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Report
Soil Investigation
Airport Corporate Center
Phase 1, Lots 18 and 19
Sonoma County, California

Prepared for
Airport Business Center
414 Aviation Boulevard
Santa Rosa, CA 95403-1069

By

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INTRODUCTION

This report presents the results of our soil investigation for the proposed commercial building to be constructed on Lots 18 and 19 of the Airport Corporate Center (Phase I) subdivision in Sonoma County, California. The site is located southwest of Aviation Boulevard, and is bordered by Redwood Creek on the southeast. We understand the project will consist of a concrete tilt-up wall structure with concrete slab-on-grade floors. The building will be served by asphalt-paved driveway and parking areas with underground utilities.

The object of our investigation, as outlined in our confirming proposal dated March 20, 1998, was to review selected geologic references in our files, explore subsurface conditions, measure depth to groundwater, and determine the physical properties of the soils encountered. We then performed engineering analyses to develop conclusions and recommendations concerning:

1. Proximity of the site to active faults.
2. Site preparation and grading.
3. Foundation support and design criteria.
4. Support of concrete slab-on-grade floors.
5. Loading dock and retaining wall design criteria, if appropriate.

6. Preliminary flexible pavement thicknesses based on our experience with similar projects and soils.

7. Soil engineering drainage.

8. Supplemental soil engineering services.

WORK PERFORMED

We reviewed our previous soil investigation for adjacent lots and selected, published, geologic information in our files including:

1. The "Geologic Map of the Santa Rosa Quadrangle, California," by D. L. Wagner and E. J. Bortugno, California Division of Mines and Geology, 1982.

2. The "Geology for Planning in Sonoma County" maps, Special Report 120, dated 1980 by California Division of Mines and Geology.

3. The Healdsburg Quadrangle Sheet of the Alquist-Priolo Special Studies Zone maps, California Division of Mines and Geology, 1983.

4. Flood-Prone Areas in the San Francisco Bay Region, California, by J. T. Limerinos, K. W. Lee and P. E. Lugo, USGS (Water Resources Investigation, 37-73), 1973.

5. Flood Insurance Rate Map (FIRM), Sonoma County, California, Community Panel Number 060375-0655A, dated January 20, 1982, Federal Emergency Management Agency.

On March 25, 1998, we observed surface features and explored subsurface conditions to the extent of four test borings at the locations shown on Plate 1. The borings were drilled to depths ranging from about 11½ to 14½ feet with truck-mounted, auger equipment. Our representative located the borings, observed the drilling, logged the conditions encountered, and obtained samples for visual classification and laboratory testing. Relatively undisturbed samples were obtained with a 2.5-inch (inside-diameter) split-spoon sampler driven with a 280-pound drop hammer. The stroke during driving was about 30 inches. The blows required to drive the sampler were recorded and converted to equivalent Standard Penetration blow counts for correlation with empirical data. Logs of the borings showing soil classifications, sample depths and converted blow counts are presented on Plates 2 through 5. The soils are classified in accordance with the Unified Soil Classification System explained on Plate 6.

Selected samples were tested in our laboratory to determine moisture content, dry density, classification (percent passing No. 200 sieve, Atterberg Limits and percent free swell) and strength characteristics. The test results are shown on the logs with the strength data shown in the manner described by the Key to Test Data, Plate 6. Detailed results of the Atterberg Limits tests are presented on Plate 7.

The boring locations indicated on Plate 1 are approximate and were established by visually estimating from existing surface features. The location of the borings should be considered no more accurate than implied by the methods used to establish the data. All of the borings were backfilled at the completion of the exploration.

SURFACE AND SUBSURFACE CONDITIONS

The site is relatively flat and appears to sheet drain to the northwest toward an existing drainage channel that extends along the northwest property line. This area was noted to be very soft and saturated at the time of our exploration. The areas south and southwest of the proposed building area are slightly higher in elevation, and the contours are suggestive of the presence of several small stockpiles of fill.

The borings and laboratory tests indicate that the site is underlain by discontinuous layers of clay, sand and gravel to the maximum depth explored. The upper topsoils extend to depths of about 2 to 3 feet and consist of weak, sandy clays of apparent low to possibly moderate expansion potential. That is, the soils would tend to undergo low to possibly moderate strength and volume changes with seasonal variation in moisture content. Below the upper topsoils, the soils consist of medium stiff to stiff sandy clay and clayey sand of low to moderate strength. In Borings 1 and 4, medium dense sands were encountered that contain varying amounts of clay. The sandy soils were noted at depths of about 4½ to 6½ feet in Boring 1, and 5 feet to 12½ feet in

Boring 4. All the borings bottomed in firm clayey soils or very dense gravelly soils of high strength.

