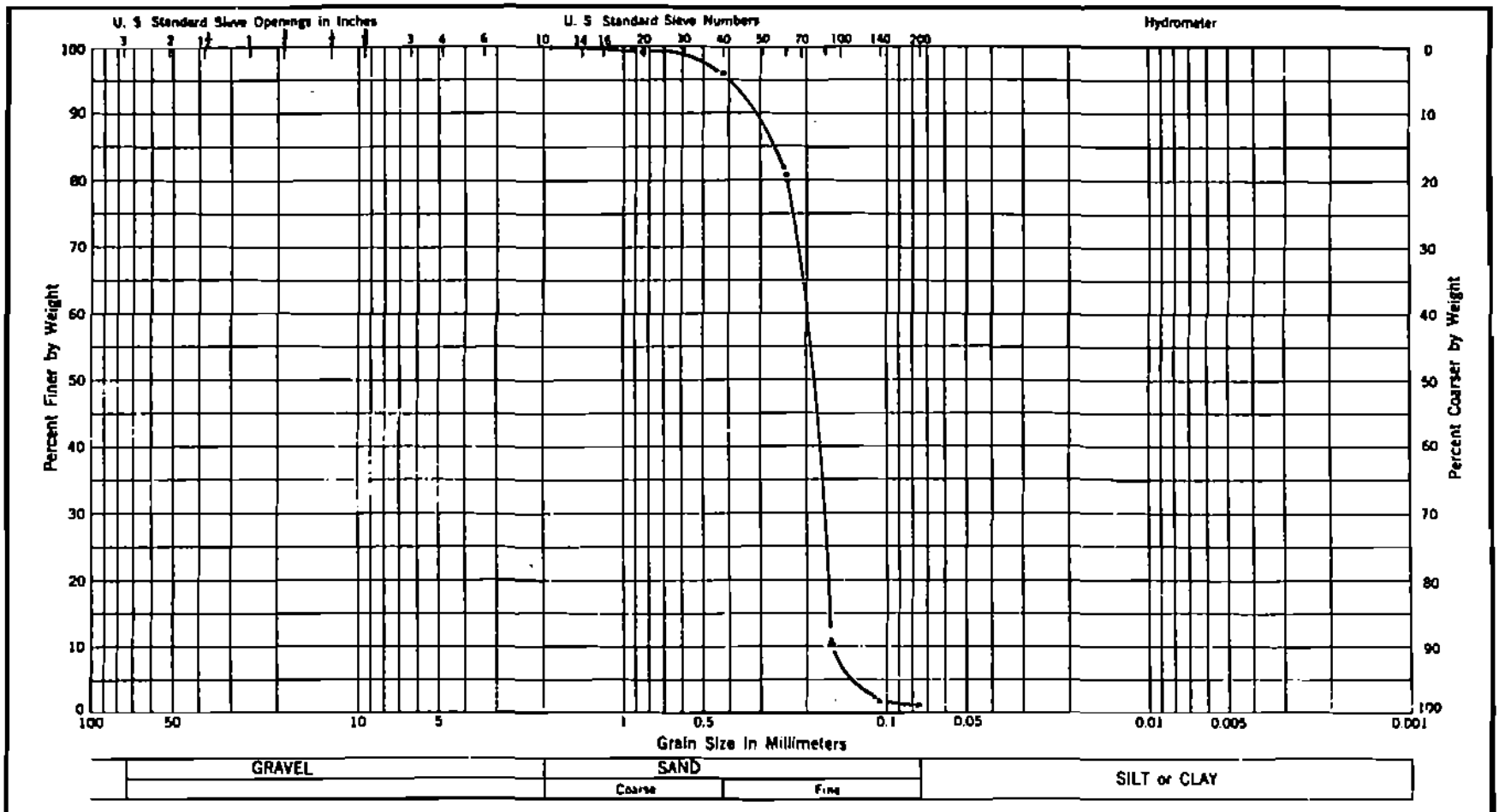
Number	Depth	Natural Moisture	L L	P. L	P. I.	Classification
DW-8	10' - 12'		N/O	N/P		Grayish brown Fine SAND (SP)
						% Passing -200 Sieve = 1.0%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



