APPENDIX 2

GEOTECHNICAL STUDY

GEOTECHNICAL EVALUATION
JAMUL GAMING FACILITY DEVELOPMENT PROJECT
JAMUL INDIAN VILLAGE
SAN DIEGO COUNTY, CALIFORNIA

PREPARED FOR:

JAMUL INDIAN VILLAGE
STATE ROUTE 94 AND MELODY ROAD
JAMUL AREA, SAN DIEGO COUNTY, CALIFORNIA

PREPARED BY:

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CTE JOB NO. 40-2739G **October 6, 2011**

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EXECUTIVE SUMMARY

As requested, Construction Testing & Engineering, Inc. (CTE) has performed an independent analysis and assessment of the project geotechnical data provided for the project. The geotechnical data were used for and applied to our evaluation. The evaluation was performed to provide an independent review of the recommendations and design parameters provided and, if appropriate, provide updated recommendations based on our findings.

To accomplish the requested evaluation, CTE utilized the design recommendations, analyses, field exploration, subsurface in-situ testing, and laboratory testing conducted previously as part of the geotechnical and other investigations referenced below. Using these data, this updated report is being provided based on the 2010 CBC and preliminary construction plans.

The evaluation indicates that the structures may be supported on conventional shallow spread footings bearing on compacted fill or bedrock. Undocumented fill should be removed and wasted elsewhere.

Based on our investigation, the proposed development is considered feasible from a geotechnical standpoint, provided the recommendations herein are implemented during project design and construction.

1.0 INTRODUCTION AND SCOPE OF SERVICES

1.1 Introduction

This report presents the results of an independent evaluation of the engineering recommendations, analyses, field explorations and field in-situ testing as well as laboratory testing of subsurface deposits located at the subject site. Utilizing these results, an independent analysis was performed. Alternate recommendations or modifications, as appropriate, are provided for structure foundations, and other geotechnical design parameters.

1.2 Scope of Services

Our scope of services included:

- Review project geotechnical data provided by the Jamul Indian Village.
- Perform a review of field exploration and in-situ field testing performed as part of the previous referenced geotechnical site investigations.
- Perform a review and analysis of laboratory testing performed previously on site soil and bedrock deposits and presented in previous site geotechnical reports.
- Perform an assessment of geologic conditions pertinent to the site.
- Preparation of this report providing a summary of the evaluation and analysis performed, and providing conclusions and geotechnical engineering recommendations for the site.

1.3 Site Location and Project Description

The site is located at the Jamul Indian Reservation. It slopes down from the east and west towards an intermittently flowing drainage that traverses the site in a north-south direction. The majority of the site is sparsely vegetated with scrub and trees. Site elevations range from approximately 1150 feet MSL at the top of the western slope and approximately 960 feet MSL at the top of the eastern slope to about 860 feet MSL at the bottom of the drainage at the south side of the project.

Based on the preliminary drawings, we understand that it is proposed to construct the gaming facility in one of three alternative sizes. The largest of these, the proposed project, as well as a mid-sized project (Alternative #1) would consist of a three-story structure over a reinforced-concrete parking garage. The third alternative would consist of a two-story structure with adjacent surface parking. Cuts on the order of 30 feet and fills on the order of 10 to 15 feet are anticipated.

2.0 FIELD AND LABORATORY INVESTIGATIONS

2.1 Field Investigation

The field investigations (Law Crandall, 2001, 2002; CTE 2011; Petra, 2007, 2008), included a site reconnaissance, the excavation of exploratory hollow stem auger borings, test pits, air track borings, seismic refraction lines and *in-situ* percolation testing of subsurface deposits. The explorations were excavated to investigate and obtain samples of the subsurface soils and to evaluate depth to and type of bedrock. Soils encountered within the borings were classified in the field in accordance with Unified Soil Classification System. In general, soil samples were obtained at 2-1/2 to 5-foot intervals with standard split spoon (SPT and California Modified) samplers. Specifics of the soils encountered can be found in the Boring Logs, Test Pit Logs, Air Track logs, and Seismic Refraction Results from the geotechnical report which was provided. These data are attached to this update report.

2.2 Laboratory Analyses

Laboratory tests were conducted on representative soil samples to evaluate their physical properties and engineering characteristics. Specific laboratory tests included:

- In-place moisture and density
- Expansion index
- Direct shear
- Gradation
- Chemical analyses.

These tests were conducted to determine the material strengths, physical properties, and corrosivity of the on-site soils. Test method descriptions and laboratory results are presented in the referenced reports. Laboratory data are attached.

3.0 GEOLOGY

3.1 Geologic Setting

The site lies approximately between Elevation 860 and 1150 feet MSL on moderately steep slopes in the Jamul Mountains, south of Jamul in San Diego County, California. In the vicinity of the site, pre-tertiary granitic and metavolcanic bedrock is locally overlain by Quaternary alluvial and colluvial deposits which are locally covered by shallow fill. The site is located in the Peninsular Ranges geomorphic province of California. The dominant structural trend of the Peninsular Ranges is characterized by faults associated with the Rose Canyon and Elsinore fault zones, along with other similar northerly and northwesterly-trending fault zones in southern and Baja California that form steep "tread and riser" topography that rises to the east. Geologic maps and major fault zones are presented on Plate 2 and Figure 2 of the referenced geotechnical report (Law Crandall, 2001).

3.2 Geologic Materials

Surficial materials include undocumented fill, alluvium, colluvium and possible landslide deposits. Undifferentiated granitic and volcanic bedrock underlies the the site and can be observed along ridges, the bottom of natural drainages and along slopes above the site.

Undocumented Fill

The fill at the site consists of silty sand and sand. It is composed of locally derived stream terrace deposits and colluvium generated from cutting into the natural slope during grading for previously existing structures.

Alluvial Deposits

Alluvial deposits are present along the drainage which traverses the site. The alluvial soils are composed of sand and silty sand with scattered gravel.

Colluvium

Colluvium locally covers the granitic bedrock on the slopes. The colluvial materials consist of sand and silt mixtures.

Possible Landslide Deposits

Possible landslide deposits at the site were mapped based on surficial expression and stereoscopic photographs. Landslide deposits are composed of intermixed surficial soil and granitic bedrock.

Granitic Bedrock

Pre-Tertiary granitic bedrock underlies the site soil deposits. The granitic bedrock is considered as undifferentiated igneous crystalline bedrock that locally forms bold outcrops. The granitic bedrock is composed mainly of diorite with contact metamorphic zones. The bedrock is hard and dense.

Metamorphic Bedrock

Pre-Tertiary volcanic and metamorphic bedrock is exposed on the southwest corner of the site. The bedrock forms outcrops and is hard and dense. It is composed of intermixed volcanic and sedimentary rocks that have experienced low-grade metamorphism.

3.3 Ground Water

Evidence of springs or seeps was not observed. During the geotechnical investigation and percolation testing, relatively shallow ground water was observed in the borings. It is anticipated that water will flow in the drainages during seasonal rains. Ground-water conditions may vary due to seasonal variations, local irrigation and other factors. Furthermore, the potential for a perched water condition exists at the contact between granitic bedrock and the overlying soil deposits and landslide deposits.

3.4 Geologic Hazards

From our investigation, it appears that geologic hazards at the site are limited primarily to those caused by strong shaking from earthquake-generated ground motions. Presented here are the geologic hazards that are considered for potential impacts to site development.

Tsunamis and Seiche Evaluation

The site is about 15 miles inland from the Pacific Ocean at an elevation of approximately 900 feet above sea level. Therefore, risk of damage from seismic sea waves (tsunamis) is not anticipated. The site is not downslope of a large body of water that could adversely affect the site in the event of earthquake-induced failures or seiches (wave oscillations in an enclosed or semi-enclosed body of water).

Landsliding

Based on surface expression, possible landslides have been mapped in the northeast corner of the site.

Compressible and Expansive Soils

Encountered site soils consisted of non-expansive sands and hard bedrock with low compressibility. Therefore, compressible and/or expansive site materials are not anticipated to adversely impact the proposed development.

4.0 FAULT RUPTURE AND EARTHQUAKE HAZARD EVALUATIONS

4.1 Local and Regional Faulting

Based on review of readily available geologic literature and the computer program EQFAULT (Blake, 2000a), the subject site is located approximately 15.5 miles from the Rose Canyon fault. As defined by the California Geological Survey, an active fault is one that has had surface displacement within the Holocene Epoch (roughly the last 11,000 years). This definition is used in delineating Earthquake Fault Zones as mandated by the Alquist-Priolo Special Studies Zones Act of 1972 and revised in 1994 and 1997 as the Alquist-Priolo Earthquake Fault Zoning Act and Earthquake Fault Hazard Zones. The intent of this act is to require fault investigations on sites located within Earthquake Fault Hazard Zones to preclude new construction of certain habitable structures across the trace of active faults. Based on our review of available literature, the site is not located within an Alquist-Priolo Earthquake Fault Zone. Based on our observations, no evidence of active faulting is present on the site.

The California Geological Survey broadly groups faults as "Class A" or "Class B" (Cao et al, 2003). Class A faults are identified based upon relatively well constrained paleoseismic activity, and a fault slip rate of more than 5 millimeters per year (mm/yr). In contrast, Class B faults have comparatively less defined paleoseismic activity and are considered to have a fault slip rate less than 5 mm/yr. The following Table 1 presents the 10 nearest faults to the site and includes magnitude and fault classification.

TABLE 1
NEAR SITE FAULT PARAMETERS

FAULT NAME	DISTANCE FROM SITE (mi)	MAXIMUM EARTHQUAKE MAGNITUDE	CLASSIFICATION
Rose Canyon	15.5	7.2	B
Coronado Bank	27.5	7.6	B
Elsinore-Julian	32.2	7.1	A
Elsinore-Coyote Mountain	34.6	6.8	A
Earthquake Valley	35.6	6.5	B
Newport-Inglewood (Offshore)	45.2	7.6	B
Elsinore-Temecula	47.3	6.6	A
San Jacinto-Coyote Creek	52.0	6.8	A
San Jacinto-Borrego	52.2	6.6	A
San Jacinto-Anza	55.7	7.2	A

California Geologic Survey, Probabilistic Seismic Hazards Mapping Ground Motion Page (online pshamap.asp), indicates ground motions with 10 % probability of exceedance in 50 years for the site as underlain by firm rock are shown in Table 2.

TABLE 2
SITE GROUND MOTION WITH 10% PROBABILITY OF EXCEEDANCE IN 50 YEARS

PARAMETER	UNIT GRAVITY (firm rock)
Ground Acceleration	0.211
Spectral Acceleration at Short (0.2 second) Duration	0.499
Spectral Acceleration at Long (1.0 second) Duration	0.192

4.2 Seismic Design Criteria

The seismic ground motion values listed in the following Table 3 were derived in accordance with the California Building Code (CBC), 2010. This was accomplished by establishing the Site Class based on the soil properties at the site, and then calculating the site coefficients and parameters using the United States Geological Survey (USGS) Java Ground Motion Parameter Calculator – Version 5.0.9a and site coordinates of 32.7029° North latitude, 116.8686° West longitude. These values are intended for the design of structures to resist the effects of earthquake ground motions.

TABLE 3 SEISMIC GROUND MOTION VALUES		
PARAMETER	VALUE	CBC REFERENCE
Site Class	B	Table 1613.5.2
Mapped Spectral Response Acceleration Parameter, S_S	0.948g	Figure 1613.5(3)
Mapped Spectral Response Acceleration Parameter, S_1	0.327g	Figure 1613.5(4)
Seismic Coefficient, F_a	1.0	Table 1613.5.3(1)
Seismic Coefficient, F_v	1.0	Table 1613.5.3(2)
MCE Spectral Response Acceleration Parameter, S_{MS}	0.948g	Section 1613.5.3
MCE Spectral Response Acceleration Parameter, S_{M1}	0.327g	Section 1613.5.3
Design Spectral Response Acceleration, Parameter S_{DS}	0.632g	Section 1613.5.4
Design Spectral Response Acceleration, Parameter S_{D1}	0.218g	Section 1613.5.4

4.3 Liquefaction Evaluation

Liquefaction occurs when saturated fine-grained sands, silts or low plasticity clays lose their physical strength during earthquake-induced shaking and behave as a liquid. This is due to loss of point-to-point grain contact and transfer of normal stress to the pore water. Liquefaction potential varies with groundwater level, soil type, material gradation, relative density, and the intensity and duration of ground shaking. Since the site soils and bedrock are very dense, the potential for liquefaction should be considered very low. However, the soils present in the drainage area may be subject to liquefaction. This area, however, will not be used for construction.

4.4 Seismic Settlement Evaluation

Seismic settlement (dynamic densification) occurs when loose to medium dense granular soils densify during seismic events. The underlying site materials were generally very dense and are not considered likely to experience significant seismic settlement. Therefore, in our opinion, the potential for seismic settlement resulting in damage to site improvements is considered low.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 General

Based on our review of existing documents, the proposed construction on the site is feasible from a geotechnical standpoint, provided the recommendations in this report are incorporated into design and construction of the project. Recommendations for the design and construction of the proposed development are included in the subsequent sections of this report.

5.2 Site Preparation

General

Prior to grading, the site should be cleared of existing debris, pavement, foundations and deleterious materials. In areas to receive structures or distress-sensitive improvements, expansive, surficial eroded, desiccated, burrowed, or otherwise loose or disturbed soils should be removed to the depth of competent material. Organic and other deleterious materials not suitable for use as structural backfill should be disposed of offsite at a legal disposal site. Septic systems and leach fields, if encountered, should be abandoned in accordance with San Diego County regulations.

Preparation of Areas to Receive Fill

Prior to fill placement, exposed excavation bottom surfaces should be scarified to a minimum depth of six inches, brought to optimum moisture content or slightly above, and compacted to at least 90 percent of the maximum dry density as determined by ASTM D 1557.

Excavation

The existing fill soils, colluvium, alluvium and highly weathered bedrock are not expected to pose unusual excavation difficulties and conventional heavy-duty earthmoving equipment may be used. The less weathered bedrock, however, is likely to be excavatable with heavy-duty earthmoving equipment to relatively shallow depths. Blasting of less weathered bedrock should be anticipated in deeper cuts.

Temporary, unsurcharged, excavation walls may be sloped back at an inclination of ¾:1 (horizontal:vertical) in the competent bedrock materials and 1:1 in existing fill, colluvium, alluvium and highly weathered bedrock. Where space for sloped embankments is not available, shoring will be necessary.

Where sloped excavations are used, the tops should be barricaded to prevent vehicles and storage loads within 10 feet of the tops of excavated slopes. If temporary construction slopes are to be maintained during the rainy season, berms are recommended along the tops of the slopes to prevent water from entering the excavation and eroding the slope faces.

Rippability

A seismic refraction survey was conducted at the site to evaluate rippability of the subsurface materials. The seismic refraction method uses the first-arrival times of refracted seismic waves generated to evaluate the thickness and seismic wave velocities of subsurface layers. Seismic waves generated at the surface are refracted at boundaries separating materials of contrasting velocities. The refracted seismic waves are detected by geophones and recorded in

seismograph. The travel times are used in conjunction with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials.

The refraction method requires that subsurface velocities (material density) increase with depth. In general, seismic wave velocities can be correlated to rock hardness. The relationship between rock rippability and seismic velocity is empirical and assumes a homogeneous rock mass. Localized areas of differing composition, texture or structure may affect both the measured data and the actual rippability of the rock mass. The rippability of the rock is also dependant on the excavation equipment used and the skill and experience of the equipment operator.

The following rippability chart assumes that a Caterpillar D-9 dozer ripping with a single shank is used. The cutoffs presented in Table 4 are approximate and the rock characteristics, such as fracture spacing and orientation, play an important role in evaluating rippability. These characteristics may also vary with location and depth.

TABLE 4

RIPPABILITY

Seismic Wave Velocity (feet/second)	Rippability
0 to 2,000	Easy Ripping
2,000 to 4,000	Moderate Ripping
4,000 to 5,500	Difficult Ripping, Possible Local Blasting
5,500 to 7,000	Very Difficult Ripping, Probable Local to General Blasting
Greater than 7,000	Blasting Generally Required

For trenching operations, the rippability figures should be scaled downward. Velocities as low as 3,500 feet per second may indicate difficult ripping during trenching operations. In addition, the presence of boulders, which can cause difficulties in a narrow trench, should be anticipated. The above classifications should be used with discretion, and contractors should not be relieved of making their own evaluation of rippability of the on-site materials prior to submitting their bids.

Cut/Fill Transition

In the event that a cut/fill transition is encountered below a structure, the bedrock materials should be excavated three feet below the bottom of the footings or H/3, whichever is greatest, where H is the thickness of the adjacent fill. The excavated bedrock material should be replaced with compacted fill. The width of the excavation should extend at least three feet beyond the outer edge of the footing.

Oversize Material

Rock fragments from possible blasting operations can, in general, be used within the lower portion of site fills provided the method of placement and compaction is approved by CTE. The oversize rock disposal should not extend below a 1:1 plane projected downward and outward from the base of a proposed structure. Rock designated for disposal areas should be placed with sufficient sandy soil to fill voids.

Fill should be placed and compacted over and around the rock. The amount of rock greater than 1-1/2 inches should not exceed 40% of the total dry weight of the fill unless the fill is specially designed and constructed as rock fill. Rocks or other materials greater than four inches but less than four feet in dimension generated during grading may be placed in windrows and capped with finer materials in accordance with our recommendations and the approval of the governing

agencies. Select native or imported granular soil (SE>30) should be placed and flooded over and around windrowed rock such that the voids are filled.

Windrows should be staggered so that successive windrows are not in the same vertical plane. Rocks greater than four feet in dimension should be broken down to four feet or smaller before placement or disposed of off site.