Groundwater was encountered in all of our borings during the exploration. Water levels were initially recorded at depths of about 5 to 6½ feet below the surface, then were observed to rise to within about 1½ to 5½ feet of the surface within about one hour after drilling. We believe that groundwater levels vary seasonally and could rise and fall several feet with seasonal changes.

The geologic maps reviewed did not indicate the presence of active faults at the site. The closest faults generally considered active are the San Andreas Fault Zone located approximately 20 miles to the southwest and the Healdsburg Fault zone about 1¼ miles to the northeast.

CONCLUSIONS

Based on the results of our field exploration, laboratory tests and engineering analyses, we conclude that, from a soil engineering standpoint, the site can be used for the proposed construction. The most significant soil factors that must be considered in design and construction are the presence of weak, upper clayey natural soils of low to moderate expansion potential, and underlying, near-surface sandy and clayey soils of relatively low strength.

The geologic maps reviewed did not indicate the presence of active faults at the site, and the parcel is not located within a presently designated Alquist-Priolo Earthquake Fault Zone. Therefore, we judge that there is little risk of fault-related ground rupture or failure during earthquakes. However, like the entire Sonoma County area, there is potential for strong ground-shaking during future earthquakes. The intensity at the site will depend on the distance to the earthquake epicenter, depth and magnitude of the shock, and the response characteristics of the materials beneath the site. Because of the proximity to the nearby Healdsburg and other fault zones and the potential for strong ground-shaking, it will be necessary to design and construct the project in strict accordance with current standards for earthquake-resistant construction.

Surface cracking and subsidence can result from soil liquefaction or densification during strong earthquake shaking. Liquefaction, a loss in shear strength, and densification, a reduction in void ratio, are phenomena associated with loose, sandy soil deposits subjected to ground shaking. We have analyzed the soil data from the borings at the site in accordance with the "*Simplified Procedure for Evaluating Soil Liquefaction Potential*" by H. B. Seed and I. M. Idriss, published in the Journal of the Soil Mechanics and Foundation Division of the American Society of Civil Engineers, dated September 1971, and subsequent papers by Seed and others, published in 1985. Based on our analysis, we judge that the loose sandy soils at the site could be subject to liquefaction and/or densification and resultant settlement during strong ground shaking. However, whether such phenomena would actually occur depends on complicated factors such as intensity and duration of ground shaking at the site and underlying soil and groundwater conditions. If liquefaction or densification were to occur in the site vicinity, we believe that damage to the structure in the form of differential settlement, tilting or sagging could occur. The use of well reinforced foundation systems and compacted fill pads, as subsequently recommended herein, would reduce potential distress should these phenomena occur.

Our experience indicates that such weak, upper topsoils can undergo considerable strength loss and settlement when saturated under load. Where evaporation is inhibited by footings, slabs or fill, eventual saturation of the underlying soils can occur. Therefore, we judge that the existing weak, upper topsoils are not suitable for fill, foundation or slab support in their present condition.

We conclude that spread footing foundations and concrete slab-on-grade floors can be used. However, to provide adequate support for slab-on-grade floors and relatively shallow spread footings, it will be necessary to remove (overexcavate) weak, upper topsoils to their full depth in planned improvement areas, and footings would need to be underlain by a zone of properly compacted fill. The soils can then be replaced as properly compacted fill.

Although expansive clayey soils were not encountered in any of the borings, such soils have been encountered locally within the upper 2 to 3 feet of soils at other locations within the subdivision. Expansive soils can undergo considerable shrink and swell with seasonal changes in moisture content and can heave and/or distress lightly loaded footings or slabs. Therefore, for slab-on-grade floor support, it will be necessary to probe the building areas for the presence of such soils and to verify that the expansive soils have not dried and cracked. Any expansive soils encountered in building areas must be fully moisture conditioned for their full depth to cause preswelling and then covered with a sufficient depth of a moisture confining and protecting blanket of nonexpansive fill. We believe that the upper on-site soils would be suitable for reuse as fill in the upper portions of the building pads. However, special moisture conditioning measures will be needed to maintain the pad surfaces in a moist condition until concrete is placed. As an alternative to special moisture conditioning, the upper 12 inches of the building pads could be constructed of approved imported nonexpansive fill.