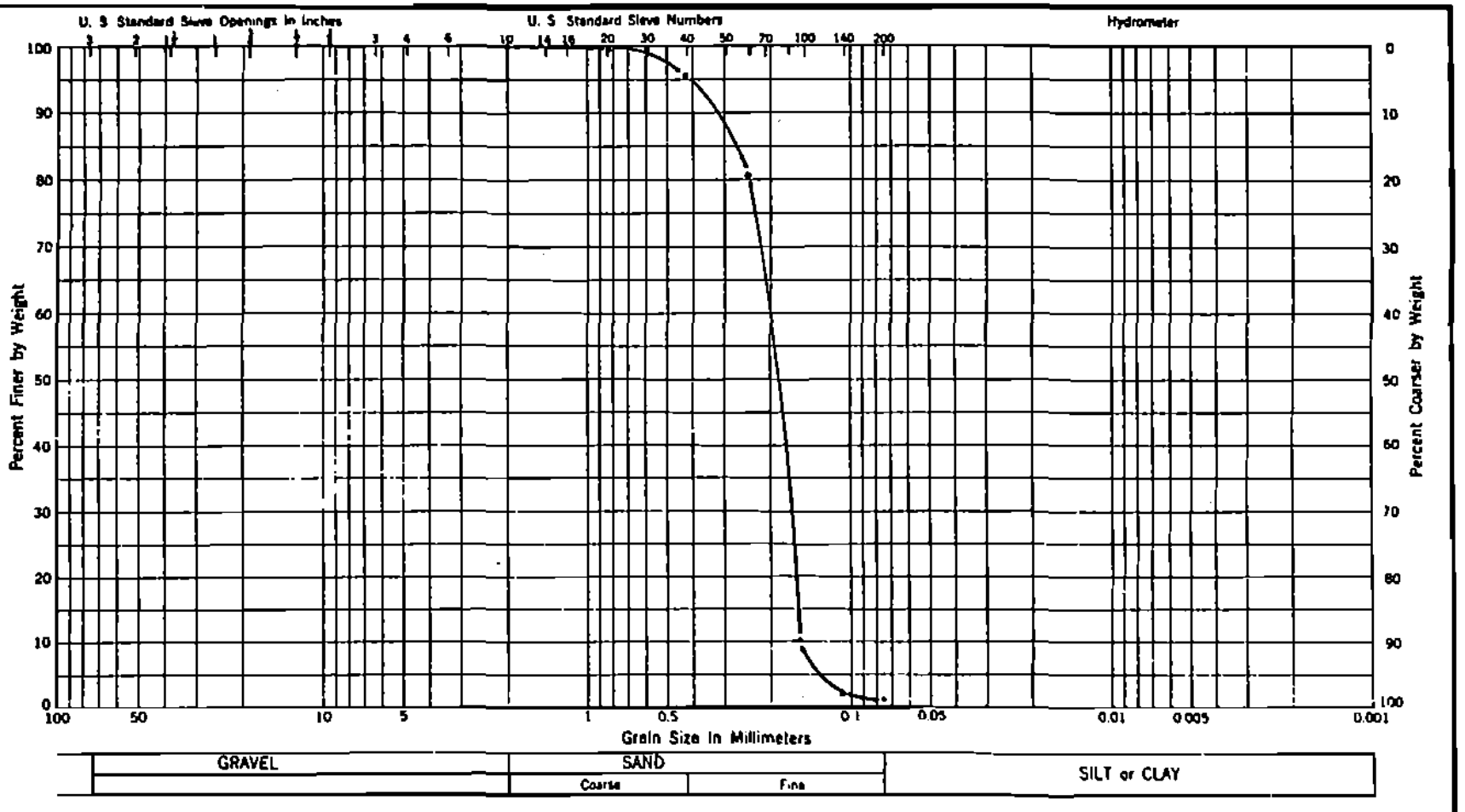
Number	Depth	Natural Moisture	L.L.	P.L.	P.I.	Classification
DW-8	25' - 27'		N/O	N/P		Brown Fine SAND (SP)
						% Passing -200 Sieve = 1.4%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