Slopes

Permanent slopes should be constructed at 2:1 or flatter. Slopes should be planted as soon as possible after construction. Where fills slopes are constructed, colluvium and other materials considered unsuitable should be removed. Where the exposed slope is steeper than 5:1 or where recommended by CTE, the original ground on which fill is to be placed should be keyed and benched. The benches should extend in the underlying bedrock. The key should be at least 15 feet wide and sloped at a minimum of 2% towards the slope. Benches should not exceed four feet in height. Fill slopes should be overbuilt by two feet and cut back to facilitate compaction at the face.

For areas above slopes, positive drainage should be provided away from slopes. This may be accomplished utilizing a brow ditch at the top of slopes to redirect surface runoff away from the slope face. Site runoff should not be permitted to flow over the tops of slopes.

Subsurface Drainage

Where fill soils are to be placed over existing drainages, existing colluvium and alluvium should be excavated to competent bedrock and a subdrain placed prior to filling. The subdrain should be placed in the middle of the drainage at the low point. The actual subdrain location should be evaluated by CTE.

The subdrain should consist of a four-inch diameter perforated pipe placed with perforations down. The pipe should be sloped at least 2% and surrounded by one cubic foot per foot of filter

material wrapped in geo-fabric. The filter gravel should meet the requirements of Class II Permeable Material as defined in the Caltrans Standard Specifications. If Class II Permeable Material is not available, ¾-inch crushed rock or gravel may be used. The crushed rock should have less than 5% passing the #200 sieve. The subdrain should have an outlet that should be maintained after construction. Subdrains should also be placed at the base of keys prior to constructing fill slopes.

Fill Placement and Compaction

Fill should be compacted to at least 90 percent of the maximum dry density (as determined by ASTM D 1557) at a moisture content of optimum or slightly above. The upper foot of subgrade for pavements should be compacted to 95% of the maximum density at a moisture content above optimum. The optimum lift thickness for fill soils will be dependent on the type of compaction equipment being utilized. Generally, fill should be placed in uniform horizontal lifts not exceeding eight inches in loose thickness. Placement and compaction of fill should be performed in general conformance with geotechnical recommendations and local ordinances.

Material for Fill

Soils generated from on-site excavations are anticipated to be suitable for use as structural fill, provided they are free from deleterious material. Rocks or other soil fragments greater than four inches in size should not be used in the fills. Proposed import material should consist of non-expansive soil with an Expansion Index less than 20. Imported material be evaluated by CTE prior to being brought on site.

Utility Trenches

Utility trenches should be excavated as previously discussed. Utility-trench backfill should be placed in loose lifts no greater than eight inches and compacted to a relative compaction of 90%

or more, as evaluated by ASTM D 1557. Trench backfills should be mechanically compacted. Flooding or jetting should not be allowed.

Temporary excavations up to 5 feet high may be cut vertically. Deeper excavations should be shored or cut at an inclination of 1:1 or flatter.

5.3 Temporary Shoring

General

Where there is not sufficient space for sloped embankments and where shoring will not also serve as a permanent retaining structure, temporary shoring will be required. For vertical excavations less than 15 feet in height, cantilevered shoring may be used. One method of shoring would consist of steel soldier piles placed in drilled holes and backfilled with concrete. For vertical excavations greater than 15 feet, temporary shoring consisting of rock bolts or soil nails may be used. The actual method of shoring should be provided and designed by a contractor experienced in installing temporary shoring under similar soil/rock conditions. Once the final excavation and shoring plans are complete, we recommend that we review the plans so that we may provide additional data required as design progresses.

Lateral Pressures

For design of cantilevered shoring, a triangular distribution of lateral earth pressure may be used. It may be assumed that the retained soils with a level surface behind the cantilevered shoring will exert a lateral pressure developed by a fluid with a density of 25 pounds per cubic foot (pcf).

Soldier Piles

For the design of soldier piles spaced at least two diameters on-centers, the allowable lateral bearing value (passive value) of the soils below the level of the excavation may be assumed to

be 800 pounds per square foot (psf) per foot of depth, up to a maximum of 6,000 psf. To develop full lateral value, provisions should be taken to assure firm contact between the soldier pile and the undisturbed soils. The concrete placed in the soldier pile excavations should be of sufficient strength to adequately transfer the imposed loads to the surrounding materials.

The minimum depth of embedment for soldier piling should be in accordance with the design requirements as determined by the structural engineer or shoring contractor. However, for cantilevered shoring, a minimum embedment of 10 feet is recommended.

Lagging

Continuous lagging will be required between the soldier piles. The lagging should be installed as the excavation proceeds. The soldier piles should be designed for the full anticipated lateral pressure. However, the pressure on the lagging will be less due to arching in the soils. We recommend that the lagging be designed for the recommended earth pressure but limited to a value of 400 psf. If caving occurs, it may be necessary to carefully backfill portions of the lagging with clean sand or sand-cement slurry (CLSM) after installation.

5.4 Retaining Walls and Walls Below Grade

We understand that the below-grade walls will be up to approximately 30 feet below existing grade and that the floor will be a slab-on-grade. Single-level walls below grade should be designed to resist an at-rest triangular distribution of lateral-earth pressure plus lateral surcharge from adjacent loads. The recommended equivalent fluid pressure for the case where the grade is level behind the wall is 50 pcf for restrained walls with a level backfill and 72 pcf for walls with a 2:1 backfill slope. The recommended earth pressures assume that a drainage system will be installed behind the base of the wall so that external water pressure will not develop. The wall should be founded as previously recommended.

In addition to the above-recommended earth pressures, walls adjacent to areas subject to vehicular traffic should be designed to resist a uniform lateral pressure of 72 psf acting as a result of a uniform load equivalent to a two-foot thick soil surcharge as recommended by Caltrans. If traffic is kept back 10 feet or more from the wall, the traffic surcharge may be neglected.

Walls below grade should be properly drained. Drainage behind the wall may be provided with a continuous-gravel backdrain or a geosynthetic-drainage composite. In our opinion, Miradrain 6000 or equivalent, attached to the back of the wall before backfilling, would provide satisfactory drainage. The drainage composite should be placed continuously along the back of the wall and connected to a four-inch diameter perforated discharge pipe. The pipe should be sloped at two percent or more and surrounded be one cubic foot per foot of filter gravel. The drain should discharge to an appropriate outlet. The wall should be appropriately waterproofed.

The filter gravel should meet the requirements of Class II Permeable Material, as defined in the current State of California Department of Transportation, Standard Specifications. If Class II Permeable Material is not available, ¾" crushed rock or gravel can be used. The crushed rock or gravel should be wrapped in a filter fabric such as Mirafi 140N or equivalent.

Cantilever retaining walls may be designed in accordance with the following recommendations. For the design where the surface of the backfill is level, it may be assumed that the soils will exert an active lateral pressure equal to that developed by a fluid with a density of 30 pcf. This pressures should be increased to 45 pcf for walls retaining soils inclined at 2:1. A traffic surcharge as previously described should be added to the above pressures, if applicable. of soil.

Lateral pressures on cantilever retaining walls (yielding walls) due to earthquake motions may be calculated based on work by Seed and Whitman (1970). The total lateral thrust against a

properly drained and backfilled cantilever retaining wall above the groundwater level can be expressed as:

$P_{AE} = P_A + \Delta P_{AE}$

Where:

P_A = Static Active Thrust = 30 pcf
ΔP_{AE} = Dynamic Active Thrust Increment = (3/8) $k_h \gamma H^2$
k_h = ½ Peak Ground Acceleration = ½ (S_{DS}/2.5) = 0.253g,
H = Total Height of the Wall
γ = Total Unit Weight of Soil ≈ 125 pounds per cubic foot

The below ground walls for the gaming facility and parking garages are assumed to be non-yielding (or "restrained'). As such, the total lateral thrust due to earthquake motions may be calculated based on work by Wood (1973, Earthquake-Induced Soil Pressures on Structures, Report EERL 73-05. Pasadena: California Institute of Technology) and Whitman (1991, "Seismic Design of Earth Retaining Structures," in *Proceedings*, Second International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, St. Louis, Missouri):

$P_{KE} = P_K + \Delta P_{KE}$

Where:

P_K = Static Restrained Wall Thrust =50 pcf
ΔP_{KE} = Dynamic Restrained Thrust Increment = $k_h \gamma H^2$
k_h = ½ Peak Ground Acceleration = ½ (S_{DS}/2.5) = 0.253g,
H = Total Height of the Wall
γ = Total Unit Weight of Soil ≈ 125 pounds per cubic foot

The increment of dynamic thrust in both cases should be distributed as an inverted triangle, with a resultant force located at 0.6H above the bottom of the wall.

The above design values for wall backfill pressure assume backfill with an Expansion Index of 20 or less and free-draining conditions. Wall backfill should be compacted to at least 90 percent relative compaction, based on ASTM D1557. Backfill should not be placed until walls have

achieved adequate structural strength. Heavy compaction equipment, which could cause distress to walls, should not be used.

Structure walls more than one level below grade and/or permanently shored walls may be designed to resist a trapezoidal distribution of lateral earth pressure plus lateral surcharge from adjacent loads. The maximum pressure is equal to 22H psf where H is the height of the wall. The trapezoidal load is distributed with a lower and upper height equal to 0.2H and the central height equal to 0.6H. The recommended earth pressure assumes that a drainage system will be installed behind the wall so that external water pressure will not develop against the walls.

As discussed previously, soil nails or tiebacks may be used to support the excavation sidewalls. Actual design and construction should be done by a contractor experienced in shoring installation. For preliminary design purposes, an ultimate bond stress of 40 psi may be used for soil nails installed in decomposed granitic bedrock. Soil nails should be corrosion protected. CTE should review design plans prior to installation.

In addition to the recommended earth pressures, the upper ten feet of wall adjacent to vehicular traffic areas should be designed to resist a uniform lateral pressure of 100 psf acting as a result of an assumed 300 psf surcharge behind the wall due to normal traffic. If traffic is kept back at least 10 feet, the surcharge may be neglected.

5.5 Foundations

General

The gaming facility and parking garages may be supported on spread footings founded in undisturbed bedrock. The remaining structures and retaining walls may be founded on spread footings in compacted fill or undisturbed bedrock.

Allowable Bearing Capacity

Footings for the gaming facility and parking garages founded in undisturbed bedrock may be designed to impose a dead-plus-live load of 15,000 psf. Footings founded in compacted fill may be designed to impose a nominal dead-plus-live load pressure of 3,000 psf. Footings should be established at a depth of at least two feet below the lowest adjacent grade. Footings near slopes should be provided with a minimum eight-foot horizontal distance from the face of the slope to the outer bottom edge of the footing. Footing excavations should be deepened as necessary to extend into satisfactory bearing materials. A one-third increase in the bearing value may be used for wind or seismic loads. When founded as above, settlement is estimated to be less than one inch. Differential settlement is estimated to be less than ½ inch.

Lateral Loads

Lateral loads may be resisted by friction and the passive resistance of the materials. A coefficient of friction of 0.5 may be used between footings and undisturbed bedrock. The passive resistance of undisturbed bedrock may be assumed to be equal to the pressure developed by a fluid with a density of 500 pcf. A coefficient of friction of 0.4 may be used between footings and compacted fill. A passive resistance of fill of 300 pcf may be used. A coefficient of friction of 0.4 may be used between slabs-on-grade and the underlying materials. A one-third increase in the passive value may be used for wind or seismic loads. The passive resistance may be combined with the frictional resistance without reduction in determining the total lateral resistance.

Footing Observation

To evaluate the presence of satisfactory materials at design elevations, footing excavations should be observed by personnel of CTE. Footing excavations should be cleaned of loosened

soil and debris before placing steel or concrete. Soft or loose soils or unsatisfactory materials should be removed and may be replaced with a two-sack sand-cement slurry (CLSM) or structural concrete

5.6 Concrete Slab-On-Grade

Floor slabs may be supported at grade. The minimum floor slab thickness should be in accordance with the design requirements as determined by the structural engineer or architect. However, a minimum thickness of 4-1/2 inches is recommended. The thickness for the basement slab of the parking garages should be determined by the structural engineer based on wheel-loading requirements. A modulus of subgrade reaction (k) of 180 pci may be used for the design of the slab.

Concrete slabs-on-grade should be placed on the exposed subgrade as previously recommended. They should be reinforced with a minimum of number 3 reinforcing bars supported on chairs and placed on 24-inch centers, each way at or above mid-slab height, but with proper concrete cover. Additional steel reinforcement may be recommended by the structural engineer. The correct placement of the reinforcement in the slab is vital for satisfactory performance under normal conditions. Wire mesh is not recommended since it is seldom properly placed. Control joints should be spaced per the structural engineer's recommendations.

In areas to receive moisture-sensitive floor covering or used to store moisture-sensitive materials, a polyethylene or visqueen moisture retarder (10-mil or thicker) should be placed beneath the slab. A four-inch layer of ¾" by #4 gravel or crushed stone should underlie the moisture retarder. To protect the membrane during steel and concrete placement, a maximum two-inch layer of coarse sand should be placed over the moisture retarder.

Alternatively, a 15-mil vapor retarder (Stego Wrap or equivalent) may be used without the two-inch thick sand cover. However, care should be taken during construction to avoid tearing or puncturing the membrane.

It is recommended that a water-cement ratio not exceeding 0.5 be used for concrete and that the slump not exceed four inches. The slab should be moist-cured for at least five days in accordance with the methods recommended by the American Concrete Institute. On-site quality control should be used to confirm the design conditions.

5.7 Pipe Bedding andThrust Blocks

We recommend that pipes be supported on a minimum of 6 inches of sand, gravel, or crushed rock. The pipe bedding material should be placed around the pipe, without voids, and to an elevation of at least 12 inches above the top of the pipe. The pipe bedding material should be compacted in accordance with the recommendations in the earthwork section of this report.

Thrust forces may be resisted thrust blocks and/or the friction between the pipe and adjacent soil. Thrust blocks may be designed using a passive resistance equal to the pressure developed by a fluid with a density of 300 pcf. A friction value of 0.25 may be used between the pipe and adjacent soil.

5.8 Pavements

We understand that roadways are planned for the proposed development. Recommendations for pavement design are presented below.

Subgrade Preparation

To provide support for pavements, the subgrade soils should be prepared as recommended in the earthwork section. Compaction of the subgrade, including trench backfill, will be important for pavement support. The pavement subgrade should be prepared immediately before placement of the base course. Positive drainage of the paved areas should be provided to

reduce moisture infiltration into the subgrade which can decrease the life of pavements.

Asphalt Concrete

The pavement surface and base thicknesses depend on the expected wheel loads and volume of traffic (TI). Assuming the pavement subgrade will consist of the on-site soils compacted as recommended, the recommended pavement structural sections are presented in the following Table 4.

TABLE 4

Traffic Use	Traffic Index	AC Thickness (inches)	Base Thickness (inches)
Automobile Traffic/Parking	5.0	3	6
Heavy Traffic/Driveways	7.0	4-1/2	8

The pavement sections were designed in accordance with Caltrans criteria, a design R-value of 35, a 20-year design life and the noted Traffic Index. We recommend that the actual R-value of the subgrade soils be confirmed prior to final pavement design.

Portland Cement Concrete

Assuming that the paving subgrade is prepared as recommended, areas subject to medium to heavy traffic (i.e. fire lanes and driveways) may be paved with seven inches of portland cement concrete placed on uniformly compacted subgrade soils.

This pavement section is based on the design procedure from the Portland Cement Association and the recommended subgrade conditions. The design assumes that the pavement will be subjected to truck traffic of less than 25 trucks per day and that the portland cement concrete will have a flexural strength (modulus of rupture) of 600 psi. A modulus of subgrade reaction (k

value) of 180 pci was assumed for the top of the compacted subgrade. It was also assumed that aggregate interlock would be used for control joints. The pavement is based on a theoretical 35-year design life.

Base Course

The base course should meet the specifications for Class II Aggregate Base as defined in Section 26 of the Caltrans Standard Specifications, current edition. Alternatively, the base course could meet the specifications for untreated base materials as defined in the current edition of the Standard Specifications for Public Works Construction ("Greenbook"). The base course should be compacted to at least 95% of the maximum density as evaluated by ASTM D1557.

Alternate Pavement

We understand that consideration is being given to paving with a porous paving product such as Gravelpave or equivalent. If used, it should be placed on subgrade and base compacted as recommended above. The pavement should be placed per the manufacturer's specifications. Six inches or more aggregate base should underlie the pavement in parking areas.

5.9 Corrosive Soils

Sulfate-containing solutions or soil can have a deleterious effect on the in-service performance of concrete. In order to evaluate the foundation environment, samples of site soils were laboratory tested for pH, resistivity, soluble sulfate and chloride.

Based on ACI 18 Building Code and Commentary Table 4.3.1, the sulfate exposure is considered *negligible*. Based on the results of the resistivity and chloride tests, site soil appears to be moderately corrosive to ferrous metals. CTE does not practice in the field of corrosion engineering. Therefore, a corrosion engineer could be consulted to determine the appropriate protection, if any, for metallic improvements in contact with site soils.

Based on the test results, we recommend that consideration be given to using plastic pipe instead of metal. We further recommend that Type II cement be used and that at least a three-inch thick concrete cover be maintained over the reinforcing steel in concrete in contact with the soil.

5.10 Exterior Flatwork

Exterior concrete flatwork should have a minimum thickness of four inches, unless otherwise specified by the project architect. To reduce the potential for distress to exterior flatwork caused by minor settlement of foundation soils, we recommend that such flatwork be installed with crack-control joints at appropriate spacing as desired by the structural engineer. Flatwork, such as driveways, sidewalks, and architectural features, should be installed with crack control joints. The upper 6 inches of flatwork subgrades should be scarified and compacted in accordance with the earthwork recommendations provided herein. Positive drainage should be established and maintained adjacent to flatwork as per the recommendations of the project civil engineer of record.

5.11 Drainage

Positive drainage should be established around site structures and is defined as drainage away from structures and improvement as recommended by the project civil engineer of record. To facilitate this, the proper use of construction elements such as roof drains, downspouts, earthen and/or concrete swales, sloped external slabs-on-grade, and subdrains may be employed. The project civil engineer should thoroughly evaluate the on-site drainage and make provisions as necessary to keep surface water from entering structural areas.