A review of our files indicates that fills were placed on the western portion of Lot 18 and possibly a portion of Lot 19 in December 1989 under our soil engineering observation and testing services. Prior to placement of the fills, weak, upper natural soils were overexcavated to mitigate potential future settlements. Our tests indicate that the fills were thoroughly compacted. Therefore, we conclude that it would not be necessary to remove the compacted fills from planned asphalt-paved areas. However, the fills contained a significant amount of moderately expansive clays. Therefore, we judge that it would be necessary to probe the existing fills within the building area. Overexcavations as discussed above could be needed.

For footings founded on properly compacted fill, as subsequently recommended, we judge that settlements resulting from imposed structural loads will be about 1/2-inch. Post-construction settlements should be about 1/4-inch or less.

We believe that driveway and parking area pavements can consist of asphalt concrete and aggregate base materials that can be placed on properly prepared on-site natural soils or existing compacted fills. Because paved areas are less sensitive to settlement, we judge that it would not be necessary to over-excavate the weak, upper natural soils prior to pavement construction.

Cut and fill slopes should be inclined no steeper than two horizontal to one vertical (2:1). All slopes greater than 3 feet in height should be planted with deep rooted, fast growing ground cover to help reduce erosion.

RECOMMENDATIONS

Site Grading

The areas proposed for development should be cleared of existing vegetation and debris. The surface should then be stripped of the upper soils containing root growth and organic matter, where needed. We anticipate that the required depth of stripping would be about 3 inches. The strippings should be removed from the site or stockpiled for reuse as topsoil.

Wells, septic tanks or other voids encountered or generated should be filled with compacted soil, compacted granular material or capped with concrete, as determined by the soil engineer.

After clearing and stripping, excavation should be performed as necessary. We anticipate that, with the exception of organic matter and rocks or hard fragments larger than 4 inches in diameter, the excavated materials will be suitable for reuse as fill within building and exterior slab and paved areas, as discussed below.

Within building areas and extending to at least 5 feet beyond the perimeter and 3 feet beyond adjacent exterior concrete walkway slabs (building envelope), the upper natural soils should be overexcavated to about 24 to 36 inches below planned pad grade. The depth of the overexcavation should also be adjusted so as to provide space for at least 24 inches of compacted fill below the bottom of all footings. The fill under footings should extend to at least 3 feet beyond footing edges.

The surfaces exposed by stripping or overexcavation should be scarified to a depth of at least 6 inches, moisture conditioned to near optimum and compacted to at least 90 percent relative compaction.[1] Approved on-site or imported nonexpansive fill materials then should be spread in 8-inch-thick loose lifts, moisture conditioned to near optimum and compacted to at least 90 percent relative compaction.

Imported fill, if needed, should be nonexpansive and have a Plasticity Index of 15 or less. Imported fill material should be free of organic matter and rocks or hard fragments larger than 4 inches in diameter.

Loose, sandy soils, low-lying areas and poorly compacted fill material can trap significant amounts of winter rainfall and hold the moisture well into the spring or early summer. Also,

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[1] Relative compaction refers to the in-place dry density of fill expressed as a percentage of maximum dry density of the same material determined in accordance with the ASTM D 1557-91 laboratory compaction test procedure. Optimum moisture content refers to the moisture content at maximum dry density.

because sandy soils were observed within about 4½ to 5½ feet below the existing ground surface, groundwater could be encountered during excavation work. Therefore, depending on when site grading is performed, the upper, natural soils and/or existing fill materials could be saturated, requiring additional spreading, moisture conditioning and/or overexcavation to properly complete the building pad. Also, dewatering of excavations could be needed. The need for overexcavation of any saturated surface soils should be determined by the soil engineer during the grading. We suggest that unit prices be obtained in the contract to account for these possibilities. Also, we judge that the risk of encountering such saturated soil conditions and/or high groundwater would be lower if grading was performed during drier summer or fall months.

Foundations

Spread footings should be at least 12 inches wide and bottomed on properly compacted fill at least 12 inches below adjacent pad grade. Such spread footings should be underlain by at least 24 inches of properly compacted fill and can be designed to impose dead plus code live load and total design load (including wind or seismic forces) bearing pressures of 2,000 and 3,000 pounds per square foot (psf), respectively.