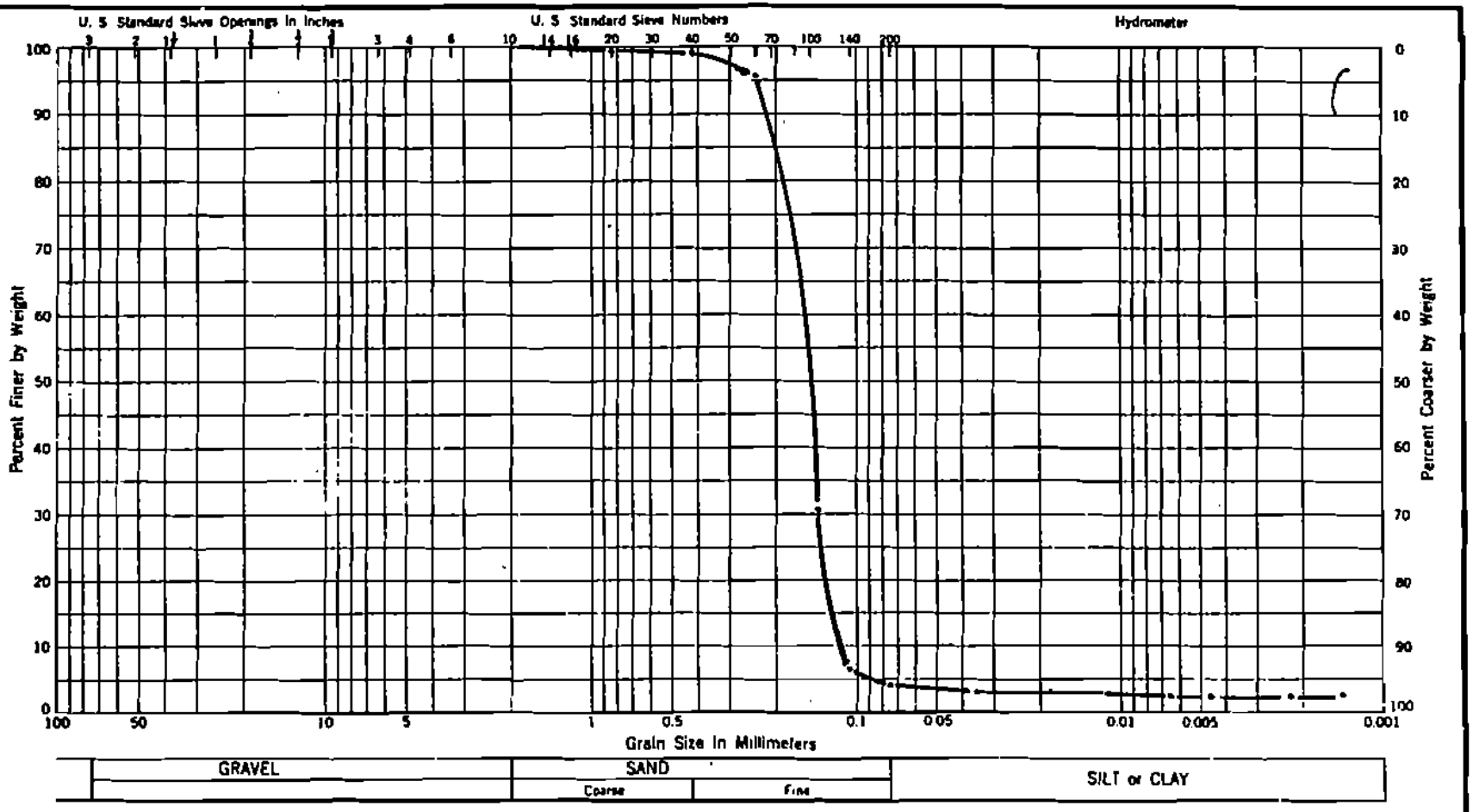
Number	Depth	Natural Moisture	L L	P. L	P. I.	Classification
DW-8	48' - 50'		N/O	N/P		Gray and brown Fine SAND (SP)
						% Passing -200 Sieve = 1.1%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



