GEOTECHNICAL INVESTIGATION REPORT
Sewage Lift Stations
55th Avenue & Arizona Canal
67th Avenue & Arizona Canal
Glendale, Arizona

SHB Job No. E83-169

Consulting Geotechnical Engineers
PHOENIX • ALBUQUERQUE • SANTA FE • SALT LAKE CITY

SERGENT, HAUSKINS & BECKWITH

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S H B

SERGENT, HAUSKINS & BECKWITH CONSULTING GEOTECHNICAL ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

B. DWAINE SERGENT, P.E.
NORMAN H. WETZ, P.E.
WAYNE A. ERICSON, P.E.
JOHN B. HAUSKINS, P.E.
DALE V. BEDENKOP, P.E.
ROBERT L. FREW
DONALD L. CURRAN, P.E.
GEORGE H. BECKWITH, P.E.
ROBERT R. KOONS, P.E.
DONALD G. METZGER, P.G.
ALLON C. OWEN, JR., P.E.
ROBERT D. BOOTH, P.E.
ROBERT W. CROSSLEY, P.E.
RALPH E. WEEKS, P.G.

January 13, 1984

PRC Engineering
4131 North 24th Street
Phoenix, Arizona 85016

SHB Job No. E83-169

Attention: Glenn F. DenBesten, P.E.

Re: Sewage Lift Stations
55th Avenue & Arizona Canal
67th Avenue & Arizona Canal
Glendale, Arizona

Gentlemen,

Our Geotechnical Investigation Report on the referenced project is herewith submitted. The report includes the results of test drilling, laboratory analysis, and recommended criteria for foundation design, slab support, excavations and earthwork.

Should any questions arise concerning this report, we would be pleased to discuss them with you.

Respectfully submitted,
Sergent, Hauskins & Beckwith Engineers

By _____
Robert W. Crossley, P.E.

Reviewed by _____
George H. Beckwith, P.E.

Registered Professional Engineer (Civil) CERTIFICATE NO. 11049 ROBERT W. CROSSLEY Date Signed 1-13-84 ARIZONA, U.S.A.

Registered Professional Engineer (Civil) CERTIFICATE NO. 5663 GEORGE H. BECKWITH Date Signed 1-13-84 ARIZONA, U.S.A.

Copies: Addressee (4)

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Sewage Lift Stations
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1. INTRODUCTION

This report is submitted pursuant to a geotechnical investigation made by this firm of two sites where lift stations will be constructed to carry trunk sewer lines beneath the Arizona Canal Diversion Channel. The stations are associated with crossings along 67th Avenue and near the alignment of 55th Avenue in Glendale, Arizona. The object of this investigation was to evaluate the physical properties of the subsoils underlying the sites in order to provide recommendations for foundation design, slab support, excavations and backfilling.

2. PROJECT DESCRIPTION

Preliminary details of the proposed construction were provided by Glenn F. DenBesten, P.E., of PRC Engineering.

It is understood that at each of the two crossings approximately 700 lineal feet of trunk sewer line will be built approximately 30 feet below surrounding natural grade. A 24-inch diameter line is involved at the 57th Avenue crossing; while a 10-inch diameter line is involved at 55th Avenue. Each crossing will necessitate the construction of a lift station at locations downgrade from the crossings.

The lift station south of the 67th Avenue crossing consists of a poured-in-place concrete chamber (wet well),

with plan dimensions about 10 by 22 feet and associated prefabricated pump station contained in an 11 by 22-foot chamber. The floor of the wet well is to be elevation 1172.0, which is about 41 feet below surface elevation.

The lift station downgrade from the 55th Avenue crossing will be similar in detail but somewhat smaller. A packaged station is planned. The floor of the chamber is at elevation 1178.0, which is about 39 feet below the surface.

Floor loading from the pumps and ancillary equipment is expected to be nominal; probably less than 2,000 pounds per square foot.

Should details involved in final design vary significantly from those as outlined, this firm should be notified for review and possible revision of recommendations.