Resistance to lateral loads can be obtained from passive earth pressures and soil friction. We recommend the following criteria for design:

Passive Earth Pressure	=	300 pounds per cubic foot (pcf) equivalent fluid, neglect the upper 1-foot, unless confined by pavement or slab
Soil Friction Factor	=	0.30

Retaining Walls

Retaining walls that are free to rotate slightly and support level backfill should be designed to resist an active equivalent fluid pressure of 40 pcf acting in a triangular pressure distribution. If the wall is constrained at the top and cannot tilt, the design pressure should be increased to 60 pcf. Where retaining wall backfill is subject to vehicular traffic, the walls should be designed to resist an added surcharge pressure equivalent to 1½ feet of additional backfill.

Retaining wall foundations should similarly bottom on properly compacted fill and can be designed in accordance with the criteria outlined above for building foundations.

Retaining walls should be fully backdrained. The backdrains should consist of 4-inch-diameter, perforated rigid plastic pipe sloped to drain to outlets by gravity and clean, washed, free-draining crushed rock or gravel. The crushed rock or gravel should extend to within 1 foot of the surface. The drainrock should be covered and separated from the soil bank by a nonwoven, geotextile fabric[2] weighing about 4 ounces per square yard. The upper 1-foot should be backfilled with compacted soil to exclude surface water unless capped by a concrete slab. The ground surface behind retaining walls should be sloped to drain.

Where migration of moisture through retaining walls would be detrimental, the walls should be waterproofed.

Slab-on-Grade

Provided the site is prepared as recommended above, floor slab areas should be underlain by at least 24 inches of properly compacted fill materials of low expansion potential. Slab-on-grade subgrade should not be allowed to dry prior to concrete placement. Slabs should be underlain by a capillary moisture break and cushion layer consisting of at least 4 inches of free-draining, crushed rock or gravel at least 1/4-inch and no larger than 3/4-inch in size.

Moisture vapor will condense on the underside of the slabs. Where moisture migration through a slab is detrimental, a moisture vapor barrier should be provided between the drainrock and the slab. Two inches of clean sand should be placed over a

[2] Mirafi 140 and Supac 5 are among the brand names of suitable fabrics that may be locally available.

plastic membrane, if used, to aid in slab curing and help provide puncture protection.

The slabs should be at least 4 inches thick and be reinforced with bars to reduce cracking and help keep closed those cracks that do appear. The actual slab thickness and amount of reinforcing used should be determined by the design engineer.

Depending on actual finish floor elevations, underslab drainage could be needed. During final design, we should be consulted to provide specific recommendations, if warranted.

Pavements

For planning purposes, driveway and parking area pavements can consist of 2½ inches of asphalt over 8 and 6 inches, respectively, of aggregate base. Such pavements should be suitable for auto and pickup truck traffic. Heavy truck and trash pickup (dumpster) traffic could reduce the useful life of such pavement sections and cause premature distress and increased maintenance. Longer pavement life and lower maintenance can be achieved by thickening the driveway section to about 3 inches of asphalt and about 10 to 14 inches of aggregate base where heavy traffic loads are anticipated. Thickened sections or concrete slabs should be used at dumpster lift points.

The flexible pavement materials should conform to the quality requirements of the State of California Caltrans Standard Specifications, current edition, and the requirements of the County of Sonoma.

Prior to subgrade preparation, all underground utilities in the paved areas should be installed and properly backfilled. Subgrade soils should be uniformly moisture conditioned to or near optimum, compacted to at least 95 percent relative compaction and should provide a firm and unyielding surface. This may require scarifying and recompacting to achieve uniformity. The aggregate base materials should be placed in layers no thicker than 6 inches, compacted to at least 95 percent, and should also be firm and unyielding.

Soil Engineering Drainage

Ponding water will cause softening of the site soils and would be detrimental to foundations. It is important that the site be sloped to drain away from foundations and slopes. The roofs should be provided with gutters, and the downspouts should discharge onto paved areas, concrete slabs or splash blocks draining at least 30 inches away from foundations.

Where irrigated landscape areas abut the building, excess water can be trapped in soil layers along the edge of the building, increasing the risk of potential heave of the floor slab and/or migration of excess water into the underslab rock. We believe that the installation of the compacted fill pad that extends to at least 5 feet beyond the building perimeter should provide an effective barrier to the infiltration of excess waters from landscape areas. Any below-grade cold joints in the perimeter foundation grade beams should be hot-mopped or waterproofed on the exterior side in some manner. We recommend that good, positive surface drainage away from the building consisting of at least 1/4-inch per foot extending at least 4 feet out should be provided around the building.