5.12 Plan Review

CTE should be authorized to review project grading and foundation plans and the project specifications before the start of earthwork to identify potential conflicts with the recommendations contained in this report.

6.0 LIMITATIONS

The recommendations provided in this update report are based on the anticipated construction and the subsurface conditions identified in the referenced reports. The interpolated subsurface conditions should be checked in the field during construction to document that conditions are as anticipated.

Recommendations provided in this update report are based on the understanding and assumption that CTE will provide the observation and testing services for the project. Earthwork should be observed and tested to document that grading activity has been performed according to the recommendations contained within this update report. The project geotechnical engineer should observe foundation excavation and steel and concrete placement.

The geotechnical analyses presented in this report have been conducted according to current engineering practice and the standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No other warranty, expressed or implied, is made regarding the conclusions, recommendations and opinions expressed in this update report.

Variations may exist and conditions not observed or described in this report may be encountered during construction.

This update report is applicable to the site for a period of three years after the issue date provided the project remains as described herein. Modifications to the standard of practice and

regulatory requirements may necessitate an update to this report prior to the three years from issue.

Our conclusions and recommendations are based on review of referenced reports. If conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if required, will be provided upon request. CTE should review project specifications for earthwork and foundation activities prior to the solicitation of construction bids.

We appreciate this opportunity to be of service on this project. If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,
CONSTRUCTION TESTING & ENGINEERING, INC.

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APPENDIX A

REFERENCES

REFERENCES

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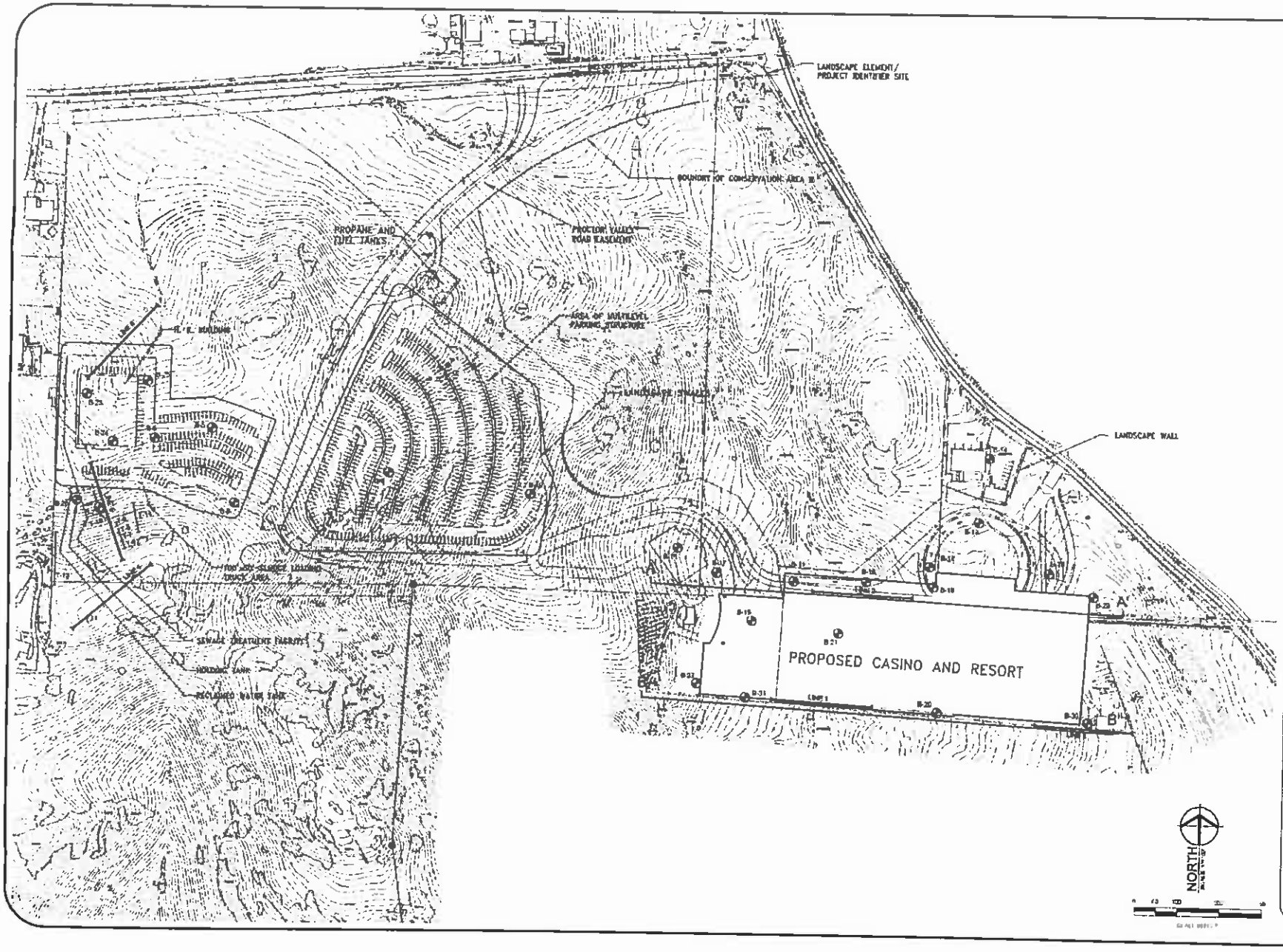
APPENDIX B

FIELD AND LABORATORY DATA



General Notes/Legend

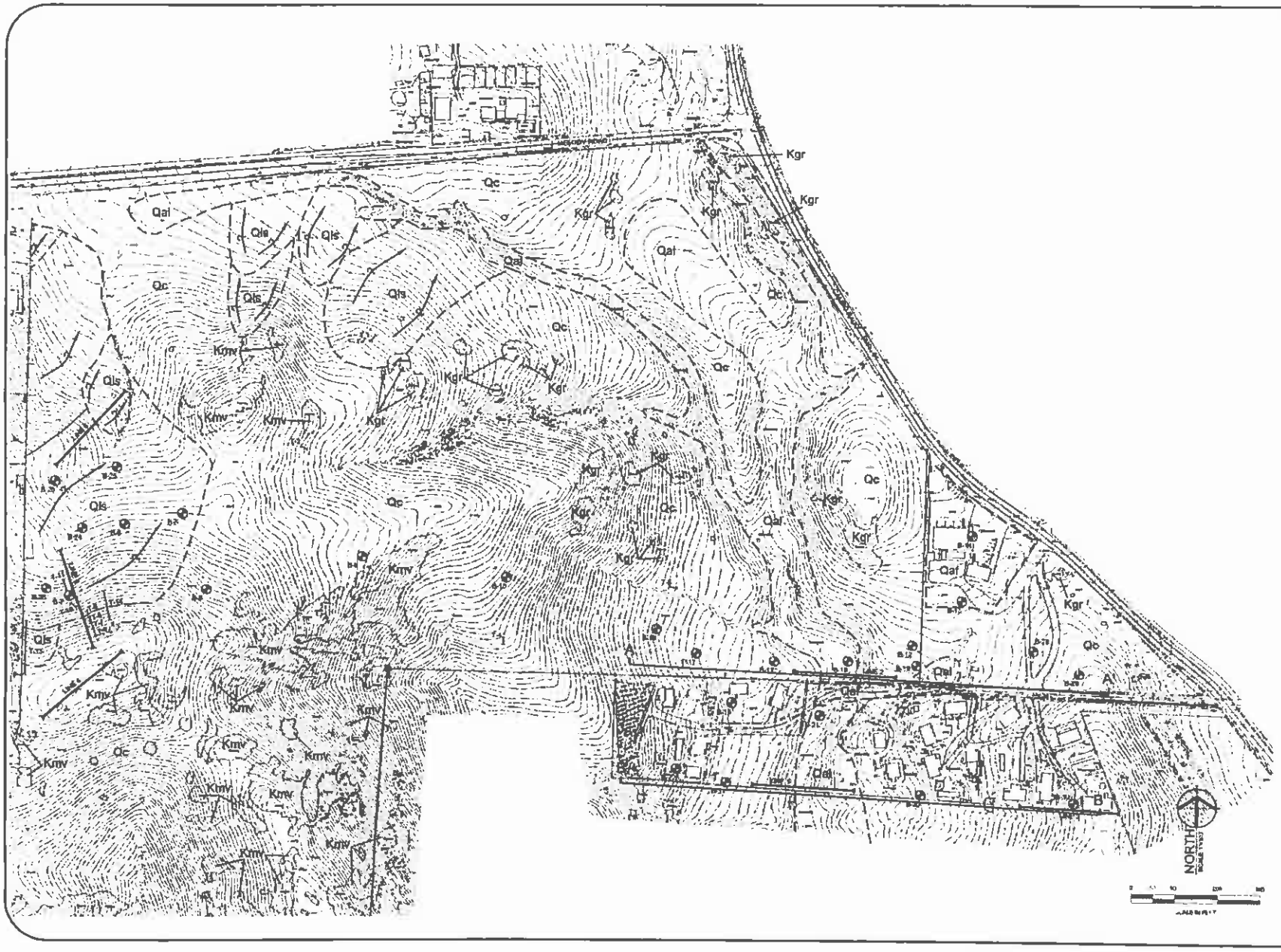
No	Revision/Issue	Date

LAW Crandall
LAWGIBB Group Member

JAMUL INDIAN VILLAGE
c/o LAKES GAMING, INC

SITE PLAN

1



General Notes/Legend

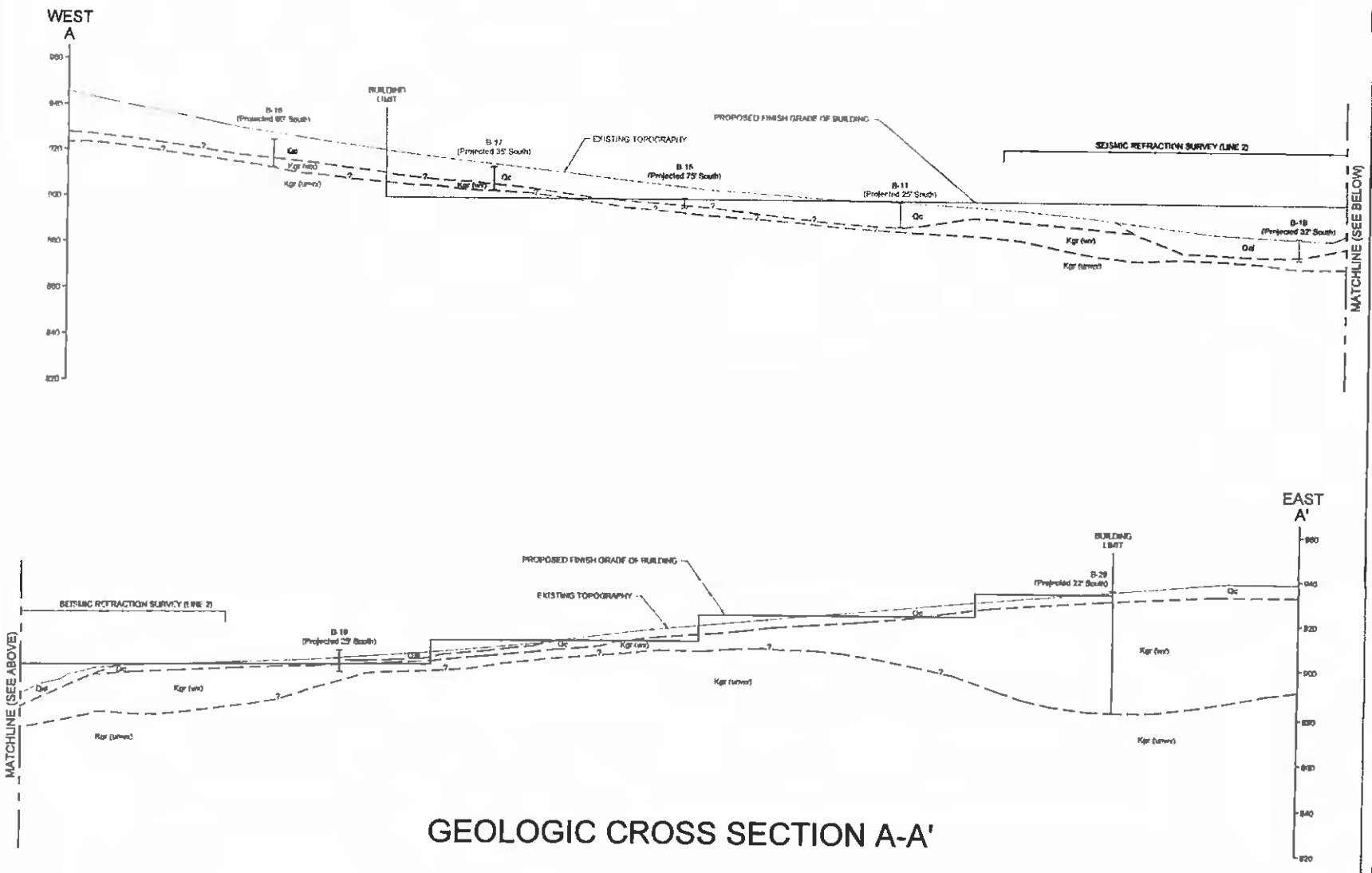
By:	SKR	11-14-01
No.	Revision/Issue	Date

LAW Crandall
LAWGIBB Group Member

JAMUL INDIAN VILLAGE
c/o LAKES GAMING, INC

GEOLOGIC MAP

2



GEOLOGIC CROSS SECTION A-A'

General Notes/Legend

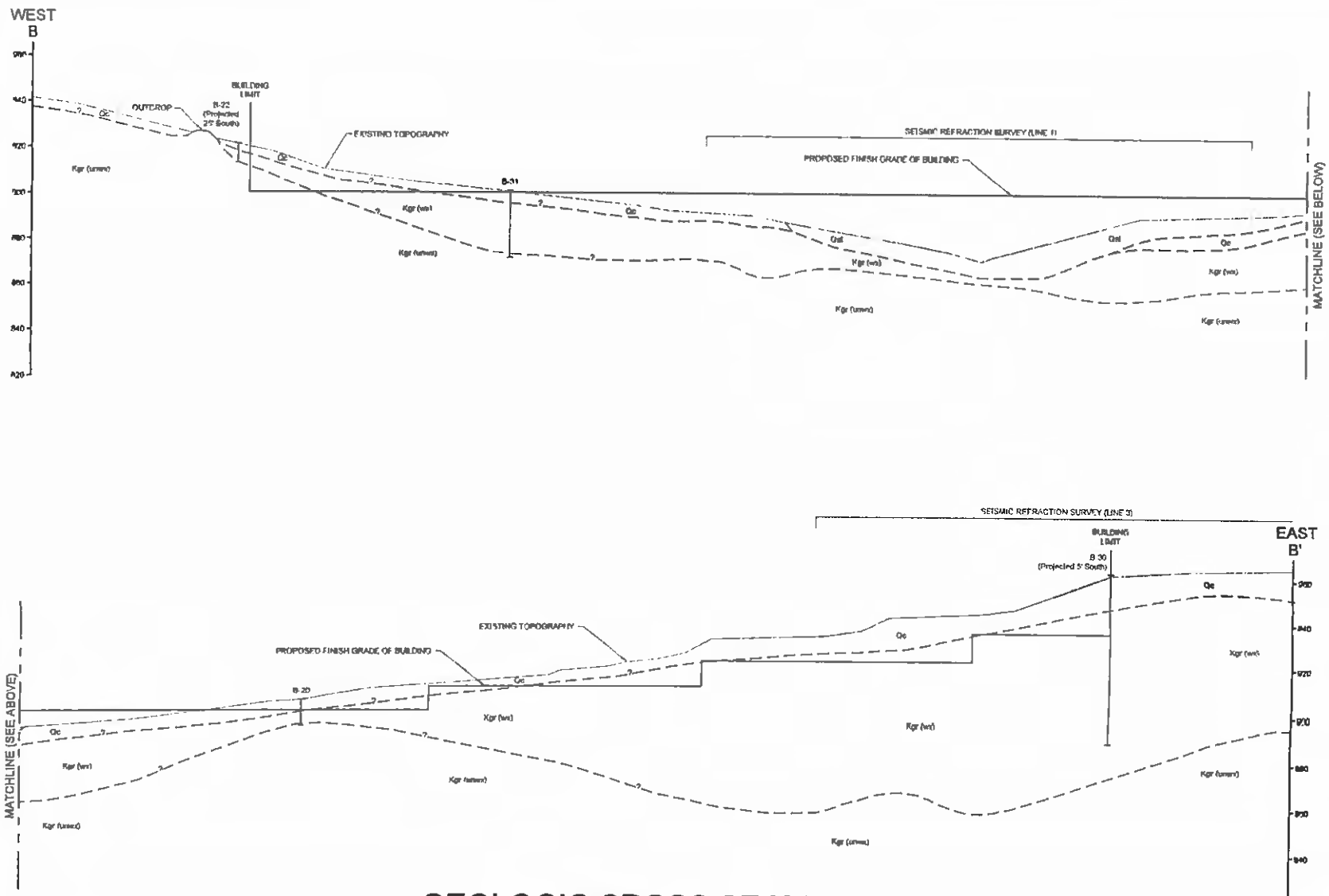
By:	SKR	
No	Revision/Issue	Date

LAW Crandall
LAWGIBB Group Member

JAMUL INDIAN VILLAGE
c/o LAKES GAMING, INC.