3. INVESTIGATION

3.1 Subsurface Exploration

Four exploratory borings were performed. One boring was located at each lift station and at the north side of each crossing.

The borings were drilled to depths of 35 to 45 feet below grade with a truck-mounted CME-55 drill rig advancing 6 5/8-inch O.D. hollow stem auger. Standard

penetration testing and open-end drive sampling were performed at selected intervals in the borings.

The results of the field investigation are presented in Appendix A, which includes a brief description of drilling and sampling equipment and procedures, site plans showing the boring locations, and logs of the test borings. The field investigation was supervised by Norman H. Wetz, P.E., staff engineer of this firm.

3.2 Laboratory Analysis

Moisture content determinations were made on selected tube samples recovered, while dry densities were determined for selected 2.42 inch diameter open-end drive samples. The results of these tests are shown on the boring logs.

Grain-size analysis and Atterberg Limits tests were performed on selected samples. The results of these tests are presented in Appendix B.

4. SITE CONDITIONS & GEOTECHNICAL PROFILE

4.1 Site Conditions

At the 55th Avenue site, the Arizona Canal diversion channel has been constructed. Boring 1 is located at the crest of the east side slope of the diversion channel. Boring 2, at the site of the lift station, is

located within a citrus orchard which borders the west side of the existing Arizona Canal.

At the 67th Avenue crossing, the Arizona Canal diversion channel has not, as yet, been excavated. Presently, the site of the lift station and most of the diversion channel, is pasture land which appears to be part of small farm acreages on the west side of 67th Avenue.

4.2 Geotechnical Profile

4.2.1 55th Avenue Crossing

On the east side (boring 1), disturbed soil which is associated with the construction of the ACDC extends to about a foot. Below this depth, stratified desert alluvium consisting primarily of sandy clay and clayey silt of low to medium plasticity was encountered. Some to considerable gravel is present in many strata, particularly below 33 feet. At the site of the lift station, material which is believed to be fill was encountered to a depth of about 4 feet. Below this depth, stratified, predominantly fine grained alluvium, similar to that found in boring 1, was encountered throughout the depth of the 45-foot deep boring. Below about 37 feet, silty clay of high plasticity was encountered.

All of the subsoils are cemented with calcium carbonate to some degree. The degree of cementation

may be described as generally weak in the upper 10 to 20 feet and moderate to strong below this depth.

4.2.2 67th Avenue Crossing

The subsurface profile consists of more thickly stratified desert alluvium throughout the depths encountered. At this location, generally coarser material (sand and gravel in a silt and clay matrix) was encountered. As was the case at the 55th Avenue crossing, the subsoils are cemented with calcium carbonate to some degree. These subsoils may be described as generally firm to hard.

4.3 Soil Moisture & Groundwater Conditions

No free groundwater was encountered in the borings and soil moisture contents were relatively low throughout.

5. DISCUSSION & RECOMMENDATIONS

5.1 Analysis of Results

The existing soils at the level of the below grade lift stations are strongly cemented and will provide excellent support for the structural elements which will be built or placed. Nevertheless, it is recommended that floor slabs be supported on a course of open graded material, such as crushed rock, in order to provide pressure relief beneath slabs. Free drainage is also

recommended behind the retaining walls, in that seepage could occur from the diversion channel, Arizona Canal or from adjacent irrigated areas. Seepage from these sources is considered possible in the stratified soils involved. This matter is discussed in Section 5.4. The possibility exists that swelling soils could cause some heave of floor slabs or mats, if a large thickness of soils were to become saturated. This phenomena would be more likely to occur at the 55th Avenue crossing due to the presence of more highly plastic clay soils at the elevation of the lift station at that site. The expansive potential, however, does not appear to be severe. Surface drainage measures should be taken to minimize the possibility of moisture increases.