Supplemental Services

During final design, we should be consulted to develop specific conclusions and recommendations concerning underfloor drainage, if appropriate. Also, we should review the final grading and foundation plans for conformance with the intent of our recommendations. During site grading operations, we should provide intermittent observation and testing to determine the conditions encountered and to modify our recommendations, if warranted. Field and laboratory tests should be performed to ascertain that the specified moisture content and degree of compaction are being attained.

The soil engineer should observe footing excavations to verify that the exposed materials are as anticipated and to modify our recommendations, if needed. Foundation excavation depth and cleanliness, forms and reinforcing should be checked by the Building Department.

LIMITATIONS

We have performed the investigation and prepared this report in accordance with generally accepted standards of the soil engineering profession. No warranty, either express or implied, is given.

Subsurface conditions are complex and may differ from those indicated by surface features or encountered at test boring locations. Therefore, variations in subsurface conditions not indicated on the logs could be encountered. If the project is revised, or if conditions different from those described in this report are encountered during construction, we should be notified immediately so that we can take timely action to modify our recommendations, if warranted.

Supplemental services as recommended herein are in addition to this investigation and are charged for on an hourly basis in accordance with our Standard Schedule of Charges. Such supplemental services are performed on an as-requested basis. We can accept no responsibility for items we are not notified to check, nor for the use or interpretation by others of the information contained herein.

Site conditions and standards of practice change. Therefore, we should be notified to update this report if construction is not performed within 36 months.

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LIST OF PLATES

Plate 1	Test Boring Location Plan and Site Vicinity Map
Plates 2 through 5	Logs of Borings 1 through 4
Plate 6	Soil Classification Chart and Key to Test Data
Plate 7	Atterberg Limits Test Results

DISTRIBUTION

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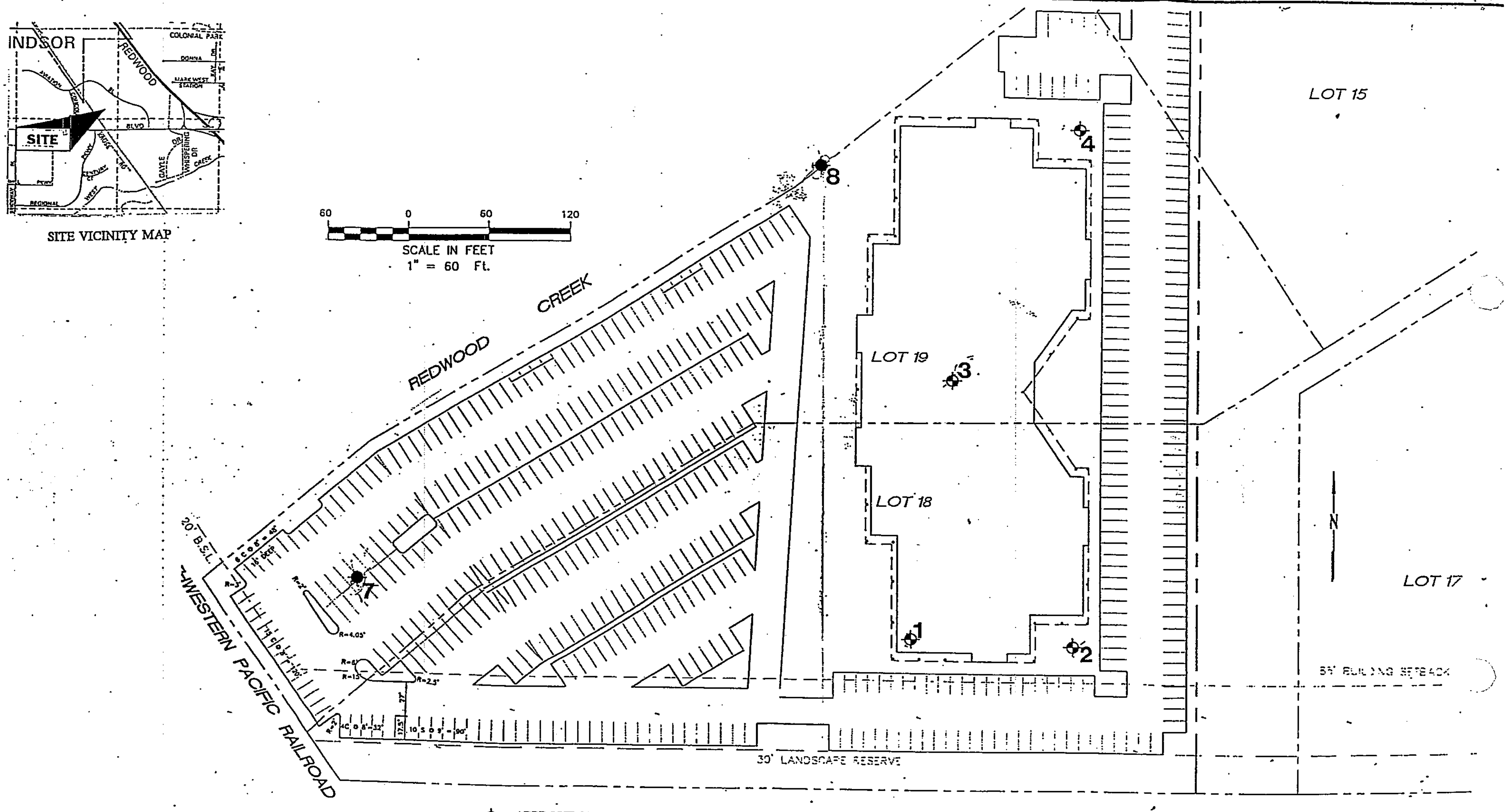