PROPOSED
JAMUL CASINO
AND RESORT

3.1



GEOLOGIC CROSS SECTION B-B'

General Notes/Legend

By		
No	Revision/Issue	Date

LAW Crandall
LAWGIBB Group Member

JAMUL INDIAN VILLAGE
c/o LAKES GAMIN, INC

PROPOSED
JAMUL CASINO
AND RESORT

3.2

Crandall Sampler

No Recovery

Standard Penetration Test (SPT) Sampler

Bulk Sample

Shelby Tube Sampler

- #200 = % Passing No. 200 Sieve

LL = Liquid Limit

PI = Plasticity Index

ND = Not Detected

TV = Torvane

PP = Pocket Penetrometer

Blow Count - Number of blows required to drive the Crandall or SPT sampler 12 inches using a 140 pound hammer falling 30 inches.

KEY TO BORINGS

LAW/CRANDALL

FIGURE A - 2.1

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel - sand - silt mixtures.
			GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand - silt mixtures.
			SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

Reference:
The Unified Soil Classification System, Corps of Engineers, U.S. Army
Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

LAW/CRANDALL

FIGURE A-2.2

BORING 1

DATE DRILLED: October 5, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 989

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		4.7	--			SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, brown, dry reddish brown
985	5	5.7	98	26	■	SM	slightly moist RESIDUAL SOIL - SILTY SAND - fine to medium, translocated Clay, soil development, mottled light brownish gray and red (oxidized)
		3.2	119	74	■		
980	10	3.0	–	50 for 5"	⊠		disturbed sample
		4.2	120	50 for 5"	■		BEDROCK DIORITE - highly weathered and oxidized, light brownish gray fine grained crystals, light gray
975	15	1.7	--	50 for 5"	■		dark gray, very hard
970	20	–	–	50 for 0"	⊠		no recovery - sampler bouncing on hard bedrock

Boring terminated at a depth of 20 feet. Ground water or water seepage not observed. Boring backfilled with excavated soil.

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.1

BORING 2

DATE DRILLED: October 5, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 979

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
						SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, brown, dry reddish brown
975		5.6	112	62		SM	RESIDUAL SOIL - SILTY SAND - fine to medium, translocated Clay, porous, soil development, reddish brown
	5	9.7	101	72 for 10"			mottled light brownish gray and red (oxidized)
970		8.4	104	85 for 10"			
	10	0.5	--	50 for 1"			BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized disturbed sample
965	15	3.3	115	50 for 4"			less weathered and fractured
960	20	4.4	120	50 for 2"			very hard drilling Boring terminated at a depth of 20.5 feet. Ground water or water seepage not observed. Boring backfilled with excavated soil.

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.2

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 3

DATE DRILLED: October 5, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 948

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		11.4	–			SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, red, dry
945		10.1	109	37	■	SM	RESIDUAL SOIL - SILTY SAND - fine to medium, dark brown, slightly moist
	5						BEDROCK DIORITE - fine grained crystals, mostly dark minerals, very hard drilling

Boring terminated at a depth of 5.5 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.3

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 4

DATE DRILLED: October 5, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1001

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
000		2.2	--			SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, light brown, dry
		2.7	106	21	■		reddish brown
	5						
995		6.1	113	68 for 11"	■	SM	RESIDUAL SOIL - SILTY SAND - fine to medium, translocated Clay, porous, soil development, light brownish gray, slightly moist
		4.5	117	90 for 9"	■		BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized
	10						Boring terminated at a depth of 10 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.4

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 5

DATE DRILLED: October 4, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1076

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
075						SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, red, dry
						SC	CLAYEY SAND - fine to medium, red, slightly moist
		2.6	110	50 for 5.5"	■	SM	LANDSLIDE DEPOSITS SILTY SAND - fine to coarse, derived from colluvial debris
	5						
070		6.8	120	71 for 11"	■		
		3.8	113	50 for 6"	■		
	10						
065		8.4	100	50 for 6"	■		highly fractured VOLCANIC ROCK, possible slide plane
	15						BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized
060		3.3	–	50 for 6"	⊠		disturbed sample
	20						Boring terminated at a depth of 20 feet. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.5

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 6

DATE DRILLED: October 4, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1080

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		4.1	--			SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, red, dry
		5.0	137	47	■	SM	LANDSLIDE DEPOSITS SILTY SAND - fine to medium, derived from colluvial debris highly fractured VOLCANIC ROCK layer from 4.5 feet to 7 feet
075	5						highly weathered GRANITIC ROCK layer
		--	--	50 for 0"	⊠		no recovery
070	10						
		--	--	50 for 2"	⊠		no recovery, possible slide plane
							BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized disturbed sample
065	15	--	--	50 for 2"	⊠		
							Boring terminated at a depth of 17 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.6

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 7

DATE DRILLED: October 4, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1106

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
105		3.4	--			SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, red, dry
		4.9	110	21	■	SC	RESIDUAL SOIL CLAYEY SAND - fine to medium, red, slightly moist
	5						
100		13.5	119	50 for 5"	■		LANDSLIDE DEPOSITS SILTY SAND - fine to medium, derived from colluvial debris
		5.2	122	86 for 10"	■		
	10						
095		4.1	121	50 for 4"	■		VOLCANIC ROCK - highly fractured, possible slide plane
	15						
090		–	--	50 for 1"	◪		BEDROCK VOLCANIC - highly weathered and fractured, no visible crystals, very hard no recovery
	20	--	--	50 for 3"	◪		no recovery

Boring terminated at a depth of 20.5 feet. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.7

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 8

DATE DRILLED: October 4, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1098

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
						SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, red, dry
095		6.3	122	21	■	SM	RESIDUAL SOIL - SILTY SAND - very fine to fine, trace Clay, mottled brown and light greenish gray, slightly moist
	5						
		8.5	110	84 for 9"	■		
090		4.5	112	50 for 6"	■		BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized
	10						
085		4.5	124	50 for 6"	■		very hard drilling

Boring terminated at a depth of 13 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.8

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 9

DATE DRILLED: October 3, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1047

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
045						SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, red, dry
		6.9	115	72 for 10"	■	SM	reddish brown, some charcoal RESIDUAL SOIL - SILTY SAND - very fine to fine, trace Clay, mottled brown and light greenish gray, slightly moist
	5						
040		4.0	113	50 for 3"	■		
		2.2	–	50 for 3"	⊠		BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized disturbed sample
	10						
035							
	15						
030							very hard drilling
	20						Boring terminated at a depth of 20 feet. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.9

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 10

DATE DRILLED: October 3, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1003

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		2.8	--			SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, reddish brown, dry
000		4.2	107	38	■	SM	RESIDUAL SOIL - SILTY SAND - very fine to fine, trace Clay, mottled brown and light greenish gray, slightly moist
	5						
		--	--	86 for 9"	◪		BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized no recovery
995		2.0	123	50 for 3"	■		
	10						
990		3.1	126	50 for 9"	■		very hard drilling
	15						
		--	--	50 for 1"	◪		no recovery
985							
	20						Boring terminated at a depth of 20 feet. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.10

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 11

DATE DRILLED: October 3, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 899

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		2.9	--			SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, reddish brown, dry
895	5	4.0	108	44	■	SM	RESIDUAL SOIL - SILTY SAND - fine to medium, translocated Clay, porous, soil development, some charcoal, light brownish gray, slightly moist
		11.2	115	58	■		Volcanic Rock residuum, trace Clay, mottled light brown and greenish gray
890	10	--	--	43	■		
							BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized

Boring terminated at a depth of 10.5 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.11

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 12

DATE DRILLED: October 2, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 909

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		10.7	--			SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, reddish brown, dry
905	5	11.5	113	47	■	SM	mostly fine Sand RESIDUAL SOIL - SILTY SAND - fine to medium, translocated Clay, porous, soil development, some charcoal, light brownish gray, slightly moist denser, hard drilling
		10.4	114	77	■		
900	10	9.7	114	42	■		BEDROCK DIORITE - highly weathered, hard, light gray, black, and red (oxidized) some wet Clay on outside of sampler, water seepage

Boring terminated at a depth of 10 feet due to drilling refusal on bedrock. Some water seepage observed at 8.5 feet. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.12

BORING 13

DATE DRILLED: October 2, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 918

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
						SM	ARTIFICIAL FILL SILTY SAND - fine to medium, trace construction debris, reddish brown, dry
915		3.9	120	90			
	5						BEDROCK DIORITE - fine grained crystals, mostly dark minerals, very hard drilling, light gray, black, and red (oxidized)
		3.5	122	70 for 10"			less weathered and oxidized
910		–	--	50 for 2"			no recovery
	10						
905							
	15						

Boring terminated at a depth of 16 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.13

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 14

DATE DRILLED: October 2, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 926

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
925		9.2	118	26		SM	ARTIFICIAL FILL SILTY SAND - fine to medium, dark brown, moist reddish brown
	5					SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, reddish brown, slightly moist
920		--	--	96 for 9"		SM	RESIDUAL SOIL - SILTY SAND - fine to medium, translocated Clay, porous, soil development, very dense, light brownish gray, slightly moist no recovery due to hard rock
		4.5	115	65			moist
	10						BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized

Boring terminated at a depth of 10 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.14

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

BORING 15

DATE DRILLED: October 1, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 900

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		2.2	--			SM	1" Conrete veneer COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, reddish brown, slightly moist
		4.3	127	64 for 11"	■		BEDROCK DIORITE - hard, light gray and black

Boring terminated at a depth of 4 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.15

BORING 16

DATE DRILLED: October 3, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 926

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
925		4.7	--			SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, red, dry
		–	–	18	■		reddish brown, slightly moist
	5						
920		10.1	117	80	■	SM	RESIDUAL SOIL SILTY SAND - fine to medium, translocated Clay, porous, soil development, very dense, light brown, slightly moist
		2.5	--	50 for 1"	⊠		BEDROCK VOLCANIC - hard, greenish gray disturbed sample
	10						
915							DIORITE - highly weathered and fractured, light brownish gray and oxidized

Boring terminated at a depth of 12.5 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.16

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 17

DATE DRILLED: October 3, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 913

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		4.6	--			SM	COLLUVIUM SLOPE WASH - SILTY SAND - very fine to fine, red, dry
910		10.3	118	84		SC	RESIDUAL SOIL - CLAYEY SAND - fine to medium, translocated Clay, porous, soil development, some charcoal, reddish brown, slightly moist mostly fine Sand rock layer, Quartzite Cobbles
	5	7.0	117	90 for 7"		SM	Silty Sand - very fine to fine, Volcanic Rock residuum, light greenish gray
905		--	--	50 for 1"			BEDROCK DIORITE - highly weathered, hard, light gray, black, and red (oxidized) no recovery

Boring terminated at a depth of 9.5 feet due to drilling refusal on bedrock. Ground water and water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.17

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 18

DATE DRILLED: October 2, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 885

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		4.5	--			SM	ALLUVIUM SILTY SAND - fine to coarse, unconsolidated, reddish brown, slightly moist
		7.2	95	7			
880	5						
		7.2	99	14			rock layer, Quartzite Cobbles
		--	--	56			BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized
875	10						Boring terminated at a depth of 10 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.18

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 19

DATE DRILLED: October 2, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 905

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		5.5	--			SM	ALLUVIUM SILTY SAND - fine to medium, unconsolidated, reddish brown, slightly moist
		--	--	7	■		
900	5					SM	COLLUVIUM RESIDUAL SOIL - SILTY SAND - very fine to coarse, dense, mottled light brownish gray and red (oxidized)
		4.9	126	69	■		
		5.2	116	60	■		less weathered and oxidized
895	10						BEDROCK DIORITE - highly weathered and fractured, light brownish gray and oxidized

Boring terminated at a depth of 10 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.19

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 20

DATE DRILLED: October 1, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 904

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
						SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, trace Gravel, reddish brown, slightly moist
900		10.8	122	32	■	SM	RESIDUAL SOIL - SILTY SAND - fine, some Clay, white mineral growths, dense, mottled light brownish gray and red (oxidized), slightly moist
	5						harder drilling, less oxidized
		--	--	85 for 11"	■		BEDROCK DIORITE - highly weathered and fractured, very hard, light gray and black
895		6.1	115	94 for 10"	■		less weathered
	10						Boring terminated at a depth of 10 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.20

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 21

DATE DRILLED: October 1, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 882

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
		6.2	--			SM	ALLUVIUM SILTY SAND - fine to medium, some rootlets, reddish brown, dry
880							some Clay, organic odor, dark brown, moist
		13.3	113	9	■		
	5					SC	
		13.3	116	13	■		CLAYEY SAND - fine to medium, some Silt, dark brown, moist
875							layer of Dioritic Cobbles
		14.5	115	33	■	SC	COLLUVIUM RESIDUAL SOIL - CLAYEY SAND - fine to medium, reddish brown, moist
	10						
870		14.4	119	35	■		
							▽ BEDROCK DIORITE - fine grained crystals, mostly dark minerals, highly weathered and oxidized, light brownish gray
	15	13.2	114	50 for 4"	■		
865							Boring terminated at a depth of 17.5 feet due to drilling refusal on bedrock. Ground water observed at 13.5 feet. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.21

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 22

DATE DRILLED: October 1, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 926

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.			
925		1.0	--				SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, reddish brown, dry
		--	--	90 for 9"				no recovery due to hard bedrock
	5							BEDROCK DIORITE - highly weathered and fractured, very hard, light gray and black
920								less weathered
								Boring terminated at a depth of 8 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.22

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHK'D

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 23

DATE DRILLED: October 25, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1070

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
						SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to medium, red, slightly moist
						CL	RESIDUAL SOIL - SILTY CLAY - trace fine Sand, reddish brown, slightly moist
		--	--	23	■		
065	5						harder drilling
							BEDROCK VOLCANIC - highly weathered and fractured, very hard, gray and greenish gray
		--	--	50 for 4"	◪		no recovery
		--	--	50 for 5"	◪		no recovery
060	10						Boring terminated at a depth of 10 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.23

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 24

DATE DRILLED: October 25, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1076

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
075						SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to coarse, red, slightly moist
		–	--	20	■		
	5						
070		--	--	49	■	ML	RESIDUAL SOIL - SANDY SILT - very fine to fine Sand, Volcanic residuum, yellowish brown, slightly moist
		--	--	50 for 6"	■		LANDSLIDE DEPOSIT VOLCANIC ROCK - highly fractured, cross jointing exhibits approximately 1/2" to 2" spacing, possible slide debris
	10						
065		–	--	73 for 7"			cross jointing approximately 1/4" to 1/2" spacing harder drilling
	15						
060		--	–	50 for 4"	■		BEDROCK VOLCANIC - highly weathered and fractured, no visible crystals, very hard high drilling pressures
	20	--	--	50 for 5"	■		Boring terminated at a depth of 20 feet. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.24

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 25

DATE DRILLED: October 25, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1058

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
						SM	**COLLUVIUM** SLOPE WASH - SILTY SAND - fine to medium, red, slightly moist
055		--	--	47	■	ML	RESIDUAL SOIL - CLAYEY SILT - trace fine Sand, Volcanic residuum, yellowish brown, slightly moist
	5						
		--	--	72 for 9"	■		**LANDSLIDE DEPOSIT** VOLCANIC ROCK - highly fractured, cross jointing exhibits approximately 1/2" to 1" spacing, possible slide debris no recovery
050		--	--	50 for 5"	◪		
	10						**BEDROCK** VOLCANIC - highly weathered and fractured, no visible crystals, very hard

Boring terminated at a depth of 10 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.25

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING 26

DATE DRILLED: October 25, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1098

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
						SM	COLLUVIUM SLOPE WASH - SILTY SAND - fine to coarse, red, slightly moist
095		--	--	14	■		some angular gravel
	5					ML	RESIDUAL SOIL - SANDY SILT - very fine to fine Sand, Volcanic residuum, yellowish brown, slightly moist
		--	--	50 for 6"	■	SM	SILTY SAND - fine to coarse, some Gravel, yellowish brown, slightly moist
090		--	--	50 for 5"	■		LANDSLIDE DEPOSIT VOLCANIC ROCK - highly fractured, cross jointing exhibits approximately 1/4" to 1/2" spacing
	10						
085		--	--	50 for 6"	■		cross jointing approximately 1/2" to 1" spacing
	15						harder drilling
		--	--	50 for 0"	☒		BEDROCK VOLCANIC - highly weathered and fractured, no visible crystals, very hard no recovery
080							
	20						Boring terminated at a depth of 20 feet. Ground water or water seepage not observed. Boring backfilled with excavated soil.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.26

BORING 27

DATE DRILLED: October 25, 2001
EQUIPMENT USED: 8-inch diameter hollow-stem auger
ELEVATION: 1021

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	BLOW COUNT (blows/ft.)	SAMPLE LOC.		
020						SM	COLLUVIUM - Slope Wash SLOPE WASH - SILTY SAND - fine to coarse, red, dry
		--	--	43	■	SM	RESIDUAL SOIL - SILTY SAND and highly weathered and fractured bedrock Cobbles, yellowish brown
	5						BEDROCK DIORITE - fine grained crystals, mostly dark minerals, very hard drilling

Boring terminated at a depth of 5.5 feet due to drilling refusal on bedrock. Ground water or water seepage not observed. Boring backfilled with excavated soil.