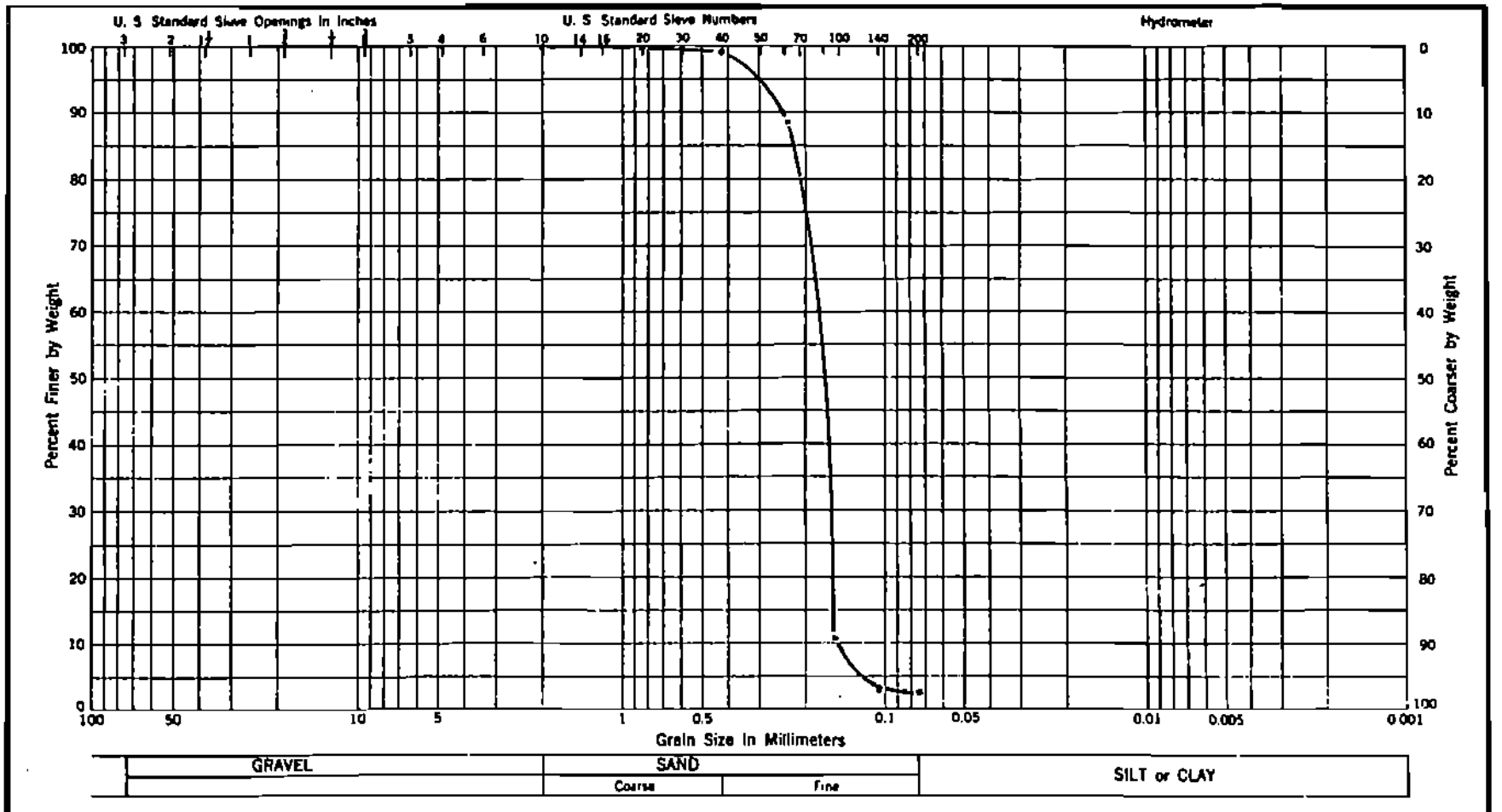
Number	Depth	Natural Moisture	L.L.	P.L.	P.I.	Classification
DW-10	3' - 4'		N/O	N/P		Dark brown Fine SAND (SP)
						% Passing -200 Sieve = 4.2%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