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TEST BORING LOCATION PLAN
AND SITE VICINITY MAP
AIRPORT CORPORATE CENTER
PHASE 1, LOTS 18 AND 19
SONOMA COUNTY, CALIFORNIA

PLATE 1

LOG OF BORING 1

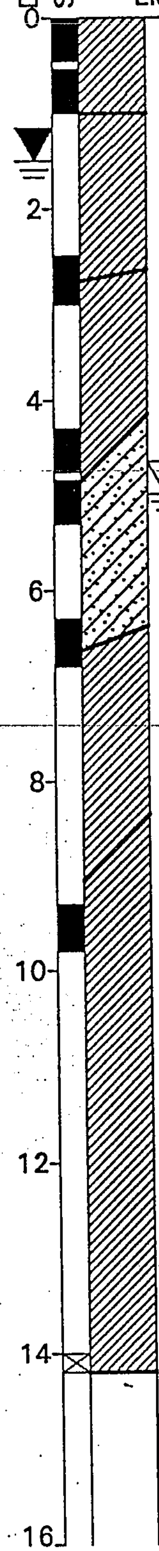
∇ ground-water first encountered at time of drilling

▼ ground-water level recorded several hours after drilling

Equipment: 6" FLIGHT AUGER

Elevation: ____ Date: 3-25-98

Laboratory Test Results or Remarks	Blows/foot*	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Description
				0	DARK BROWN SANDY CLAY (CL) soft, saturated
LL = 38 PL = 20 PI = 18 Percent Free Swell = 75	10				MOTTLED ORANGE-BROWN AND DARK BROWN SANDY CLAY (CL) medium stiff, wet to saturated
				2	
Percent Free Swell = 50	13	25.1	97		BROWN SANDY CLAY (CL) medium stiff, wet
				4	
Percent Passing No. 200 Sieve = 41.5 Percent Passing No. 200 Sieve = 26.2	11	25.3	90		BROWN CLAYEY SAND (SC) medium dense, saturated
				6	
UC = 250	7	29.1	93		LIGHT GRAY-BROWN SANDY CLAY (CL) medium stiff, saturated
				8	
UC(P) = 4500+	50	18.8	109		LIGHT GRAY-BROWN SANDY CLAY (CL) hard, wet
				10	
				12	
	50+			14	
				16	



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*Converted to Standard Penetration Blow Counts

LOG OF BORING 2

▽ ground-water first encountered at time of drilling

▼ ground-water level recorded several hours after drilling

Equipment: 6" FLIGHT AUGER

Elevation: ______ Date: 3-25-98

Laboratory Test Results or Remarks	Blows/foot *	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Description
				0	MOTTLED ORANGE-BROWN AND DARK BROWN SANDY CLAY (CL) soft, saturated, with root fibers, porous to 36 inches
Percent Free Swell = 55	4	24.9	97		
				2	
UC = 960 Percent Free Swell = 45	12	25.6	99		BROWN SANDY CLAY (CL) medium stiff, wet to saturated
				4	
TxUU = 610 (1500)	9	40.7	71	6	GRAY-BROWN SANDY CLAY (CL) medium stiff, saturated
UC(P) = 2700	17	27.1	96	8	
				10	
					LIGHT BROWN SANDY CLAY (CL) hard, wet to saturated
	50+			12	
				14	
				16	