JOB 70341-1-0105.01 DATE 11/21/2001 F.T. DPW DR. DPW O.E. BEC CHKD

Note: The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

LAW/CRANDALL

FIGURE A-1.27

LAW/CRANDALL
Engineering and Environmental Services

Project:	Proposed Jamul Indian Casino & Resort	**Date:**	November 2, 2001
Station ID:	B-28	**Report By:**	D. Walsh
Elevation:	926	**G.W. Level**	N/A
Crew:	Wayne/Glenn (MJ Baxter)	**Equipment:**	Ingersoll Rand LM 600C

Description of Material Encountered

Depth		Depth	
1 ft		34 ft	
2 ft	Casing from 0-4'	35 ft	
3 ft		36 ft	
4 ft		37 ft	
5 ft		38 ft	
6 ft	Weathered Diorite	39 ft	
7 ft		40 ft	
8 ft	Average Sec/Ft - 5.8	41 ft	
9 ft		42 ft	
10 ft		43 ft	
11 ft		44 ft	
12 ft		45 ft	
13 ft		46 ft	
14 ft	Weathered Diorite	47 ft	
15 ft		48 ft	
16 ft	Average Sec/Ft - 5.4	49 ft	
17 ft		50 ft	
18 ft		51 ft	
19 ft		52 ft	
20 ft		53 ft	
21 ft		54 ft	
22 ft		55 ft	
23 ft		56 ft	
24 ft		57 ft	
25 ft	Weathered Diorite	58 ft	
26 ft	Average Sec/Ft - 7.3	59 ft	
27 ft		60 ft	
28 ft		61 ft	
29 ft		62 ft	
30 ft		63 ft	
31 ft	Boring Terminated at 30 feet	64 ft	
32 ft		65 ft	
33 ft		66 ft	

LAW/CRANDALL
Engineering and Environmental Services

Project:	Proposed Jamul Indian Casino & Resort	**Date:**	November 2, 2001
Station ID:	B-29	**Report By:**	D. Walsh
Elevation:	937	**G.W. Level**	N/A
Crew:	Wayne/Glenn (MJ Baxter)	**Equipment:**	Ingersoll Rand LM 600C

Description of Material Encountered

Depth		Depth	
1 ft		34 ft	
2 ft		35 ft	
3 ft	Casing from 0-5'	36 ft	
4 ft		37 ft	
5 ft		38 ft	
6 ft		39 ft	Weathered Diorite
7 ft	Weathered Diorite	40 ft	
8 ft		41 ft	Average Sec/Ft - 6.8
9 ft	Average Sec/Ft - 4.8	42 ft	
10 ft		43 ft	
11 ft		44 ft	
12 ft		45 ft	
13 ft		46 ft	
14 ft	Weathered Diorite	47 ft	
15 ft		48 ft	Weathered Diorite
16 ft	Average Sec/Ft - 5.6	49 ft	
17 ft		50 ft	Average Sec/Ft - 7.4
18 ft		51 ft	
19 ft		52 ft	Suface of Unweathered Diorite
20 ft		52 ft	Boring terminated at 52 feet.
21 ft		54 ft	
22 ft		55 ft	
23 ft		56 ft	
24 ft		57 ft	
25 ft		58 ft	
26 ft		59 ft	
27 ft	Weathered Diorite	60 ft	
28 ft		61 ft	
29 ft	Average Sec/Ft - 6.4	62 ft	
30 ft		63 ft	
31 ft		64 ft	
32 ft		65 ft	
33 ft		66 ft	

LAW/CRANDALL
Engineering and Environmental Services

Project:	Proposed Jamul Indian Casino & Resort	**Date:**	November 2, 2001
Station ID:	B-30	**Report By:**	D. Walsh
Elevation:	962	**G.W. Level**	N/A
Crew:	Wayne/Glenn (MJ Baxter)	**Equipment:**	Ingersoll Rand LM 600C

Description of Material Encountered

Depth		Depth	
1 ft		34 ft	
2 ft		35 ft	
3 ft	Casing from 0-5'	36 ft	
4 ft		37 ft	
5 ft		38 ft	
6 ft		39 ft	Weathered Diorite
7 ft	Weathered Diorite	40 ft	
8 ft		41 ft	Average Sec/Ft - 6.9
9 ft	Average Sec/Ft - 4.4	42 ft	
10 ft		43 ft	
11 ft		44 ft	
12 ft		45 ft	
13 ft		46 ft	
14 ft		47 ft	
15 ft	Weathered Diorite	48 ft	
16 ft		49 ft	
17 ft	Average Sec/Ft - 4.7	50 ft	
18 ft		51 ft	Weathered Diorite
19 ft		52 ft	
20 ft		53 ft	
21 ft		54 ft	
22 ft		55 ft	Average Sec/Ft - 6.3
23 ft		56 ft	
24 ft		57 ft	
25 ft		58 ft	
26 ft		59 ft	
27 ft	Weathered Diorite	60 ft	
28 ft		61 ft	Weathered Diorite
29 ft	Average Sec/Ft - 5.4	62 ft	Average Sec/Ft - 6.5
30 ft		63 ft	
31 ft		64 ft	
32 ft		65 ft	
33 ft		71 ft	Boring Terminated at 71 feet.

LAW/CRANDALL
Engineering and Environmental Services

Project:	Proposed Jamul Indian Casino & Resort	**Date:**	November 2, 2001
Station ID:	B-31	**Report By:**	D. Walsh
Elevation:	898	**G.W. Level**	Elevation 970
Crew:	Wayne/Glenn (MJ Baxter)	**Equipment:**	Ingersoll Rand LM 600C

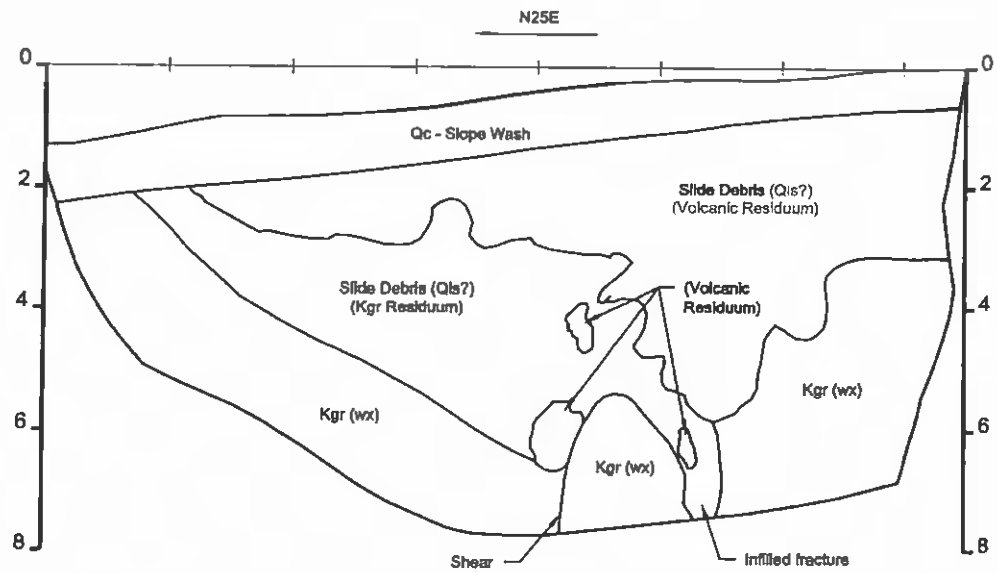
Description of Material Encountered

Depth		Depth	
1 ft		34 ft	
2 ft		35 ft	
3 ft	Casing from 0-5'	36 ft	
4 ft		37 ft	
5 ft		38 ft	
6 ft		39 ft	
7 ft	Weathered Diorite	40 ft	
8 ft		41 ft	
9 ft	Average Sec/Ft - 7.6	42 ft	
10 ft		43 ft	
11 ft		44 ft	
12 ft		45 ft	
13 ft		46 ft	
14 ft		47 ft	
15 ft		48 ft	
16 ft	Weathered Diorite	49 ft	
17 ft		50 ft	
18 ft	Average Sec/Ft - 9.9	51 ft	
19 ft		52 ft	
20 ft		53 ft	
21 ft		54 ft	
22 ft		55 ft	
23 ft		56 ft	
24 ft	Weathered Diorite	57 ft	
25 ft		58 ft	
26 ft		59 ft	
27 ft	Average Sec/Ft - 15.4	60 ft	
28 ft	Surface Water of unweathered Diorite	61 ft	
29 ft	Water table perched on unweathered	62 ft	
30 ft	Diorite	63 ft	
30 ft	Boring teminated at 30 feet	64 ft	
32 ft		65 ft	
33 ft		71 ft	

LAW/CRANDALL
Engineering and Environmental Services

Key to Test Pits

Q_c	Slope Wash - unconsolidated silts & sands.
Q_{ls} ?	Landslide deposits - Queried as existence not substantiated
Q_c	Residual soil - consolidated silts, clays, & sands with soild development features
Kgr	Plutonic Granitic Bedrock
Kmr	Volcanic & Metavolcanic Bedrock
(wx)	Weathered
(unwx)	Unweathered
———	Geologic contact
----------	(dashed where uncertain)

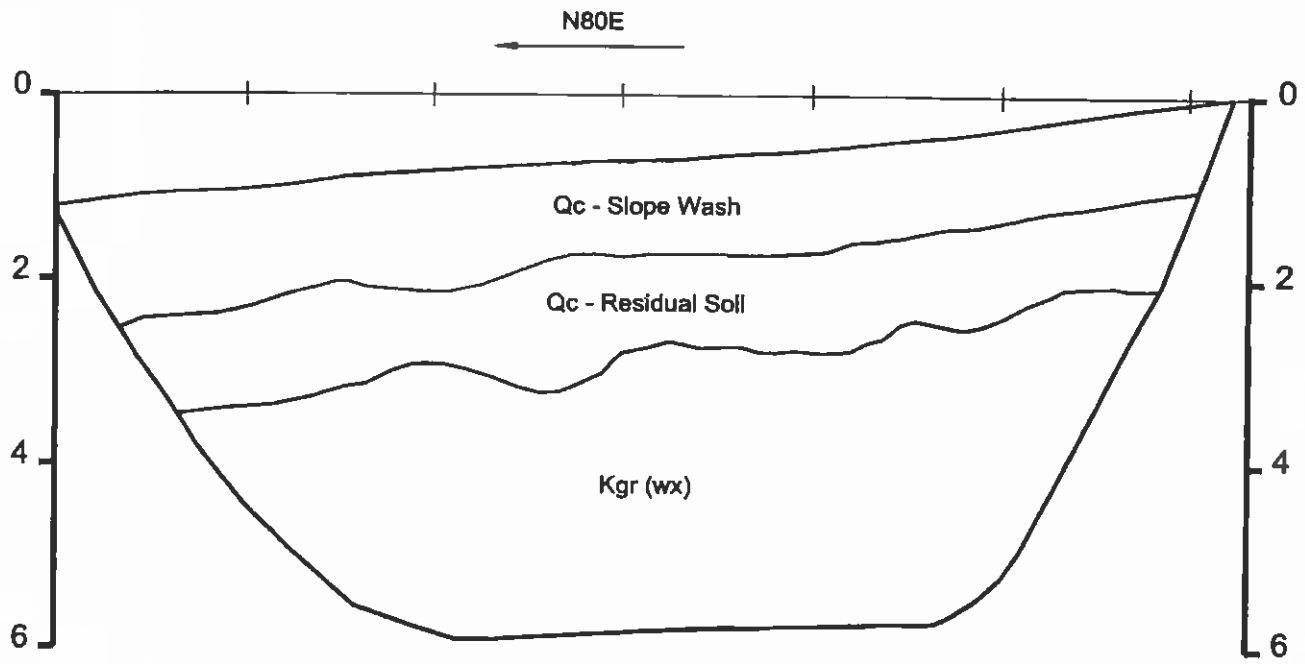


LOG OF TEST PIT 1

LAW/CRANDALL

FIGURE: A-3.1

JOB 70341-1-0105 DATE 11-16-01 DR. SKR O.E. BEC CHKD.

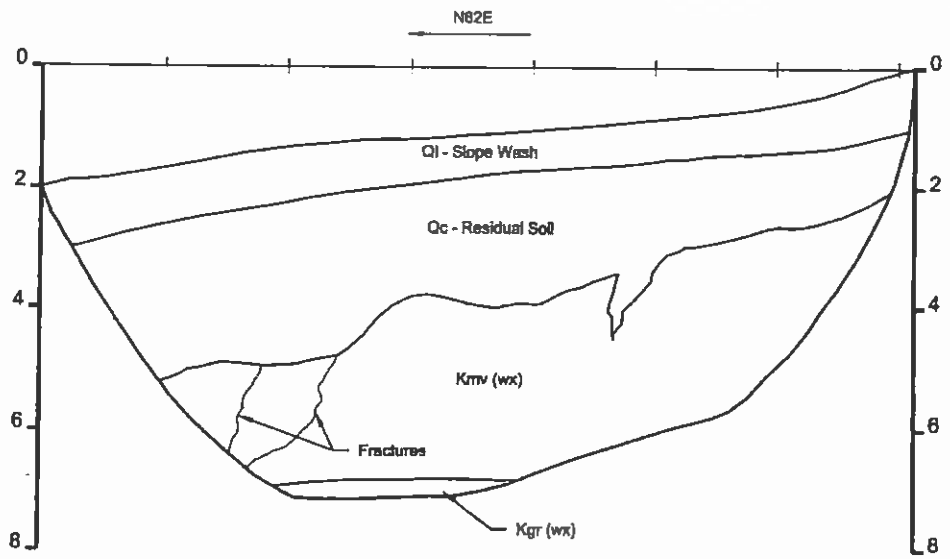


LOG OF TEST PIT 2

JOB 70341-1-0105 DATE 11-16-01 DR SKR O.E. BEC CHKD.

LAW/CRANDALL

FIGURE: A-3.2



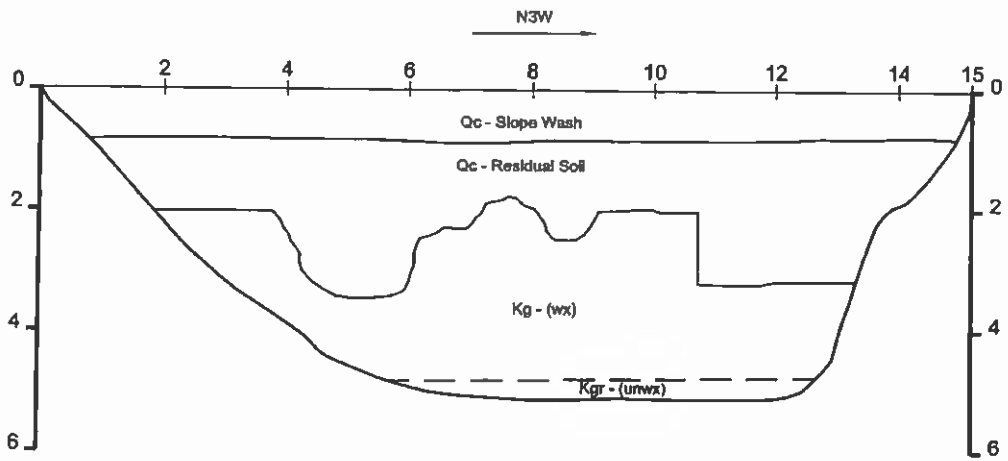
LOG OF TEST PIT 3

LAW/CRANDALL

FIGURE: A-3.3

JOB 70341-1-0105 DATE 11-16-01 DR SKR O.E. BEC CHKD.

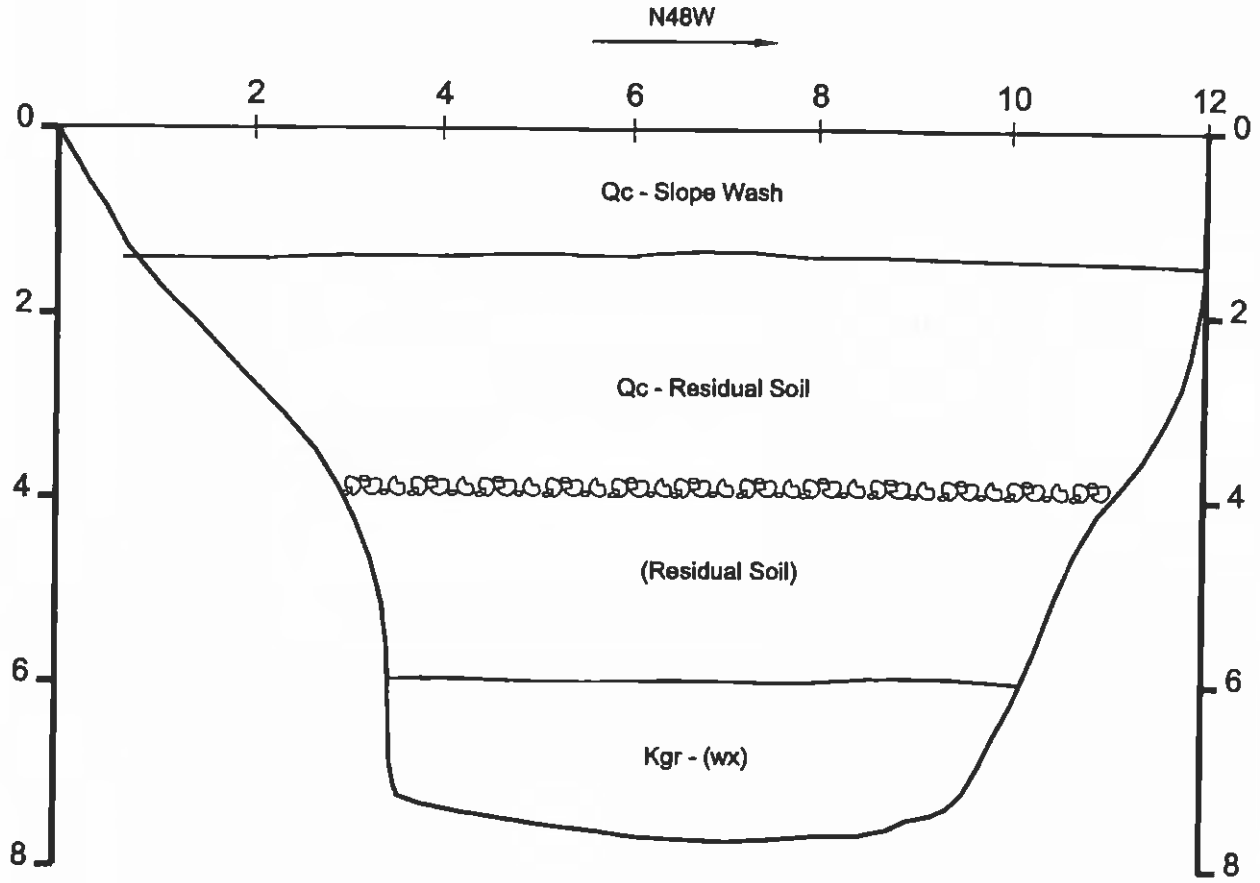
JOB /0341-1-0105 DATE 11-16-01 DR SKR O.E. BEC CHKD.