DRIGGERS ENGINEERING SERVICES, INC.
Clearwater, Florida



Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
DW-10	15' - 17'		N/O	N/P		Dark brown Fine SAND (SP)
						% Passing -200 Sieve = 3.0%

FILE: L933057 REPORT: 1

PROJECT: SDA - St. Johns

CLIENT: Ayres Associates

APPENDIX E

STE AND GROUNDWATER ANALYTICAL RESULTS

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

November 20, 1992
Project No. 04914

NOTE: SEPTIC TANK WAS BACKED UP AND SEPTA TANK PAPERS WERE SUBMERGED AT THE TIME

RECEIVED
NOV 23 1992
AYRES ASSOCIATES

LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 01 - Water, STE-22, sampled 11/5/92, 1200
Date Received: 11/6/92

Parameter	Units	(01) STE-22	Laboratory Blank
BOD (5 Day @ 20°C)	mg/l	204	< 1
Total Suspended Solids	mg/l	74	< 1
Total Dissolved Solids	mg/l	424	< 10
Nitrate-Nitrite Nitrogen	mg/l N	0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	73	0.05
Total Nitrogen	mg/l N	73	0.05
Total Phosphorus	mg/l P	17	< 0.01
Chloride	mg/l	58	< 1
Foaming Agents (MBAS)	mg/l	48	< 0.05
Sulfate	mg/l	6	< 2
Total Organic Carbon	mg/l	76	< 1
Oil and Grease	mg/l	40	< 2
Total Coliforms	Counts/100ml	30,000,000	< 1
Fecal Coliforms	Counts/100ml	16,000,000	< 1
Fecal Streptococci	Counts/100ml	230	< 1
Specific Conductance	umhos/cm	1,100	1.0

Francis I. Daniels
Laboratory Director

Environmental Lab No. E84129

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FLORIDA 34677 813-855-1844

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

February 5, 1993
Project No. 05078

LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 01 - Water, STE, sampled 1/7/93, 1230
Date Received: 1/7/93

Parameter	Units	(01) STE	Method Blank
Specific Conductance	umhos/cm	1,200	0.9
Chloride	mg/l	61	< 1
Sulfate	mg/l	3	< 2
Foaming Agents (MBAS)	mg/l	24	< 0.05
Total Dissolved Solids	mg/l	472	10
Total Suspended Solids	mg/l	38	< 1
Nitrate-Nitrite Nitrogen	mg/l N	0.01	< 0.01
Total Kjeldahl Nitrogen	mg/l N	78	< 0.05
Total Phosphorus	mg/l P	16	< 0.01
Total Organic Carbon	mg/l	89	< 1
Fecal Coliforms	Cts/100ml	6,600,000	< 1
Fecal Streptococci	Cts/100ml	470	< 1
BOD (5-Day @ 2°C)	mg/l	208	< 1
Oil & Grease	mg/l	34	< 2
Ammonia Nitrogen	mg/l N	75	< 0.01
Total Nitrogen	mg/l N	78	< 0.05

Francis I. Daniels
Laboratory Director

Environmental Lab No. E84129

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 02 - Water, TW1-6, sampled 1/7/93, 1000
03 - Water, TW1-12, sampled 1/7/93, 0950
04 - Water, TW1-20, sampled 1/7/93, 0940
Date Received: 1/7/93

Parameter	Units	(02) TW1-6	(03) TW1-12	(04) TW1-20
Chloride	mg/l	61	13	44
Foaming Agents (MBAS)	mg/l	5.7	< 0.05	< 0.05
Total Dissolved Solids	mg/l	380	118	322
Ammonia Nitrogen	mg/l N	48	0.14	0.01
Nitrate-Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	2.1
Total Phosphorus	mg/l P	14	0.02	0.05
Total Organic Carbon	mg/l	26	4.5	1.5
Fecal Coliforms	Cts/100ml	200	< 10	< 2