5.2 Spread-Type or Mat-Type Foundations

5.2.1 Design Criteria

A safe soil bearing pressure of 8,000 pounds per square foot may be utilized in design of mats or foundations bearing on soils 35 feet or deeper below grade. This value considers full dead plus any live loads and may be increased by one-third when analyzing occasional loads, such as those due to seismic forces. A minimum footing width for conventional spread-type footings of 16 inches is required.

5.2.2 Estimated Settlements

It is estimated that settlements of footings or mat

foundations designed in accordance with the above recommendations will not exceed ¼ inch for the soil moisture contents encountered in the soils at the time of test drilling. It is estimated that because of overburden pressure relief which will occur as a result of excavation, settlements for these moisture contents will be negligible, or possibly slight heave due to soil rebound will occur. Moisture increases in the supporting soils might cause some additional settlement of footings or mat foundations, or a slight amount of heave due to swelling.

5.2.3 Lateral Loads

Passive soil resistance against the edges of footings and stem walls, with properly compacted backfill, should be considered as being equal to the forces exerted by a fluid of 350 pounds per cubic foot unit weight. Where footings are cast neat to cut surfaces in native soils at depths of 20 feet or greater, the passive soil resistance against the footings may be considered equal to the forces exerted by a fluid of 550 pounds per cubic foot unit weight. A coefficient of friction of 0.45 is recommended for computing lateral resistance between the bases of footings and slabs, and the soil in analyzing lateral loads.

5.3 Excavations

Temporary excavations in the subsoils at both sites can

foundations designed in accordance with the above recommendations will not exceed ¼ inch for the soil moisture contents encountered in the soils at the time of test drilling. It is estimated that because of overburden pressure relief which will occur as a result of excavation, settlements for these moisture contents will be negligible, or possibly slight heave due to soil rebound will occur. Moisture increases in the supporting soils might cause some additional settlement of footings or mat foundations, or a slight amount of heave due to swelling.

5.2.3 Lateral Loads

Passive soil resistance against the edges of footings and stem walls, with properly compacted backfill, should be considered as being equal to the forces exerted by a fluid of 350 pounds per cubic foot unit weight. Where footings are cast neat to cut surfaces in native soils at depths of 20 feet or greater, the passive soil resistance against the footings may be considered equal to the forces exerted by a fluid of 550 pounds per cubic foot unit weight. A coefficient of friction of 0.45 is recommended for computing lateral resistance between the bases of footings and slabs, and the soil in analyzing lateral loads.

5.3 Excavations

Temporary excavations in the subsoils at both sites can

be made at slopes of about ½:1 (horizontal to vertical). These estimates for temporary cut slopes are based on geotechnical considerations only. They do not consider arbitrary requirements that might be imposed by OSHA. Current OSHA regulations should be checked in the process of planning.

5.4 Concrete Slabs Cast-on-Grade

5.4.1 Slab Support

The use of an open graded material beneath slabs will provide a more desirable working surface, minimize the capillary rise of moisture to slabs, and aid in the proper curing of concrete. Additionally, an open graded material is an essential element in a means to provide hydrostatic pressure relief beneath concrete floors should flooding of the chambers or saturation of surrounding fill and native soils occur. Accordingly, a minimum course of a 6-inch thickness of 3/4-inch crushed rock should be used beneath floors and slabs cast-on-grade. Typar 3401 geotextile or an approved equivalent should be placed beneath the crushed rock to act as a filter.

5.4.2 Structural Design of Slabs

A modulus of subgrade reaction (k) of 400 pounds per square inch per inch of deflection is recommended for the structural design of concrete slabs cast-on-grade.

5.4.3 Pressure Relief Beneath Slabs

Some means of hydrostatic pressure relief beneath the concrete slab floors of the chambers should be provided. The native soils below the level of the excavation are very low in permeability, hence, hydrostatic pressures of considerable magnitude could develop beneath floor slabs if minor leakage begins to collect beneath the slabs and adjacent to walls.

Pressure relief could be accomplished with the placement of 6 inches of 3/4-inch crushed rock beneath slabs and the use of one-way valves through the slab.