LOG OF TEST PIT 4

LAW/CRANDALL

FIGURE: A-3.4

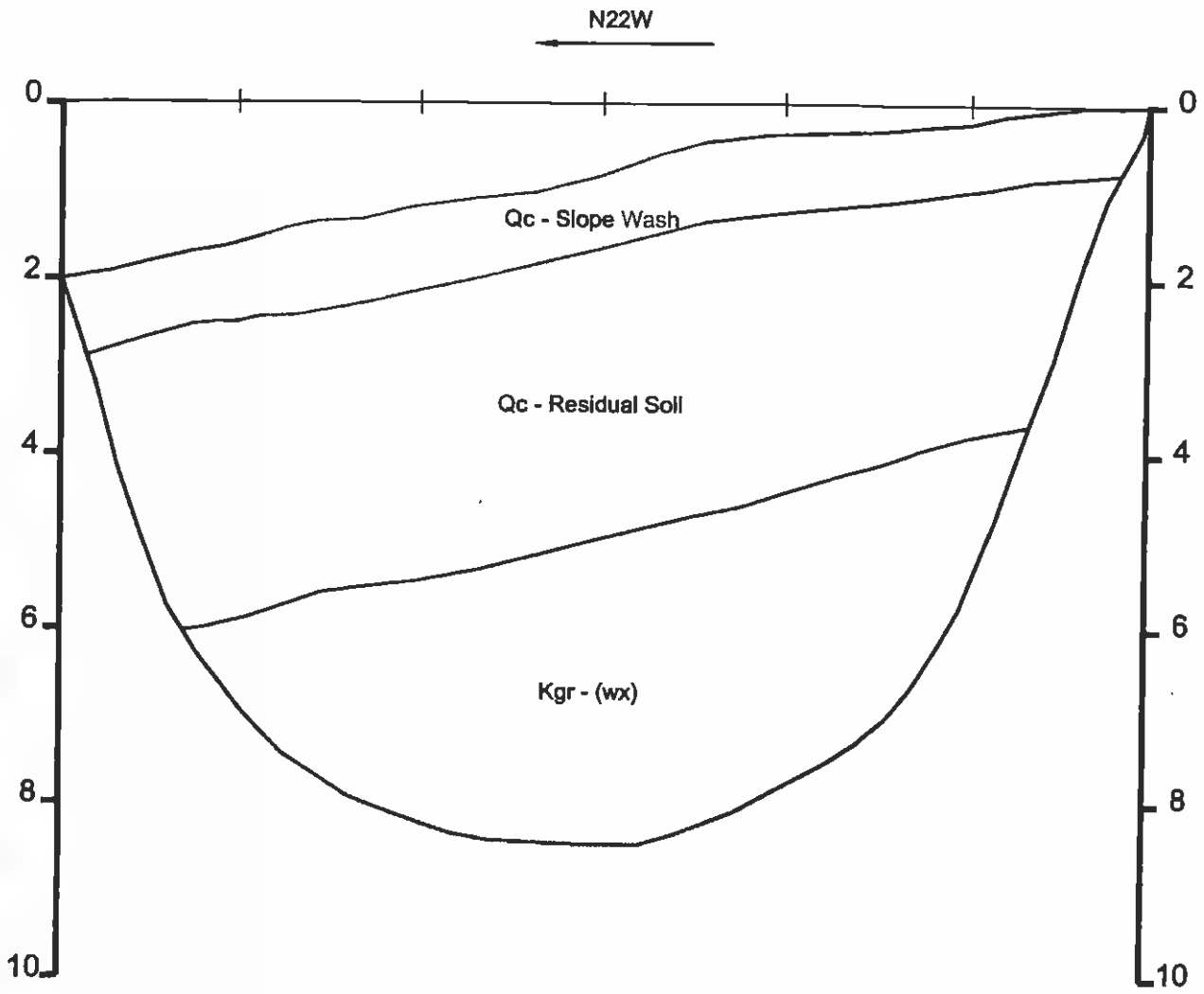


LOG OF TEST PIT 5

JOB 70341-1-0105 DATE 11-16-01 DR. SKR O.E. BEC CHKD.

LAW/CRANDALL

FIGURE: A-3.5



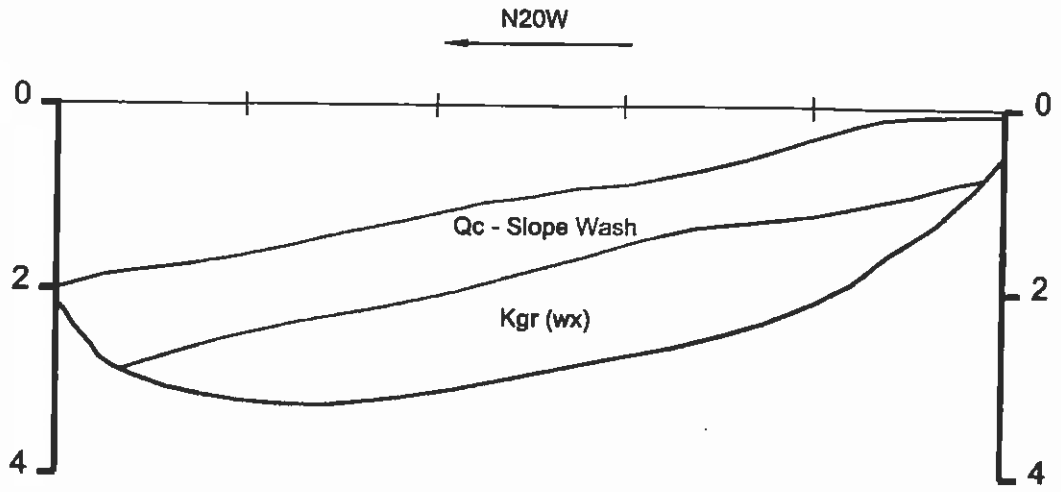
LOG OF TEST PIT 6

JOB 70341-1-0105 DATE 11-16-01 DR SKR O.E. BEC CHKD.

LAW/CRANDALL

FIGURE: A-3.6

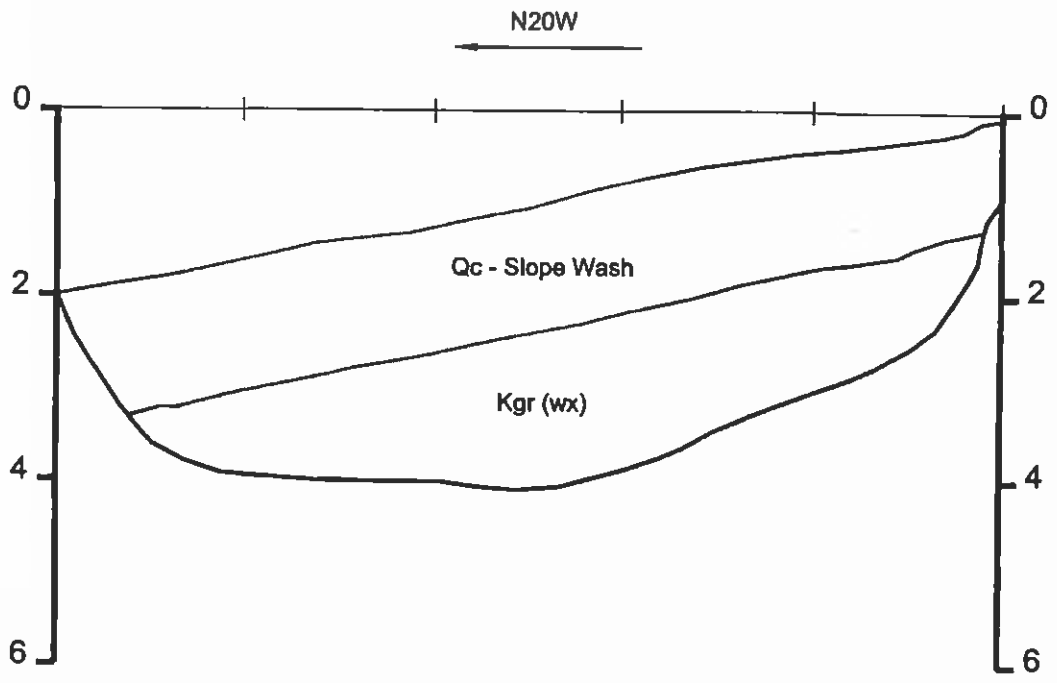
JOB 70341-1-0105 DATE 11-16-01 DR. SKR O.E. BEC CHKD.



LOG OF TEST PIT 7

LAW/CRANDALL

FIGURE: A-3.7

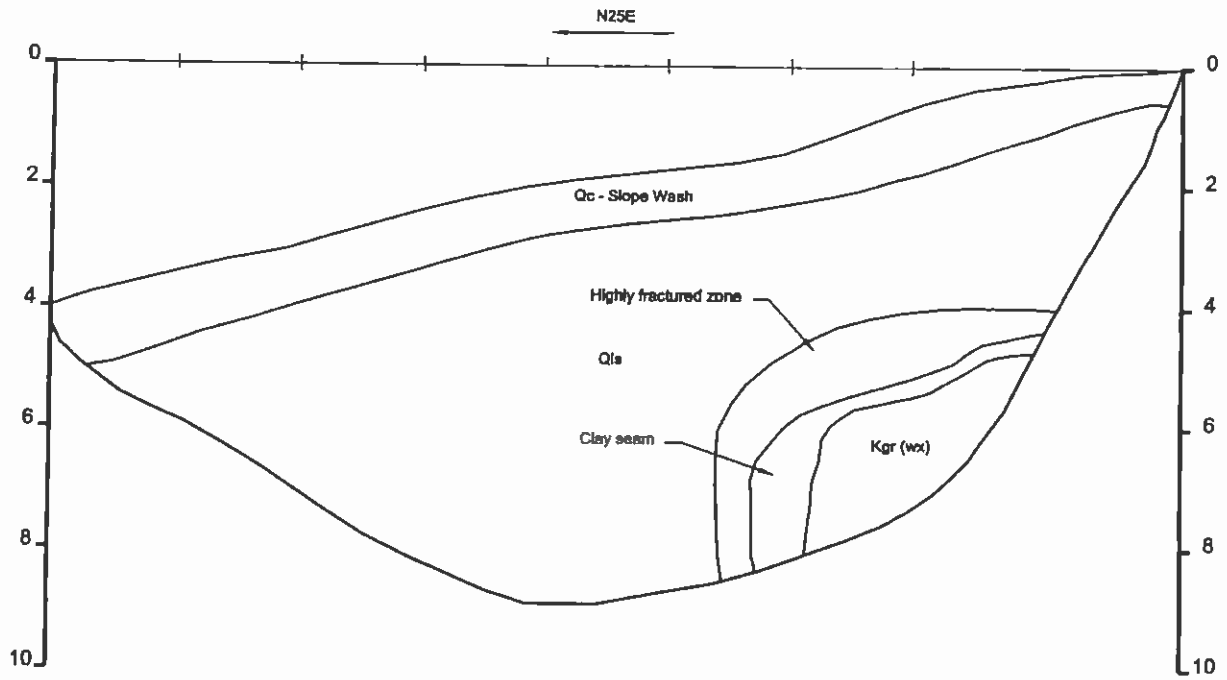


LOG OF TEST PIT 8

JOB 70341-1-0105 DATE 11-16-01 DR. SKR O.E. BEC CHKD.

LAW/CRANDALL

FIGURE: A-3.8

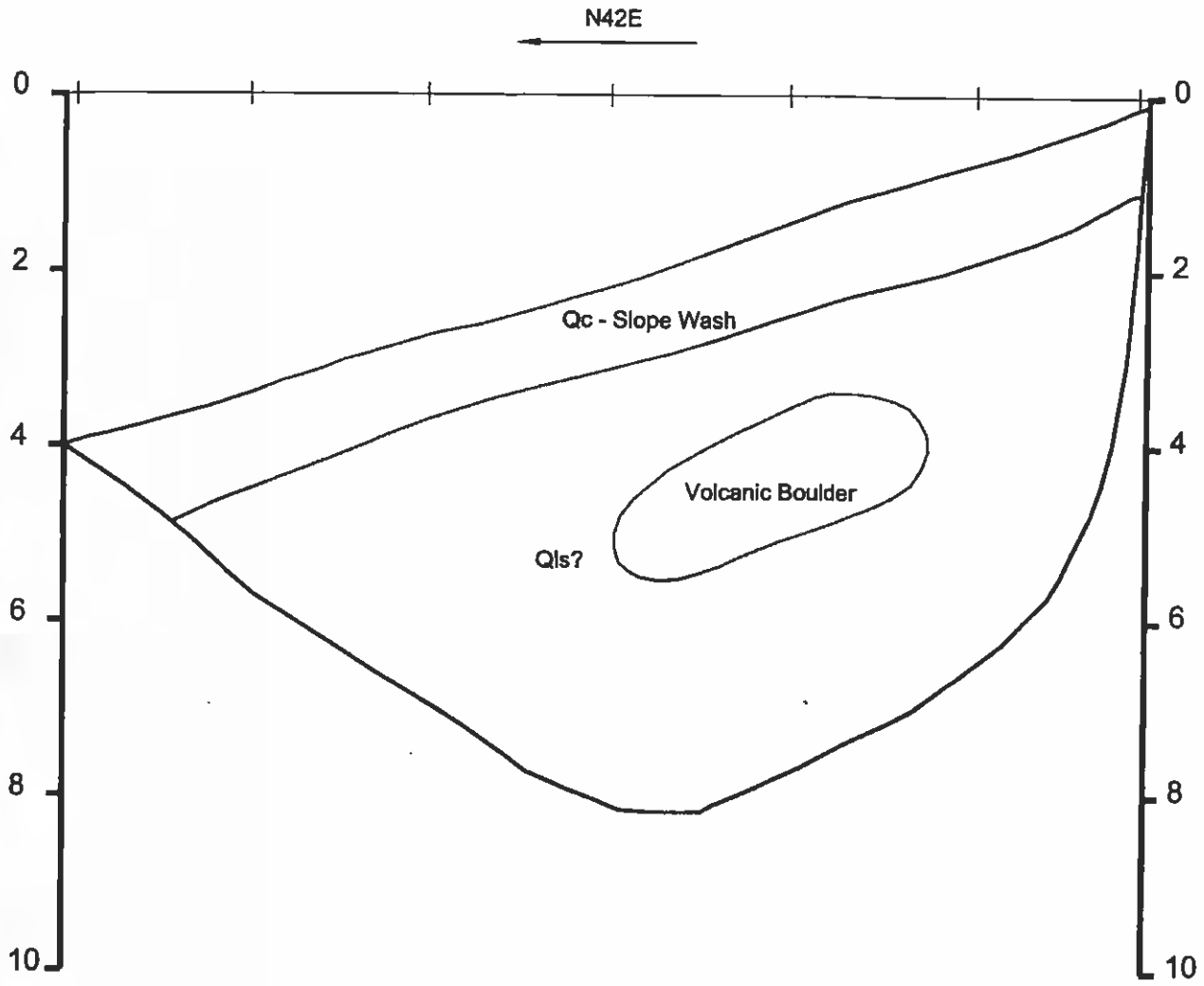


LOG OF TEST PIT 9

JOB 10341-1-0105 DATE 11-16-01 DR SKR O.E. BEC CHKD

LAW/CRANDALL

FIGURE: A-3.9

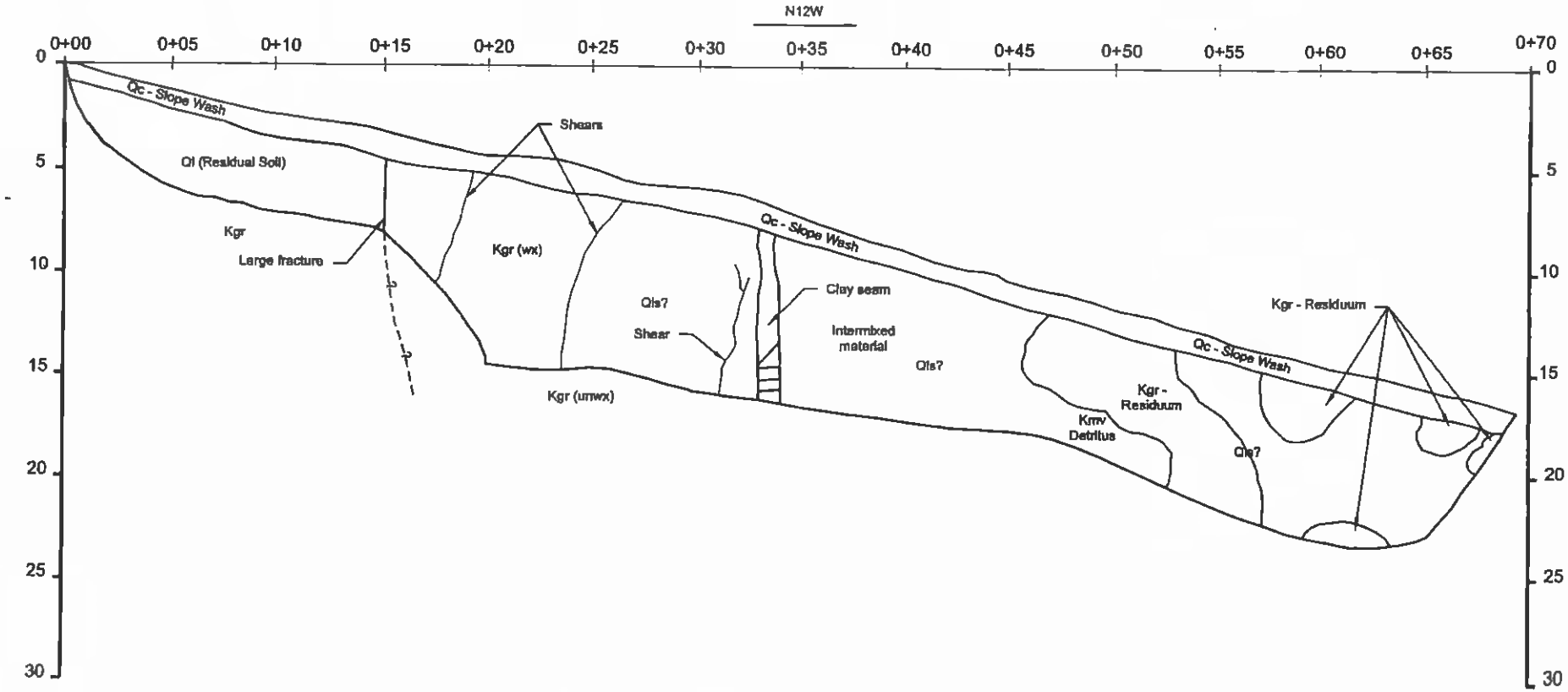


LOG OF TEST PIT 10

JOB 70341-1-0105 DATE 11-16-01 DR. SKR O.E. BEC CHKD.