Francis I. Daniels
Laboratory Director

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 05 - Water, TW2-6, sampled 1/7/93, 1030
06 - Water, TW2-12, sampled 1/7/93, 1020
07 - Water, TW2-20, sampled 1/7/93, 1010
Date Received: 1/7/93

Parameter	Units	(05) TW2-6	(06) TW2-12	(07) TW2-20
Chloride	mg/l	51	14	40
Foaming Agents (MBAS)	mg/l	0.40	< 0.05	< 0.05
Total Dissolved Solids	mg/l	330	124	320
Ammonia Nitrogen	mg/l N	19	0.08	< 0.01
Nitrate-Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	2.9
Total Phosphorus	mg/l P	13	0.02	0.15
Total Organic Carbon	mg/l	17	3.5	1.9
Fecal Coliforms	Cts/100ml	< 1	< 1	< 1

Francis I. Daniels
Laboratory Director

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 08 - Water, TW3-6, sampled 1/7/93, 0930
09 - Water, TW3-12, sampled 1/7/93, 0920
10 - Water, TW3-20, sampled 1/7/93, 0910
Date Received: 1/7/93

Parameter	Units	(08) TW3-6	(09) TW3-12	(10) TW3-20
Chloride	mg/l	59	41	41
Foaming Agents (MBAS)	mg/l	0.37	0.06	0.07
Total Dissolved Solids	mg/l	440	126	304
Ammonia Nitrogen	mg/l N	14	0.04	0.02
Nitrate-Nitrite Nitrogen	mg/l N	23	< 0.01	2.4
Total Phosphorus	mg/l P	5.6	0.26	0.02
Total Organic Carbon	mg/l	5.6	4.0	1.7
Fecal Coliforms	Cts/100ml	< 2	< 1	< 1

Francis I. Daniels
Laboratory Director

Ayres Associates
RSE Group
3901 Coconut Palm Drive
Sabal Industrial Park - Suite 100
Tampa, Florida 33619

LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 11 - Water, TW4-6, sampled 1/7/93, 0820
12 - Water, TW4-12, sampled 1/7/93, 0810
13 - Water, TW4-20, sampled 1/7/93, 0800
Date Received: 1/7/93

Parameter	Units	(11) TW4-6	(12) TW4-12	(13) TW4-20
Chloride	mg/l	65	13	43
Foaming Agents (MBAS)	mg/l	5.5	< 0.05	< 0.05
Total Dissolved Solids	mg/l	420	124	316
Ammonia Nitrogen	mg/l N	26	0.03	0.01
Nitrate-Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	2.6
Total Phosphorus	mg/l P	5.2	0.10	0.02
Total Organic Carbon	mg/l	17	2.8	1.5
Fecal Coliforms	Cts/100ml	< 1	< 1	< 1

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 14 - Water, TW5-6, sampled 1/7/93, 0850
15 - Water, TW5-12, sampled 1/7/93, 0840
16 - Water, TW5-20, sampled 1/7/93, 0830
Date Received: 1/7/93

Parameter	Units	(14) TW5-6	(15) TW5-12	(16) TW5-20
Chloride	mg/l	55	16	35
Foaming Agents (MBAS)	mg/l	4.7	< 0.05	< 0.05
Total Dissolved Solids	mg/l	354	136	264
Ammonia Nitrogen	mg/l N	4.5	0.01	0.08
Nitrate-Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01
Total Phosphorus	mg/l P	12	0.10	0.02
Total Organic Carbon	mg/l	15	3.5	3.2
Fecal Coliforms	Cts/100ml	< 1	< 1	< 1

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 17 - Water, TW6-6, sampled 1/7/93, 0750
18 - Water, TW6-12, sampled 1/7/93, 0740
19 - Water, TW6-20, sampled 1/7/93, 0730
Date Received: 1/7/93

Parameter	Units	(17) TW6-6	(18) TW6-12	(19) TW6-20
Chloride	mg/l	88	13	43
Foaming Agents (MBAS)	mg/l	0.83	< 0.05	< 0.05
Total Dissolved Solids	mg/l	324	134	332
Ammonia Nitrogen	mg/l N	37	0.04	< 0.01
Nitrate-Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	2.7
Total Phosphorus	mg/l P	8.4	0.08	0.03
Total Organic Carbon	mg/l	13	3.6	1.7
Fecal Coliforms	Cts/100ml	< 1	< 1	< 2