5.5 Retaining Walls

5.5.1 Design Criteria

The walls of the chambers will be rigid, so that rotation is not expected to occur. Accordingly, the walls should be designed to resist "at rest" earth pressures equal to the forces exerted by a 55 pound per cubic foot unit weight acting horizontally against the wall. These values apply to walls with horizontal backfill; recommendations can be presented by this office for walls involving sloping backfill if this situation should occur.

5.5.2 Backfill Adjacent to Retaining Walls

A free draining granular backfill is recommended for

backfilling adjacent to retaining walls. Weep holes should be provided in walls near the bottom of chambers.

Except for the upper 5.0 feet, the backfill behind retaining walls for a distance of at least 8.0 feet laterally beyond their perimeters should consist of selected nonplastic sand, gravel and cobble mixtures with no more than 5 percent by weight passing the no. 200 sieve and no particles more than 6 inches in diameter. These materials must be imported from off-site.

Typar 3401, or an equivalent geotextile, should be placed between the free-draining backfill and native soils or structural fill to act as a filter. The upper 5.0 feet should consist of selected finer grained material of relatively low permeability. All fill should be compacted to at least 95 percent of maximum dry density as determined by ASTM D698. Moisture content during compaction should be no drier than 2 percent below optimum moisture content.

TEST DRILLING EQUIPMENT & PROCEDURES

Drilling Equipment Truck-mounted CME-55 drill rigs powered with 4 or 6 cylinder Ford industrial engines are used in advancing test borings. The 4 cylinder and 6 cylinder engines are capable of delivering about 4,350 and 6,500 foot/pounds torque to the drill spindle, respectively. The spindle is advanced with twin hydraulic rams capable of exerting 12,000 pounds downward force. Drilling through soil or softer rock is performed with 6 1/2 O.D., 3 1/4 I.D. hollow stem auger or 4 1/2 inch continuous flight auger. Carbide insert teeth are normally used on the auger bits so they can often penetrate rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NX rods using water or air as a drilling fluid. Where auger and tricone gear bits cannot be used to advance the hole due to cobbles or caving conditions, the ODEX (overburden drilling with the eccentric method) is used. A percussion down-the-hole hammer underreams the hole and 5 inch steel casing is introduced into the hole during drilling. The drill bit is eccentric and can be removed from the center of the casing to allow sampling of the material below the bit penetration depth.

Sampling Procedures Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 procedure. In many cases, 2" O.D., 1 3/8" I.D. samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" O.D. samplers lined with 2.42" I.D. brass rings. The driving energy is generally recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the samplers in 6 inch increments. However, in stratified soils, driving resistance is sometimes recorded in 2 or 3 inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. These values are expressed in blows per foot on the logs. "Undisturbed" sampling of softer soils is sometimes performed with thin walled Shelby tubes (ASTM D1587). Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings.

Continuous Penetration Tests Continuous penetration tests are performed by driving a 2" O.D. blunt nosed penetrometer adjacent to or in the bottom of borings. The penetrometer is attached to 1 5/8" O.D. drill rods to provide clearance to minimize side friction so that penetration values are as nearly as possible a measure of end resistance. Penetration values are recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the penetrometer in one foot increments or less.

Boring Records Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487) with appropriate group symbols being shown on the logs.

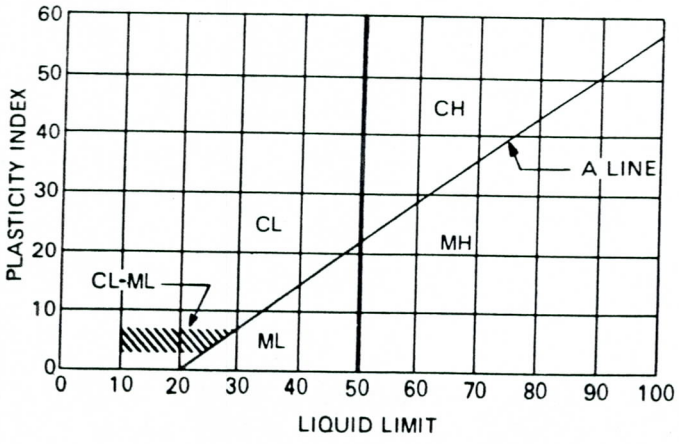
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified by the Unified Soil Classification system on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" Corp of Engineers, US Army Technical Memorandum No. 3-357 (Revised April 1960) or ASTM Designation: D2487-66T.