LAW/CRANDALL

FIGURE: A-3.10

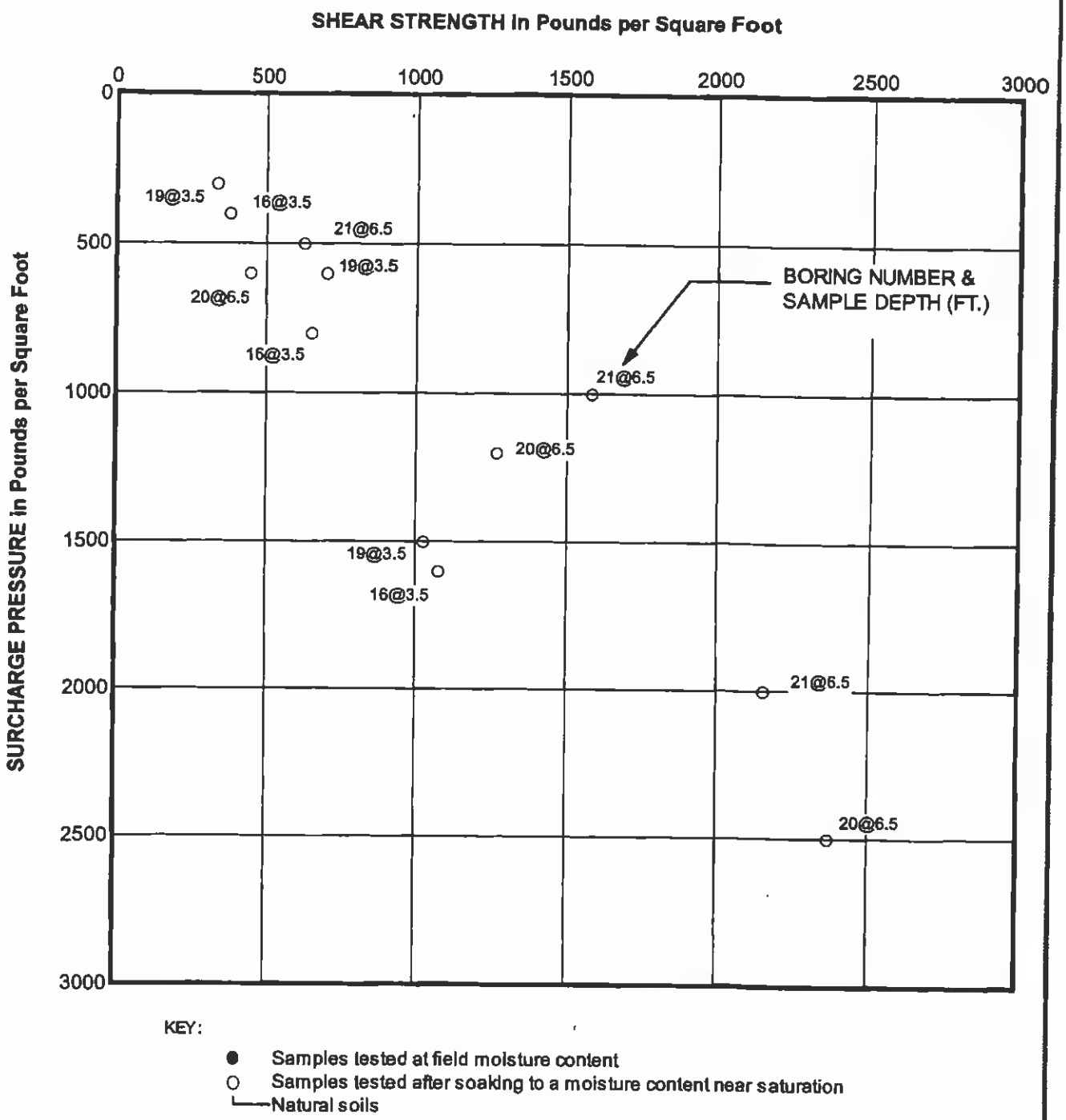


LOG OF TEST PIT 14

LAW/CRANDALL

FIGURE: A-3.14

JOB 70341-1-Q105 DATE 11-16-01 DR. SKR O.E. BEC CHKD.



JOB 70341-1-0105.01 DATE 11/19/01 DR BEC OE CAC CHKD

DIRECT SHEAR TEST DATA

LAW/CRANDALL

FIGURE A - 5

JOB 70341-1-0105.01 DATE 11/19/01 DR BEC OE CAC CHKD

BORING/TEST PIT NUMBER AND SAMPLE DEPTH:	B-2 at 0 to 5'	B-5 at 0 to 5'	B-10 at 0 to 5'
SOIL TYPE:	SILTY SAND	SILTY SAND	SILTY SAND
R-VALUE:	39	47	33

BORING/TEST PIT NUMBER AND SAMPLE DEPTH:	B-14 at 0 to 5'	T-14 at 0 to 5'
SOIL TYPE:	SILTY SAND	SILTY SAND
R-VALUE:	40	65

TEST METHOD: California Test Method 301

R - VALUE TEST DATA

LAW/CRANDALL

FIGURE A - 6

BORING NUMBER AND SAMPLE DEPTH:	4 at 0 to 5'	7 at 0 to 5'	15 at 0 to 5'
SOIL TYPE:	SILTY SAND	SILTY SAND	SILTY SAND
pH:	7.1	7.3	6.8
Minimum Electrical Resistivity:	9,300 ohm-cm	9,200 ohm-cm	2,300 ohm-cm
Soluble Sulfate:	not detected	55 ppm	85 ppm
Chloride:	20 ppm	20 ppm	100 ppm

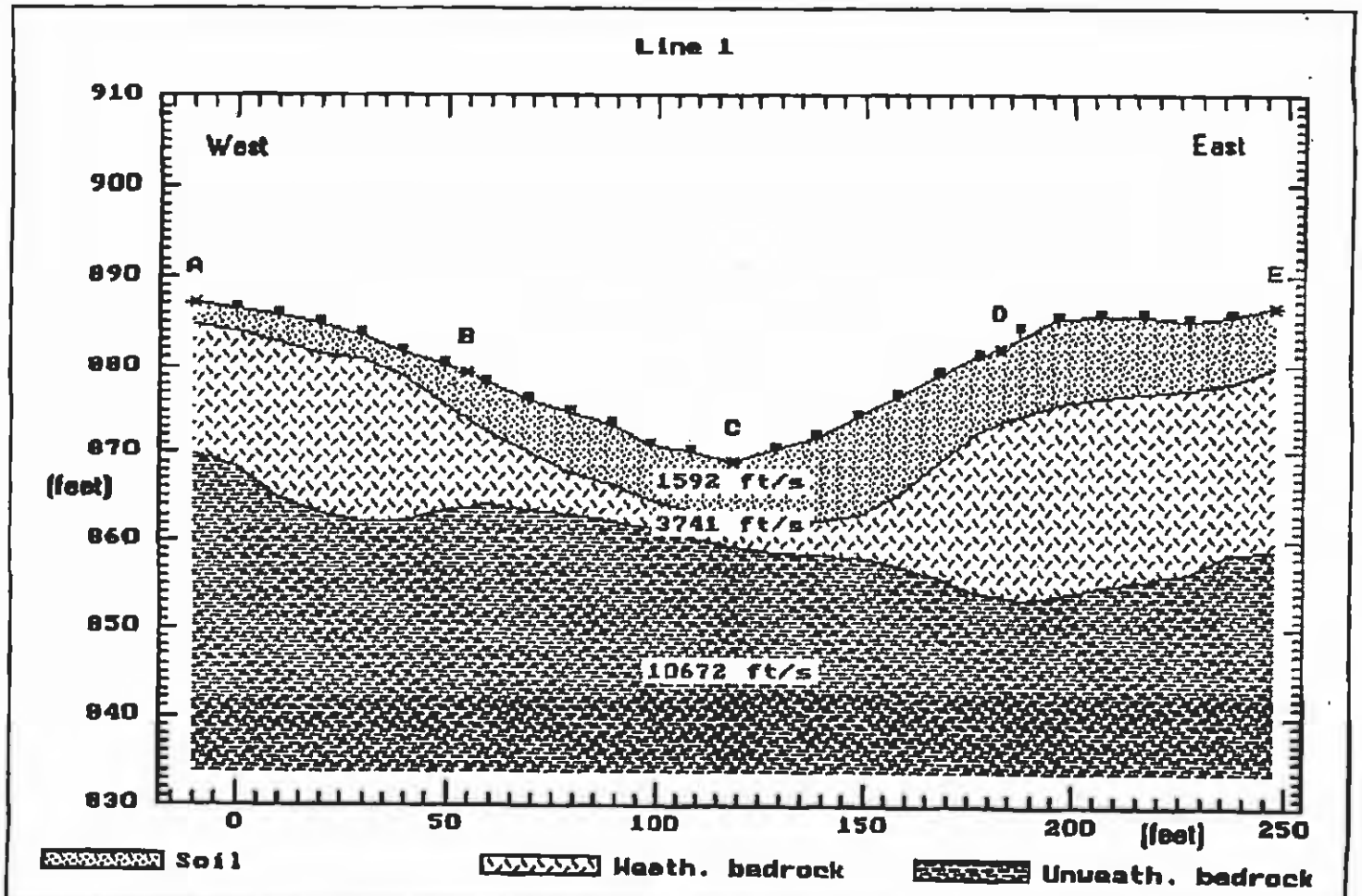
TEST METHOD: California Test Methods 417, 422, and 643

SOIL CORROSIVITY TEST DATA

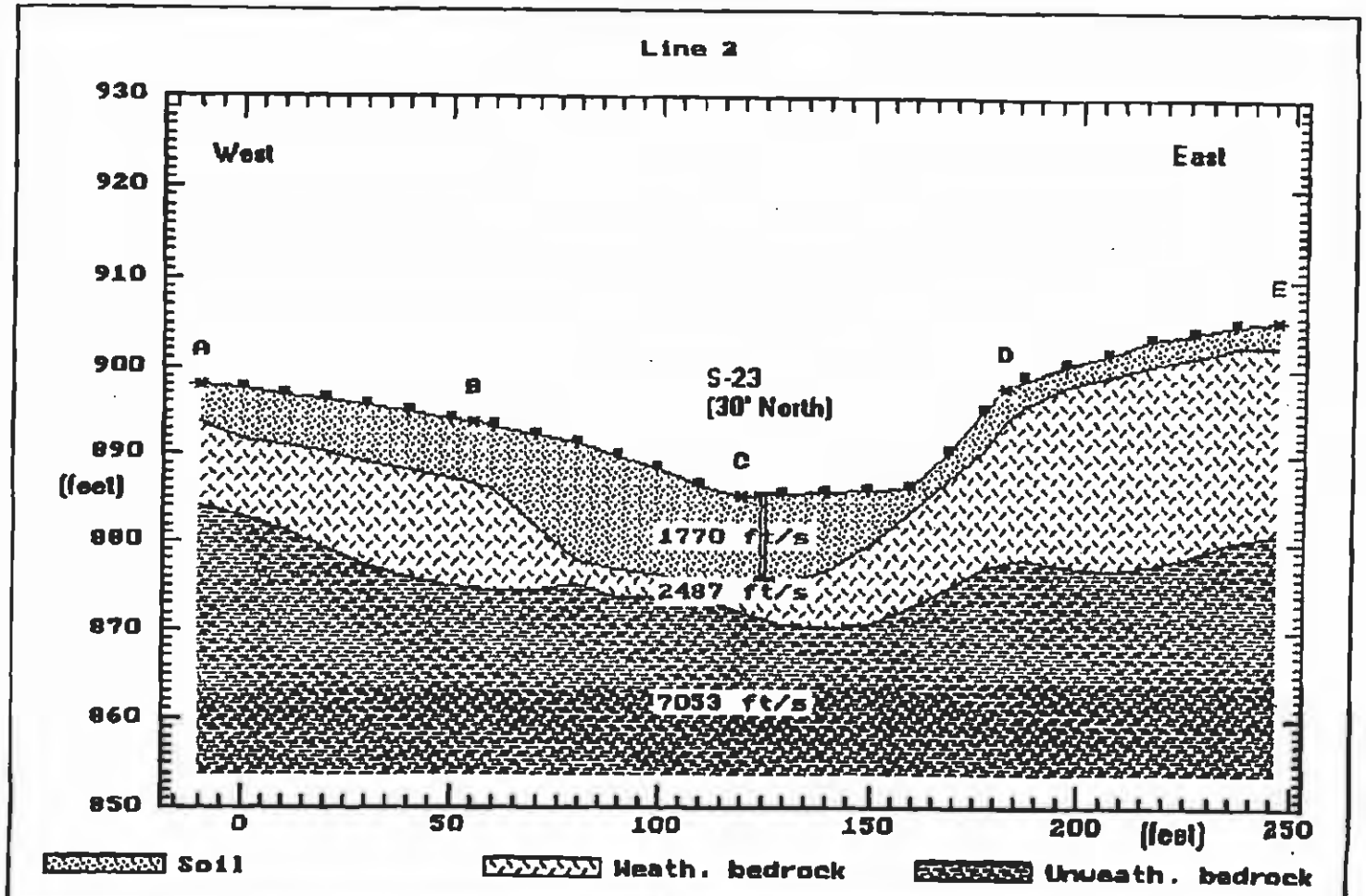
JOB 70341-1-0105.01 DATE 11/19/01 DR BEC OE CAC CHKD