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 20 - Water, TW7-6, sampled 1/6/93, 1640
21 - Water, TW7-20, sampled 1/6/93, 1630
22 - Water, TW8-6, sampled 1/6/93, 1650
23 - Water, TW8-20, sampled 1/6/93, 1700
Date Received: 1/7/93

Parameter	Units	(20) TW7-6	(21) TW7-20	(22) TW8-6	(23) TW8-20
Chloride	mg/l	83	43	24	42
Foaming Agents (MBAS)	mg/l	0.72	< 0.05	0.14	< 0.05
Total Dissolved Solids	mg/l	360	336	158	316
Ammonia Nitrogen	mg/l N	29	0.02	19	0.03
Nitrate-Nitrite Nitrogen	mg/l N	< 0.01	2.9	< 0.01	2.3
Total Phosphorus	mg/l P	5.2	0.02	3.5	0.02
Total Organic Carbon	mg/l	22	1.7	19	1.5
Fecal Coliforms	Cts/100ml	< 2	< 1	< 10	< 1

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 24 - Water, TW9-6, sampled 1/6/93, 1720
25 - Water, TW9-20, sampled 1/6/93, 1710
26 - Water, TW10-6, sampled 1/7/93, 0900
27 - Water, TW11-6, sampled 1/7/93, 1045
28 - Water, TW12-6, sampled 1/7/93, 1135
Date Received: 1/7/93

Parameter	Units	(24) TW9-6	(25) TW9-20	(26) TW10-6	(27) TW11-6	(28) TW12-6
Chloride	mg/l	76	43	53	13	69
Foaming Agents (MBAS)	mg/l	0.96	< 0.05	3.3	< 0.05	0.12
Total Dissolved Solids	mg/l	378	320	374	138	338
Ammonia Nitrogen	mg/l N	22	0.03	8.3	0.64	12
Nitrate-Nitrite Nitrogen	mg/l N	0.08	2.8	< 0.01	< 0.01	< 0.01
Total Phosphorus	mg/l P	12	0.06	9.6	0.82	0.33
Total Organic Carbon	mg/l	7.4	1.9	14	2.5	4.3
Fecal Coliforms	Cts/100ml	< 1	< 1	< 1	< 1	< 1

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
Sample Description: 29 - Water, BW1-5, sampled 1/6/93, 1615
30 - Water, BW1-10, sampled 1/6/93, 1600
31 - Water, BW1-15, sampled 1/6/93, 1610
32 - Water, SW7, sampled 1/6/93, 1545
33 - Water, W5, sampled 1/7/93, 1210
Date Received: 1/7/93

Parameter	Units	(29) BW1-5	(30) BW1-10	(31) BW1-15	(32) SW7	(33) W5
Chloride	mg/l	13	31	27	15	49
Foaming Agents (MBAS)	mg/l	< 0.05	< 0.05	< 0.05	0.05	0.31
Total Dissolved Solids	mg/l	56	66	190	248	362
Ammonia Nitrogen	mg/l N	0.15	0.10	0.10	0.79	3.0
Nitrate-Nitrite Nitrogen	mg/l N	< 0.01	< 0.01	< 0.01	< 0.01	19
Total Phosphorus	mg/l P	0.02	0.02	0.01	0.04	5.2
Total Organic Carbon	mg/l	4.3	3.8	1.3	32	7.7
Fecal Coliforms	Cts/100ml	< 1	< 1	< 1	< 10	6