MAJOR DIVISIONS			GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)		GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
				GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 seive)		SW	Well graded sands, gravelly sands.
				SP	Poorly graded sands, gravelly sands.
		SANDS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.
		SANDS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (LIMITS PLOT BELOW "A" LINE & HATCHED ZONE ON PLASTICITY CHART)	SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50)		ML	Inorganic silts, clayey silts with slight plasticity.
		SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50)		MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	CLAYS (LIMITS PLOT ABOVE "A" LINE & HATCHED ZONE ON PLASTICITY CHART)	CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50)		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50)		CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

NOTE: Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with limits plotting in the hatched zone on the plasticity chart to have double symbol.

PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to ¾ in.
Fine gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY, CONSISTENCY OR FIRMNESS OF SOILS

The terminology used on the boring logs to describe the relative density, consistency or firmness of soils relative to the standard penetration resistance is presented below. The standard penetration resistance (N) in blows per foot is obtained by the ASTM D1586 procedure using 2" O.D., 1 3/8" I.D. samplers.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands and sand-gravel mixtures.

N	Relative Density
0-4	Very loose
5-10	Loose
11-30	Medium dense
31-50	Dense
50+	Very dense

2. Relative Consistency. Terms for description of clays which are saturated or near saturation.

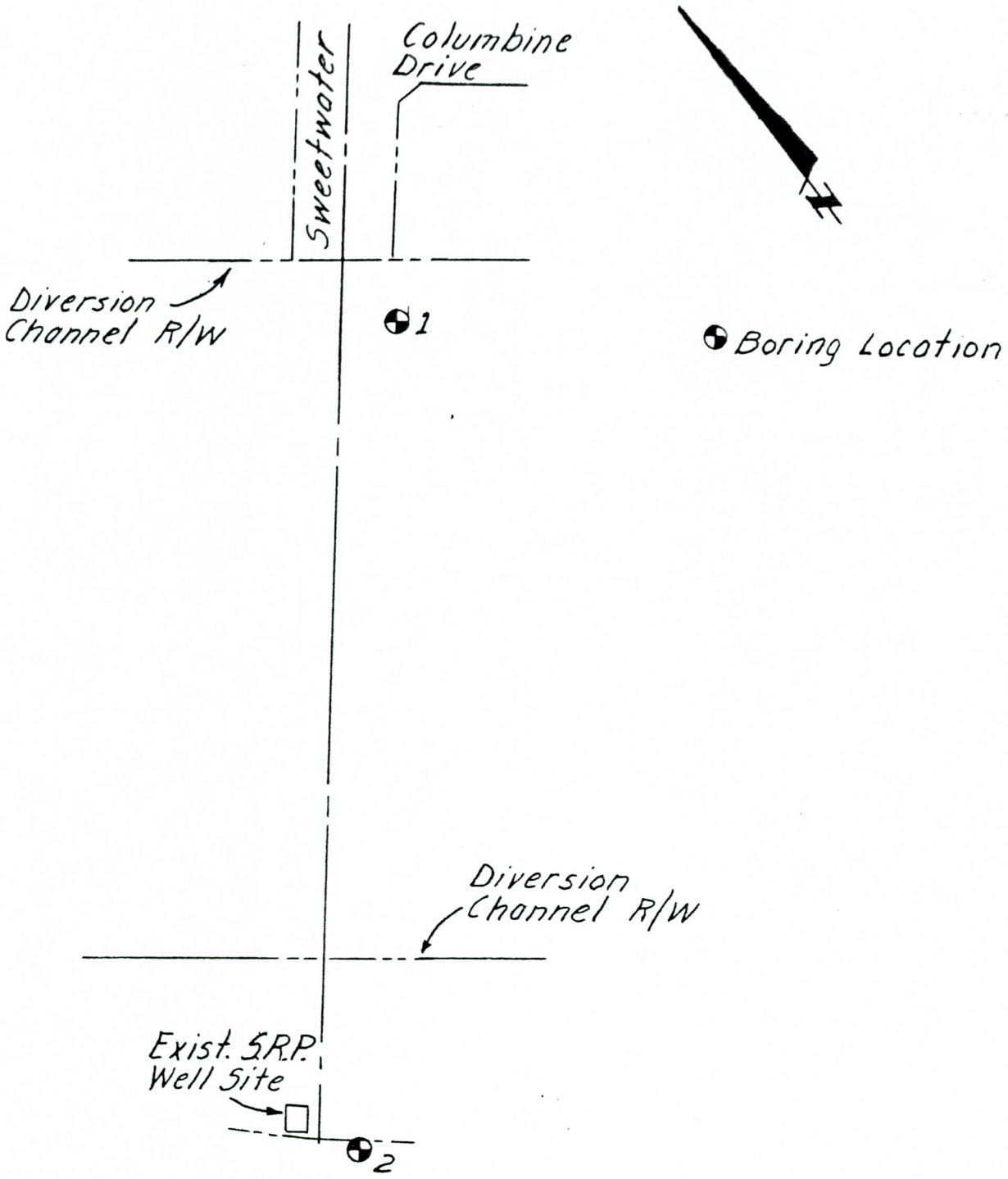
N	Relative Consistency	Remarks
0-2	Very soft	Easily penetrated several inches with fist.
3-4	Soft	Easily penetrated several inches with thumb.
5-8	Medium stiff	Can be penetrated several inches with thumb with moderate effort.
9-15	Stiff	Readily indented with thumb, but penetrated only with great effort.
16-30	Very stiff	Readily indented with thumbnail.
30+	Hard	Indented only with difficulty by thumbnail.