LAW/CRANDALL

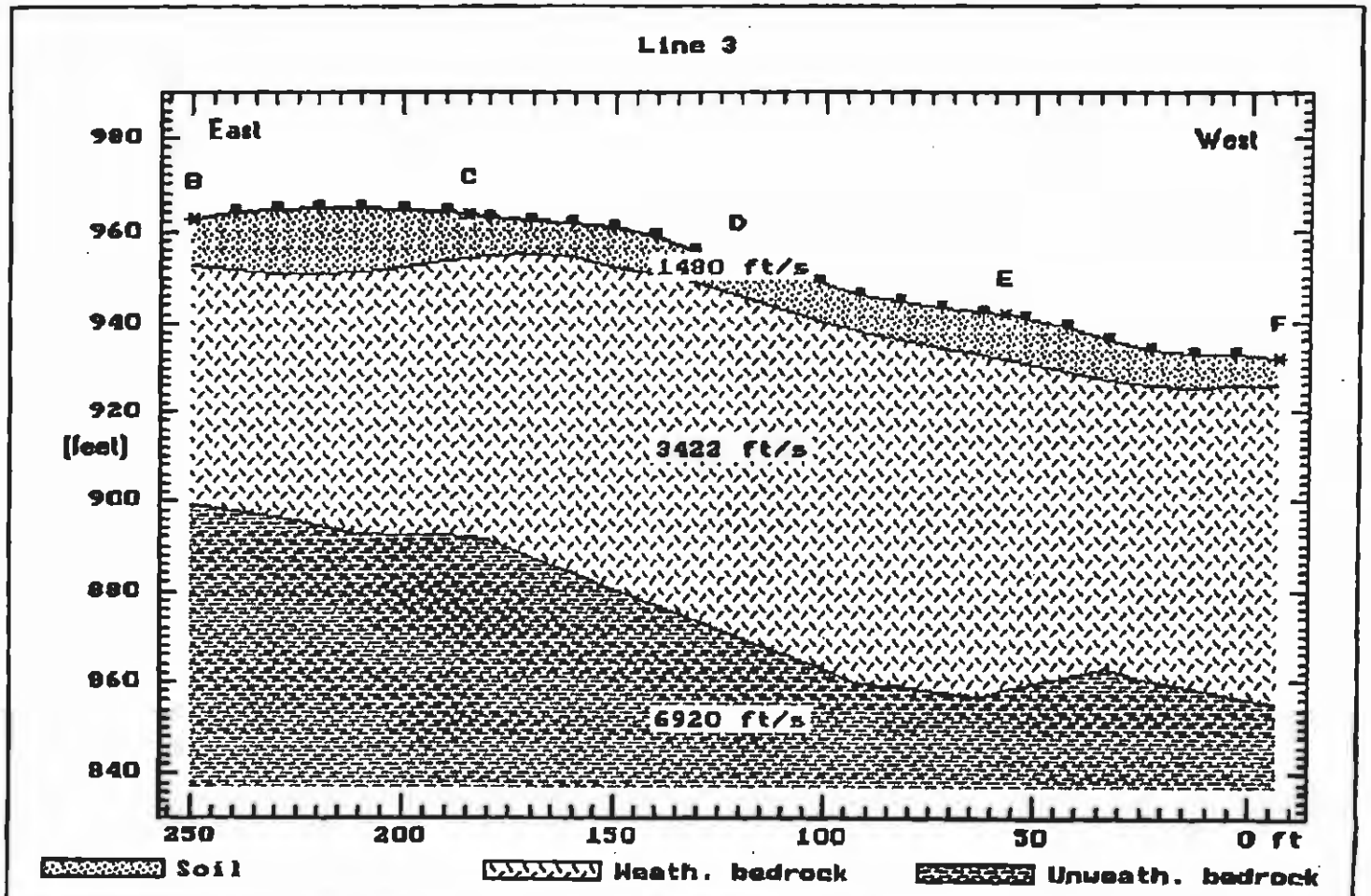
FIGURE A - 7



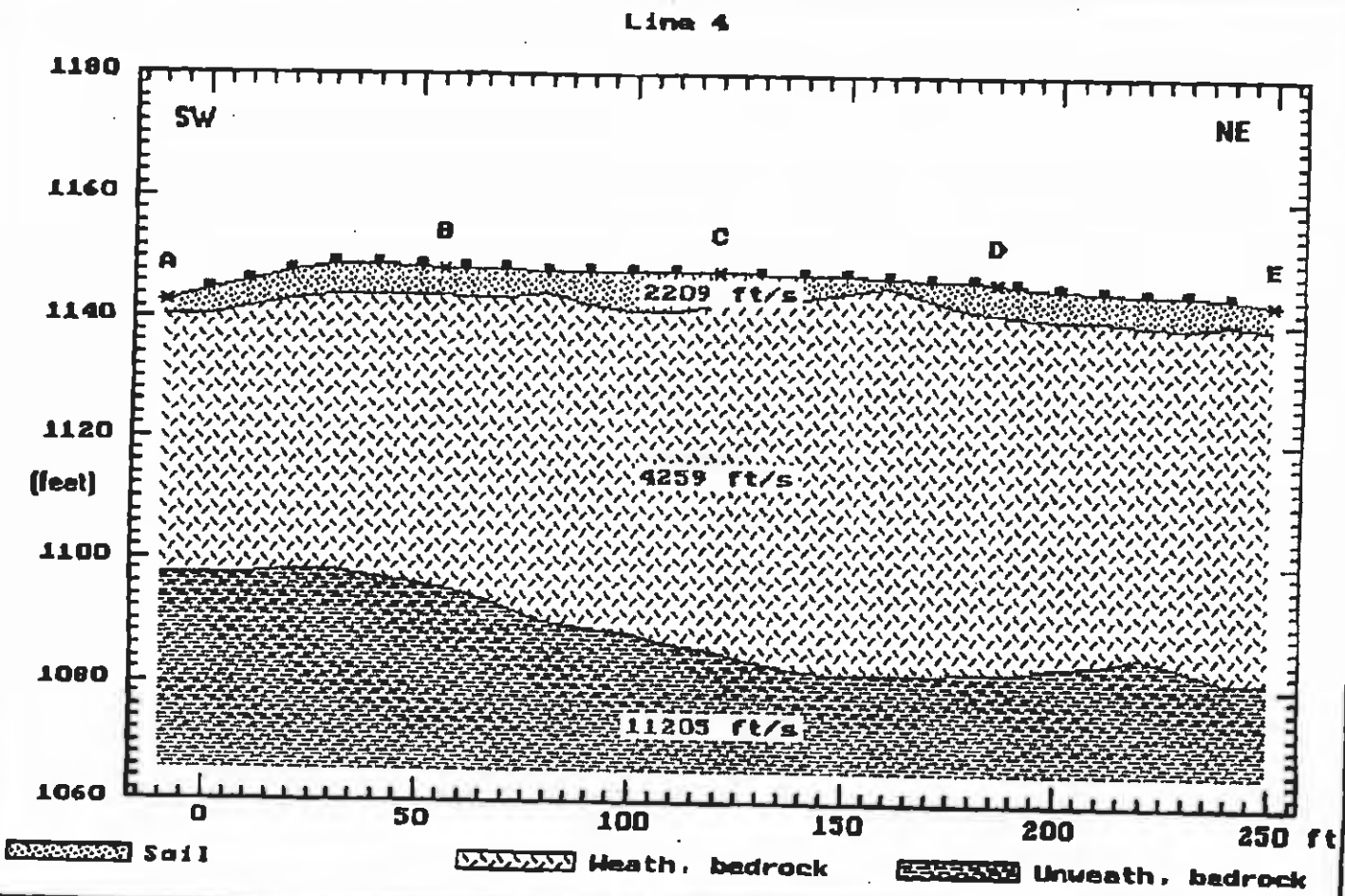
Seismic Refraction Survey 10/23/01	Jamul Casino Project
Job No. 70341-1-0105	Jamul, California



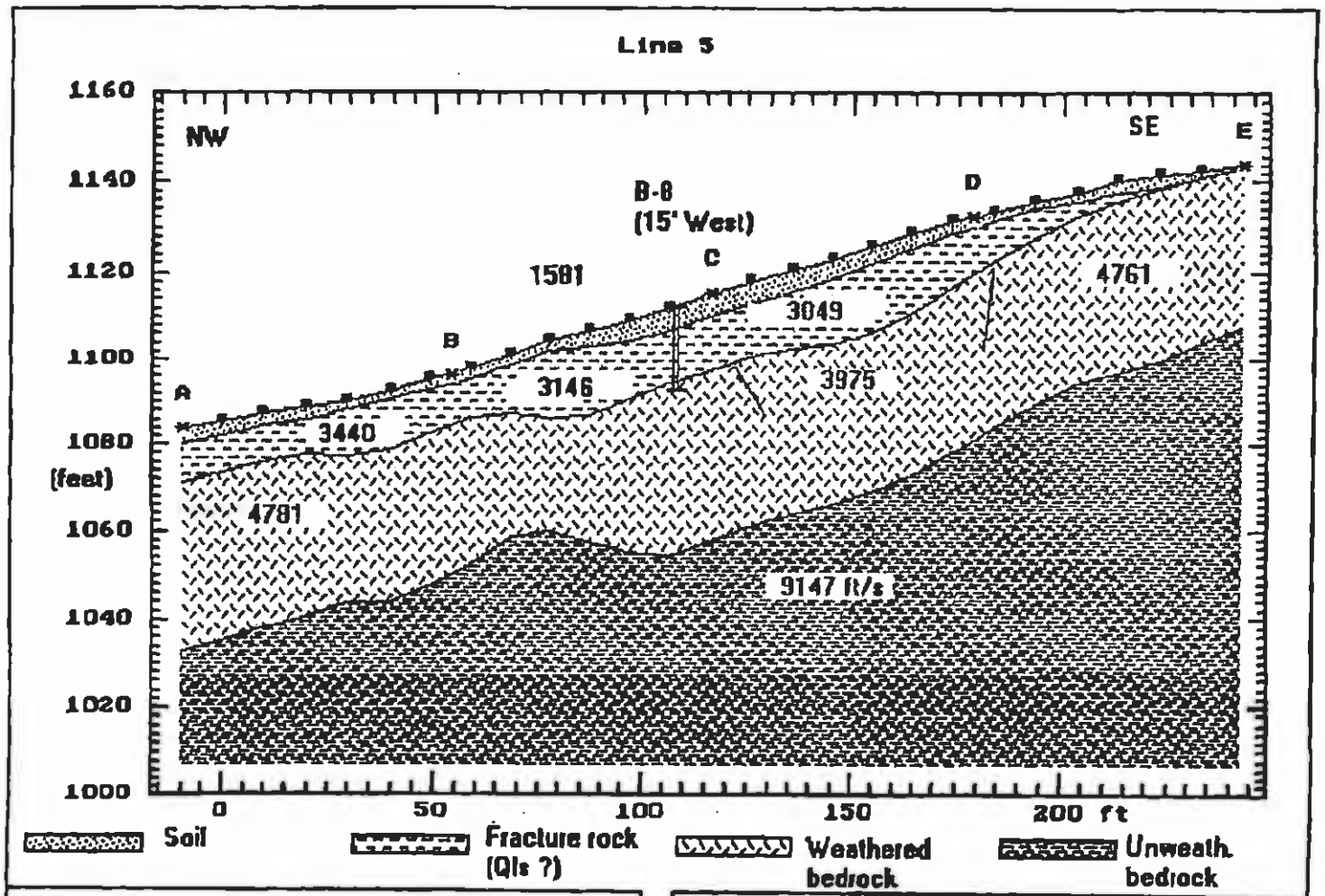
Seismic Refraction Survey 10/23/01	Jamul Casino Project
Job No. 70341-1-0105	Jamul, California



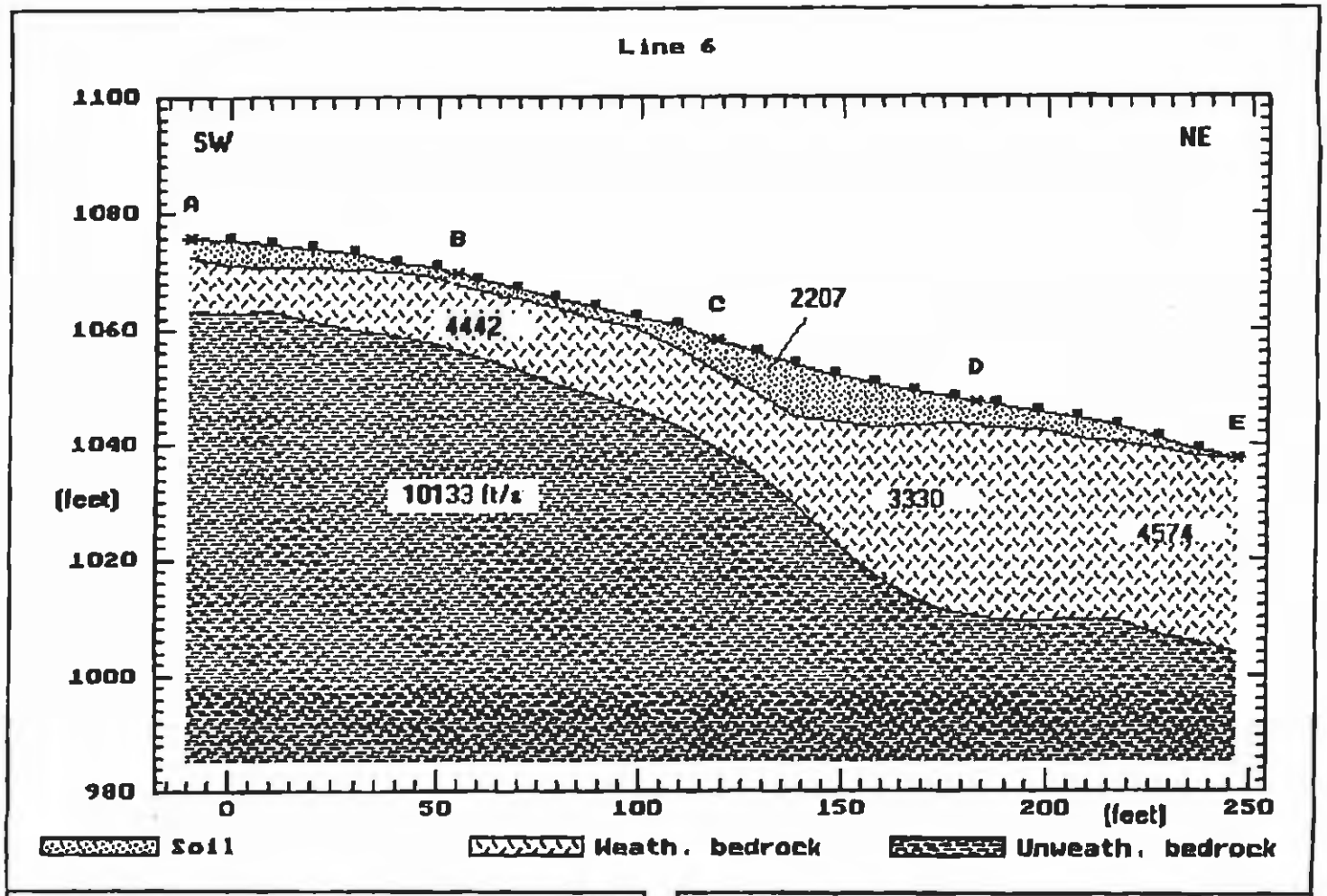
Seismic Refraction Survey 10/23/01	Jamul Casino Project
Job No. 70341-1-0105	Jamul, California



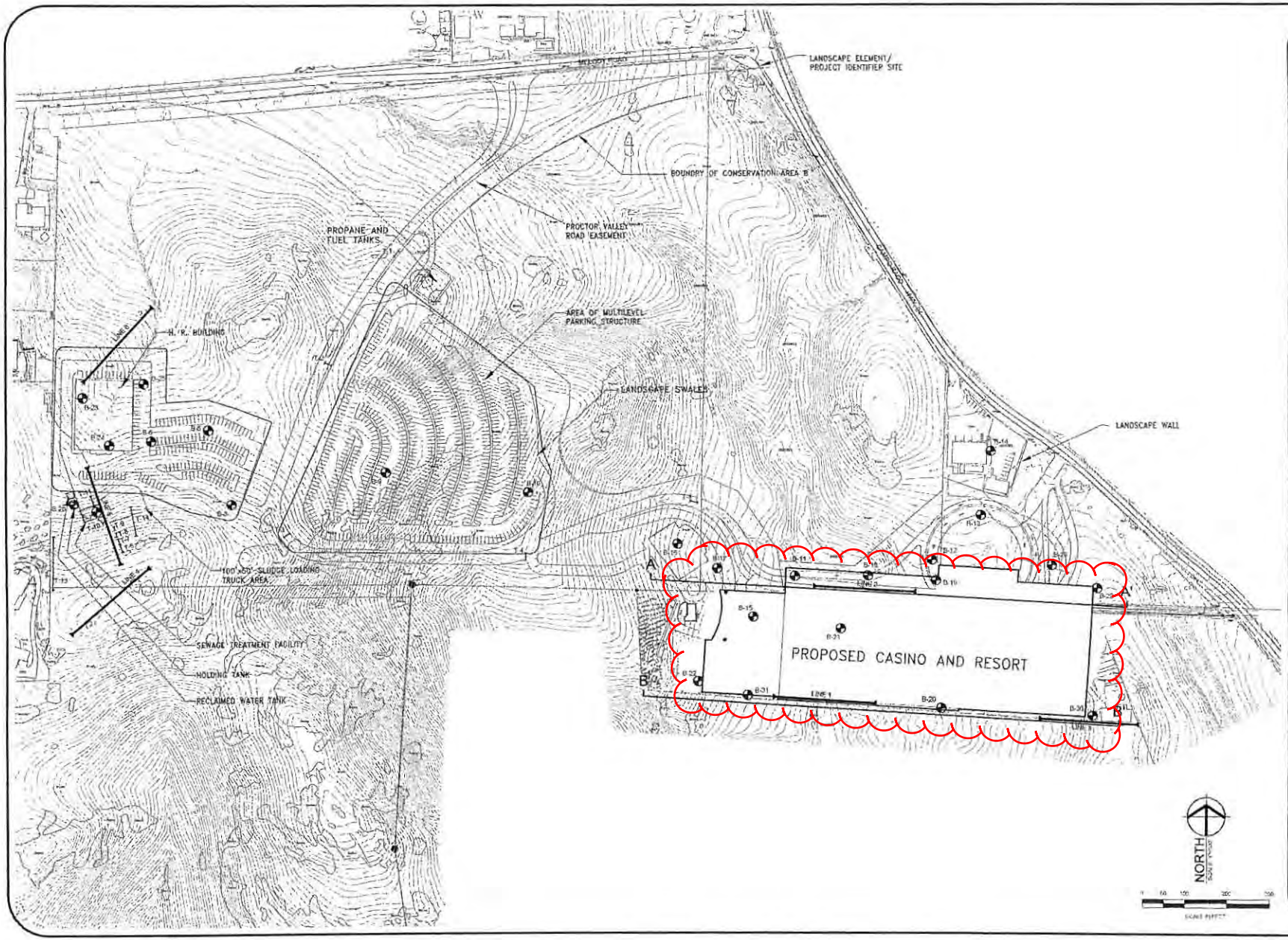
Seismic Refraction Survey 10/23/01	Jamul Casino Project
Job No. 70341-1-0105	Jamul, California



Seismic Refraction Survey 10/23/01	Jamul Casino Project
Job No. 70341-1-0105	Jamul, California



Seismic Refraction Survey 10/23/01	Jamul Casino Project
Job No. 70341-1-0105	Jamul, California



General Notes/Legend

By:		
No.	Revision/Issue	Date

LAW Crandall
LAWGIBB Group Member

JAMUL INDIAN VILLAGE
c/o LAKES GAMING, INC.

SITE PLAN

70341-1-0105
11-14-01
1"=100'

1

General Notes/Legend

Qal	Artificial fill, other than manufacturing fills and fill, but were not mapped
Qls	Alluvium, unconsolidated Sands, Silts and Gravels
Qaf	Lacustrine Deposits, current as expressed and not identified
Qc	Colluvium, Residual Soil and Slope Wash Sands and Silts with Gravel
Kgr	Pelvoid Granite Bedrock, mostly hard chiefly with aspect, mostly mostly, trace, mediating basin, fillers, augen and swarthe
Kmv	Volcanic and Sedimentary Bedrock, consisting of fine grade metamorphosis of intermixed volcanic and sedimentary rocks
T-31	Approximate boring location and number
T-14	Approximate test pit location and number
T-10 T	Approximate location of location (Survey line location and number)
B B'	Approximate location of Geologic Cross Section

By:	SKR	11-14-01
No	Revision/Issue	Date

LAW Crandall
LAWGIBB Group Member

Project

JAMUL INDIAN VILLAGE
c/o LAKES GAMING, INC

Project Name

GEOLOGIC MAP

LAW Project Number: 70341-1-0105
Date: 11-14-01
Scale: 1"=100'
Title: 2