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LOG OF BORING 2

AIRPORT CORPORATE CENTER
PHASE 1, LOTS 18 AND 19
SONOMA COUNTY, CALIFORNIA

PLATE 3

*Converted to Standard Penetration Blow Counts

▽ ground-water first encountered at time of drilling

LOG OF BORING 3

Equipment: 6" FLIGHT AUGER

Elevation: ______ Date: 3-25-98

Laboratory Test Results or Remarks	Blows/foot *	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Description
				0–2.5	DARK BROWN SANDY CLAY (CL) soft, saturated, with abundant root fibers
LL = 35 PL = 20 PI = 15 Percent Free Swell = 60	6				
				2.5–5.7	MOTTLED BROWN AND ORANGE-BROWN SANDY CLAY (CL) medium stiff, wet to saturated, with occasional root fibers, slightly porous
UC(P) = 1400 Percent Free Swell = 60	10	26.6	96		
				▽ (about 5)	
				5.7–10.5	MOTTLED ORANGE-BROWN AND LIGHT BROWN SANDY SILT (ML) medium stiff, saturated, porous to 8 feet
UC = 300	11	33.3	87		
				10.5–11.7	LIGHT GRAY-BROWN SANDY CLAY (CL) hard, wet
UC(P) = 4500+	50+	19.7	108		

Depth scale (ft): 0, 2, 4, 6, 8, 10, 12, 14, 16

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LOG OF BORING 3

AIRPORT CORPORATE CENTER
PHASE 1, LOTS 18 AND 19
SONOMA COUNTY, CALIFORNIA

PLATE 4

*Converted to Standard Penetration Blow Counts

LOG OF BORING 4

Equipment: 6" FLIGHT AUGER

Elevation: ______ Date: 3-25-98

▽ ground-water first encountered at time of drilling

▼ ground-water level recorded several hours after drilling

Laboratory Test Results or Remarks	Blows/foot *	Moisture Content (%)	Dry Density (pcf)	Depth (ft)	Description
Percent Free Swell = 40	7	26.9	94	0	DARK BROWN SANDY CLAY (CL) soft, saturated, with root fibers, very porous
	17			2	MOTTLED ORANGE-BROWN AND BROWN SANDY CLAY (CL) stiff, wet, porous to 2 feet
Percent Passing No. 200 Sieve = 32.3	18			4	BROWN CLAYEY SAND (SC) medium dense, wet to saturated
Percent Passing No. 200 Sieve = 57.9	15	35.4	85	6	BROWN VERY CLAYEY FINE SAND (SC) medium dense, saturated
Percent Passing No. 200 Sieve = 5.6	50+	13.6	122	12	BROWN GRAVELLY SAND (SP) very dense, saturated

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16

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LOG OF BORING 4

AIRPORT CORPORATE CENTER
PHASE 1, LOTS 18 AND 19
SONOMA COUNTY, CALIFORNIA

PLATE 5

*Converted to Standard Penetration Blow Counts

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS MORE THAN HALF IS LARGER THAN No. 200 SIEVE	GRAVEL MORE THAN HALF OF COARSE FRACTION IS LARGER THAN No. 4 SIEVE SIZE	CLEAN GRAVEL WITH LESS THAN 5% FINES	GW	WELL GRADED GRAVEL, GRAVEL-SAND MIXTURE
			GP	POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURE
		GRAVEL WITH OVER 12% FINES	GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURE
			GC	CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURE
	SAND MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN No. 4 SIEVE SIZE	CLEAN SAND WITH LESS THAN 5% FINES	SW	WELL GRADED SAND, GRAVELLY SAND
			SP	POORLY GRADED SAND, GRAVELLY SAND
		SAND WITH OVER 12% FINES	SM	SILTY SAND, GRAVEL-SAND-SILT MIXTURE
			SC	CLAYEY SAND, GRAVEL-SAND-CLAY MIXTURE
FINE GRAINED SOILS MORE THAN HALF IS SMALLER THAN No. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILT, ROCK FLOUR, SANDY OR CLAYEY SILT WITH LOW PLASTICITY
			CL	INORGANIC CLAY OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAY (LEAN)
			OL	ORGANIC CLAY AND ORGANIC SILTY CLAY OF LOW PLASTICITY
	SILT AND CLAY LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILT, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOIL, ELASTIC SILT
			CH	INORGANIC CLAY OF HIGH PLASTICITY, GRAVELLY, SANDY OR SILTY CLAY (FAT)
			OH	ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILT
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