3. Relative Firmness. Terms for description of partially saturated and/or cemented soils which commonly occur in the Southwest including clays, cemented granular materials, silts and silty and clayey granular soils.

N	Relative Firmness
0-4	Very soft
5-8	Soft
9-15	Moderately firm
16-30	Firm
31-50	Very firm
50+	Hard

SITE PLAN

SHOWING LOCATIONS OF TEST BORINGS



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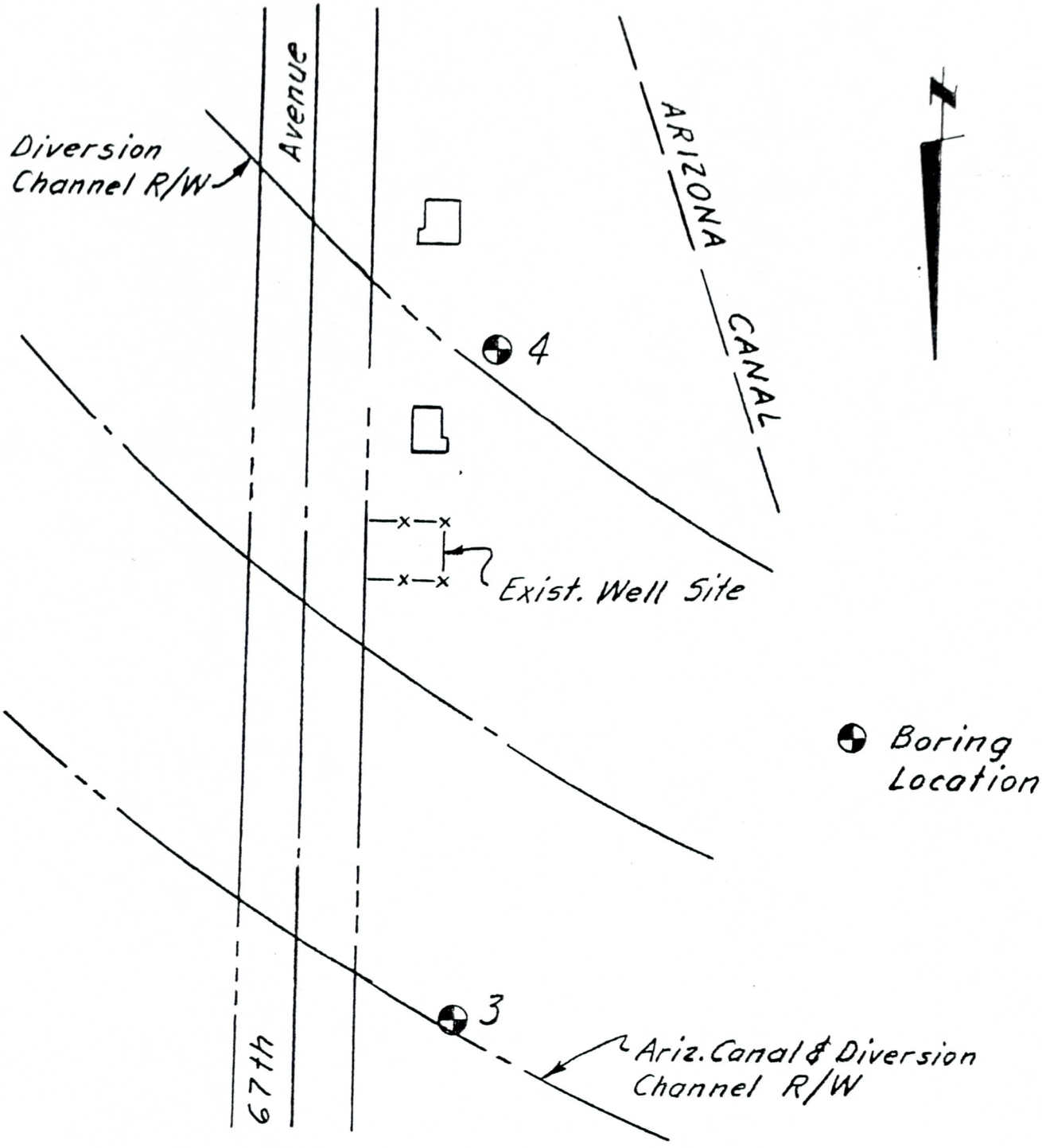
SITE PLAN

SHOWING LOCATIONS OF TEST BORINGS



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PROJECT Sewage Lift Stations

JOB NO. E83-169 DATE 12-15-83

LOG OF TEST BORING NO. 1

Location 55th Avenue

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 1220.0'+0.2'

DATUM PRC Survey

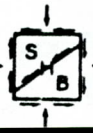
Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	17			SM		FILL SILTY SAND & GRAVEL, some clay, well graded, rounded, low plasticity to nonplastic, brown
5				S	76 (no recovery)				slightly moist to moist firm to hard	SANDY CLAY & CLAYEY SILT, stratified, weakly to moderately lime cemented, low to medium plasticity, brown to light brown note: moderately to strongly lime cemented below 15'
10				S	44					
15				S	149			CL-ML		
20				S	87		21			
25				S	66		16			
30				U	100/9"		15			
35				S	50/5"			GC		CLAYEY SAND & GRAVEL, well graded, subangular, moderately lime cemented, low plasticity, brown
										Stopped auger at 34'6" Sampler refused at 34'11"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.