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County

Parameter	Method	Detection Limit		Analysis Date
Specific Conductance	EPA 120.1	0.1	umhos/cm	1/26/93
Chloride	EPA 325.2	1	mg/l	1/20/93
Sulfate	EPA 375.4	2	mg/l	1/28/93
Foaming Agents (MBAS)	SM 512 B	0.05	mg/l	1/8/93
Total Dissolved Solids	EPA 160.1	10	mg/l	1/12/93
Total Suspended Solids	EPA 160.2	1	mg/l	1/12/93
Nitrate-Nitrite Nitrogen	EPA 353.2	0.01	mg/l N	2/3/93
Total Kjeldahl Nitrogen	EPA 351.2	0.05	mg/l N	1/14/93
Total Phosphorus	EPA 365.2	0.01	mg/l P	1/19/93
Total Organic Carbon	EPA 415.1	1	mg/l	1/28/93
Fecal Coliforms	SM 909 C	1	Ct/100mls	1/7/93
Fecal Streptococci	SM 910 B	1	Ct/100mls	1/7/93
BOD	SM 507	1	mg/l	1/8/93
Oil and Grease	EPA 413.1	2	mg/l	2/2/93
Ammonia Nitrogen	EPA 350.1	0.01	mg/l N	1/14/93 (01-20,M/B) 1/20/93 (21-33)
Total Nitrogen	Calc.	0.05	mg/l N	2/3/93

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SOA, St. Johns County
QC Description: Matrix Spike/Matrix Spike Duplicate Recoveries

Parameter	Sample No. Spiked	Accuracy Mean % R	Precision RPD	QC Control Limits Accuracy	Precision
Specific Conductance	IS01474(1/26)	102	0	90-118	0-1
Chloride	05078-02	89	1	92-109	0-3
	05078-16	100	2	92-109	0-3
	05078-30	99	1	92-109	0-3
Sulfate	05091-11	103	1	78-127	0-7
Foaming Agents (MBAS)	05078-03	97	6	74-132	0-22
	05078-15	99	6	74-132	0-22
	05078-23	101	18	74-132	0-22
Total Dissolved Solids	05078-03	99	3	81-116	0-11
	05078-19	101	3	81-116	0-11
	05078-28	94	3	81-116	0-11
Total Suspended Solids	05070-01	91	1	87-104	0-12
Nitrate-Nitrite Nitrogen	05078-02	100	2	81-132	0-14
	05078-11	99	1	81-132	0-14
	05078-24	97	0	81-132	0-14
Total Kjeldahl Nitrogen	05065-10	83	1	79-119	0-18
Total Phosphorus	05078-10	94	0	81-122	0-14
	05078-19	98	8	81-122	0-14
	05078-31	87	2	81-122	0-14
Total Organic Carbon	05078-10	97	2	82-117	0-7
	05078-20	90	1	82-117	0-7
	05078-30	94	1	82-117	0-7
Fecal Coliforms	05078-01	--	33	--	0-82
	Pos.Control(1/7)	--	29	--	0-82
Fecal Streptococci	05078-01	--	43	--	0-60
BOD	05078-01	--	5	--	0-21
	IS01820(1/8)	90	15	70-113	0-21
Oil and Grease	RS/RSD(2/2)	100	3	79-114	0-21
Ammonia Nitrogen	05078-06	103	1	83-123	0-3
	05078-16	100	1	83-123	0-3
	05078-25	117	2	83-123	0-3

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LABORATORY REPORT

Project Description: Ayres Project No. 4155.00 - SDA, St. Johns County
QC Description: Matrix Spike/Matrix Spike Duplicate Recoveries

Note: Matrix Spike/Matrix Spike Duplicates are routinely analyzed concurrently with samples, in all methods, to assess the accuracy and precision of the techniques being carried out. Two of three aliquots of at least one sample in the set being processed are spiked with known equal concentrations of actual method analytes. These duplicate spiked aliquots are subjected to the analytical method in the same manner as the samples themselves.

Recovery of the spikes is determined by comparison of analyte concentrations in the two spiked aliquots to the analyte concentration in the unspiked sample aliquot. Accuracy is reported as percent of the analyte recovered versus the original concentration spiked (Percent Recovery), averaged for the duplicate spikes. Precision is reported as Relative Percent Difference between the duplicate spike measurements.

Quality Control results published for each method are representative of the sample set in which these project samples were included. The actual sample spiked is indicated. Each matrix type (water and/or soil) in a set is spiked at least once. A minimum of 10% of all samples are routinely spiked.

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