KEY TO TEST DATA

				Shear Strength, psf	Confining Pressure, psf
EI	— Expansion Index	TxUU	— Unconsolidated Undrained Triaxial	320	(2600)
Consol	— Consolidation	TxCU	— Consolidated Undrained Triaxial	320	(2600)
LL	— Liquid Limit (in %)	DSCD	— Consolidated Drained Direct Shear	2750	(2000)
PL	— Plastic Limit (in %)	FVS	— Field Vane Shear	470	
PI	— Plasticity Index	LVS	— Laboratory Vane Shear	700	
SA	— Sieve Analysis	UC	— Unconfined Compression	2000	*
G_s	— Specific Gravity	UC(P)	— Laboratory Penetrometer	700	*
■	"Undisturbed" Sample				
□	Bulk Sample				

Notes: (1) All strength tests on 2.8" or 2.4" diameter samples unless otherwise indicated

* Compressive Strength

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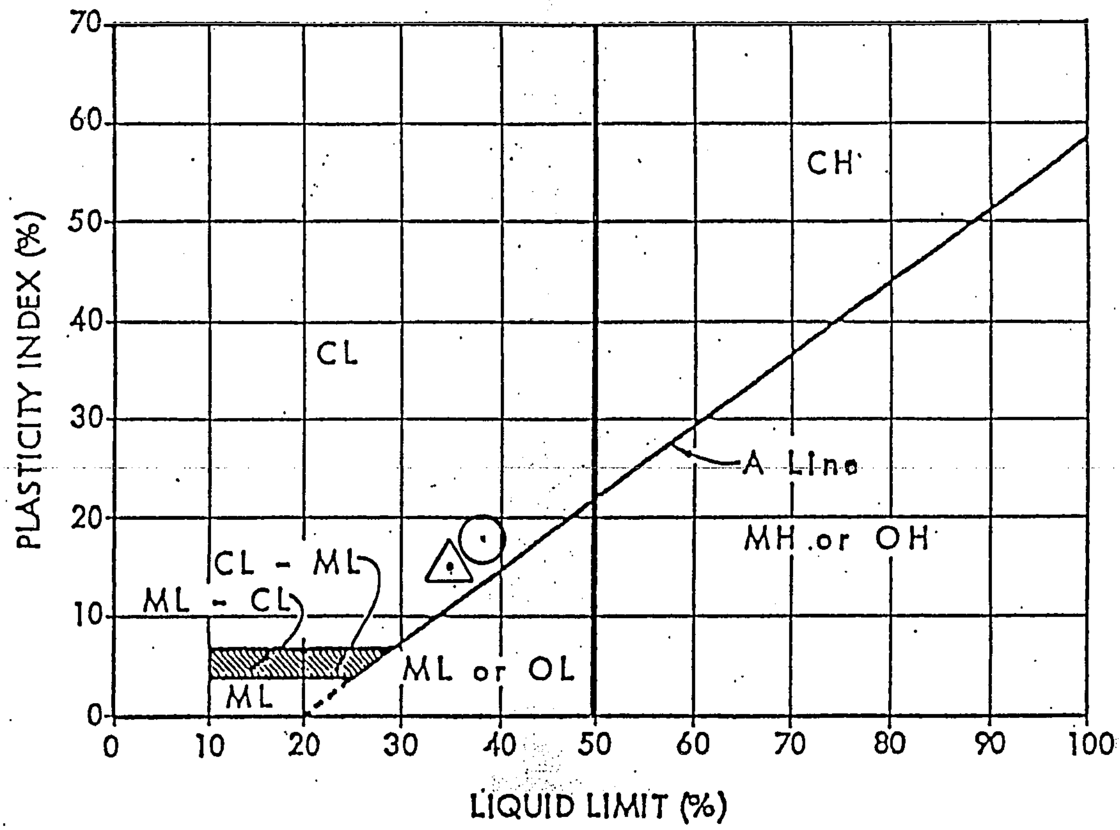
Appr: BP

SOIL CLASSIFICATION CHART AND KEY TO TEST DATA

AIRPORT CORPORATE CENTER
PHASE 1, LOTS 18 AND 19
SONOMA COUNTY, CALIFORNIA

PLATE 6



Symbol	Classification and Source	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	% Free Swell
⊙	DARK BROWN SANDY CLAY (CL) Test Boring 1 at 0.5 feet	38	20	18	75
△	DARK BROWN SANDY CLAY (CL) Test Boring 3 at 0.7 feet	35	20	15	60

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PLASTICITY INDEX TEST RESULTS

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PLATE
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