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PROJECT Sewage Lift Stations

JOB NO. E83-169 DATE 12-15-83

LOG OF TEST BORING NO. 2

Location 55th Avenue
RIG TYPE CME-75
BORING TYPE 6¾" Hollow Stem Auger
SURFACE ELEV. 1217.0'+0.2'
DATUM PRC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	14			CL	moist moderately firm	FILL SILTY CLAY, some sand & gravel, few cobbles, low plasticity, reddish brown to dark brown
5				S	50/4½"			SC	dry to slightly moist hard	CLAYEY SAND, some gravel, well graded, subangular, moderately to strongly lime cemented, low plasticity, light brown
10				S	50/3"(no recovery)					
15				S	78				slightly moist hard	SANDY CLAY & CLAYEY SILT, stratified, moderately to strongly lime cemented, low plasticity, brown to light brown
20				S	50/5"		17			
25				S	50/3"		16	CL-ML		
30				U	100/6"	117	40			
35				S	50/5"		14			
40				U	100/2"	107	12	CH	slightly moist hard	SANDY CLAY, some gravel, well graded, subrounded, strongly lime cemented, high plasticity, light brown
45				S	50/3"(no recovery)					Stopped auger at 44' Sampler refused at 44'3"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

SERGENT, HAUSKINS & BECKWITH
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PROJECT Sewage Lift Stations

JOB NO. E83-169 DATE 12-16-83

LOG OF TEST BORING NO. 3

Location 67th Avenue

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 1217.0'+0.2'

DATUM PRC Survey

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	12				dry moderately firm to very firm	SANDY CLAY, weakly lime cemented, low to medium plasticity, light brown to reddish brown
5				S	47			CL		
10				S	50/1"			GM-GC	dry	SILTY SAND & GRAVEL, some cobbles, small amount of clay, well graded, subrounded to subangular, low plasticity, brown
15										
20				S	50/4"				slightly moist to moist hard	CLAYEY SAND & GRAVEL, some cobbles, well graded, subrounded to subangular, low to medium plasticity, brown
25				S	50/2½"			GC		
30				S	50/5"					
35				S	68		22	CL	moist hard	SILTY CLAY, medium plasticity, reddish brown
40										Stopped auger at 34'6" Stopped sampler at 36'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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PROJECT Sewage Lift Stations

JOB NO. E83-169 DATE 12-15-83

LOG OF TEST BORING NO. 4

Location 67th Avenue

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 1213.0'+0.2'

DATUM PRC Survey

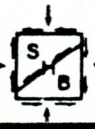
Depth in Feet	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0	S	13				CL	moist moderately firm to firm	SILTY CLAY, trace of gravel, weakly lime cemented, medium plasticity, reddish brown
5	S	28	(no recovery)					
10	S	22	(no recovery)				moist firm to hard	CLAYEY SAND & GRAVEL, some cobbles, well graded, subrounded to subangular, weakly cemented, low plasticity, reddish brown
	A							
15	S	55				GC		
20	S	50/4½"			7			
25						CL	moist hard	SILTY CLAY, medium plasticity, reddish brown
30	S	113			18	SC	moist hard	CLAYEY SAND, predominantly fine to medium, low plasticity, brown
35	U	100/11"	118		3		moist dense	SILTY SAND & GRAVEL, well graded, subangular, weakly cemented, low plasticity, brown note: some thin lenses of sandy silt (ML), low plasticity, brown
40	S	50/5½"			20	GM		
45	S	37						
50								Stopped auger at 44'6" Stopped sampler at 46'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.



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TABULATION OF TEST RESULTS

Job No. E83-169
W/O 1

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	SIEVE ANALYSIS-ACCUM % PASSING												LAB NO
					#200	#100	#50	#40	#30	#16	#10	#8	#4	.25"	.375"	.5"	
					.75"	1"	1.5"	2"	2.5"	3"	3.5"	4"	6"	8"	10"	12"	
1	AT-20'	ML	43	16	69.3	79	87	91	94	97	99	99	100				3-169-4
2	AT-40'	CH	51	28	60.6	70	76	79	85	88	91	94	97	97	100		3-169-15
3	AT-35'	CL	44	20	68.1	79	90	94	96	99	99	100					3-169-22
4	AT-35'	GP-GM	-	NP	9.1	11	12	17	20	30	36	39	45	48	55	62	
					88	100											3-169-28

B-1