

PH: 858 • 874-6768

FX: 858 • 874-6912

Email: akkutek@aol.com

*Bob Randall*

**PRELIMINARY GEOTECHNICAL EVALUATION  
FOR THE PROPOSED ARCADIA PINES APARTMENT BUILDING #3,  
LOCATED AT 1701-1759 CALLE JULES,  
VISTA, CALIFORNIA 92084**

**REFERENCE:** "Phase II, Geotechnical Distress Evaluation for the Existing Arcadia Pines Apartment Complex, Located at 1701-1759 Calle Jules, Vista, California" by Accutech Engineering Systems, Inc. Dated June 24, 1994.

**PREPARED FOR:**

**ARCADIA PINES LLC  
c/o Mr. Brian Marcus  
8453 Cliffridge Ave.  
La Jolla, CA 92037**

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## **INTRODUCTION**

### **General**

This report presents the results of a preliminary geotechnical evaluation for a proposed two-story, two-unit apartment building and associated improvements to replace the old apartment building (Building #3) which was demolished approximately five (5) years ago. The site is located at the Arcadia Pines Apartment Complex located at 1701-1759 Calle Jules in the City of Vista, San Diego County, California (see Figure 1, "Site Vicinity Map", and Figure 2, "Site Location Map"). The scope of our work, conducted to date, includes the following:

- Consultations with Brian Marcus (representative for the project Owner), and Tom Cottrell (project Structural Engineer), regarding plans for the proposed apartment building; review of the referenced report; and review of published in-house data related to the site (see Appendix A, "References").
- Field Evaluation (see Appendix B, "Field Exploration")
- Laboratory Testing (see Appendix C, "Laboratory Testing")
- Analysis and Discussion
- Conclusions and Recommendations
- Miscellaneous
- Preparation of this report presenting our observations, findings, conclusions, and recommendations

### **General Site Description**

The subject site is located at 1701-1759 Calle Jules, in the City of Vista, San Diego County, California. The apartment complex currently consists of seven (7) buildings housing thirty (30) units understood to have been constructed in 1982. In addition to the buildings, there is a centrally located swimming pool and patio area with bathroom facilities associated with this common area improvement. The former (and proposed) site for Building #3 lies immediately north of the pool and patio area. A plot plan was made available to us at the time of the referenced evaluation in 1994, indicating that the property is approximately rectangular in shape. For the purposes of clarity and consistency within this report, the property will be assumed to abut Calle Jules to the west, and all references to direction throughout this report will be based on that assumption. The property is

located at the northeasterly corner of the intersection of Calle Jules and Arcadia Avenue, and occupies approximately two and four-tenths (2.4) acres. The property is bordered by similarly developed multi-unit projects to the north and east, and individual residential single family homes to the south and west.

### **Previous and/or Proposed Site Development**

The existing buildings and the units themselves are of two-story construction, housing kitchen, living, and dining spaces on the main level, and bedrooms and bathrooms on the upper level. Each unit also contains a garage, which is accessed from a driveway system extending throughout the project. The general topography of the immediate area surrounding this site consists of rolling hills with a general trend sloping down to the west. The overall area appears to have been modified by the construction of cuts and fills creating relatively level building pads for the improvements. This site appears to have been created by the excavation of soils along the eastern portion of the property, and placement of fill to the west, to establish the existing building pads. More locally, minor benching, utilizing cuts and fills within many of the units in each building, was evident. Grading plans related to the site were not made available to us.

It is our understanding that the proposed apartment building and associated improvements will be similar to the former Building #3 and the surrounding apartment buildings described above; however, it is anticipated that a deep foundation system will be used due to the significant foundation movement exhibited by the old building, which ultimately led to its demolition. Documentation of the demolition was not conducted, and it is not known to what degree the old foundation was removed and/or the soils were recompactd. It is also our understanding that the new building will be located within the same approximate footprint as the old building. Please see Figure 3, "Site Plan/Location of Exploratory Borings" for depiction of proposed improvements.

### **FIELD EVALUATION**

#### **General**

Our field evaluation of the property, conducted on Friday, February 11, 2000 consisted of the following:

- Site Reconnaissance
- Site Improvement Observations
- Drainage Observations

- Observed Distress
- Subsurface Evaluation

### **Site Reconnaissance**

Topographically, the building site for the proposed apartment Building #3 is similar to the surrounding apartment building sites situated on a westerly sloping hillside, modified by the construction of minor cuts and fairly significant fills, creating a relatively flat building pad during construction of the previously demolished Building #3 and associated improvements. The site itself currently consists of the previously constructed building pad covered with cultivated lawn, with a landscaped fill slope down to Calle Jules to the west. The fill slope possesses one (1) bench at its approximate mid-height, and is landscaped with a combination of several evergreen trees and groundcover on sloped portions, with cultivated lawn within the benched area. The approximate elevation difference between the finished building pad and the base of the fill slope at Calle Jules is approximately fifteen feet (15'). In addition to the fill slope to the west, the proposed building site is bordered by a four-unit apartment building to the north, a common pool and patio area to the south, and an asphalt driveway that accesses the entire complex to the east.

A review of available pertinent, published, geologic maps suggests that no geologic hazards such as faults, potential landslides or areas of suspected soils liquefaction exist at or in the immediate vicinity (two hundred fifty feet [250'] of the site) and none were observed during our evaluation. The nearest known local active faults are part of the Rose Canyon Fault Zone which lies approximately sixteen (16) miles to the southwest. Other major active faults in the Southern California region which may affect the site are the Coronado Banks, Elsinore, San Jacinto and San Andreas Fault Zones which lie approximately twenty six (26) miles to the southwest, sixteen (16), thirty nine (39), and sixty (60) miles to the northeast of the site, respectively.

### **Site Improvement Observations**

The subject site for the proposed Building #3 is presently occupied by essentially no visible site improvements since the old building and associated improvements have been demolished.

The adjacent apartment Building #2 to the north utilizes "stairstepping" flat building pads for the slab-on-grade construction of each of the units within the buildings. This building and the remaining six (6) buildings that make up the complex are constructed with concrete slab-on-grade at the lower levels and are wood-framed with interior wall finishes of textured drywall and floor finishes consisting of carpet and linoleum. The exterior finishes are a mixture of heavy "knock down" cement plaster stucco and T-111 Siding with shake shingle roofs. The structures are

founded on continuous strip footings and individual pads created by thickened slabs. “Stepped” footings and slabs, of up to twenty four inches (24”) in height, separate the individual floor levels of each unit, which “step” down in a westerly direction. Garages with slab elevations independent of the elevation of the units, access the rear of each of the units from a serpentine driveway. Each unit has a ground level concrete patio slab, or a ground level wooden deck supported on four (4) small concrete footings.

Immediately adjacent and to the southwest of the proposed Building #3 site, a common area exists which is occupied by a swimming pool, spa, hardscape surrounds, and lavatory and changing facilities. The area occupies approximately two thousand (2,000) s.f. of common area space. The area consists of a relatively flat pad supported along its western, southwestern, and northwestern sides by slump block retaining walls.

### **Drainage Observations**

Aside from several surface drain inlets at the curb of the asphalt driveway to the east, no other man-made drainage features were observed within the immediate vicinity of the proposed building site. The previously constructed pad is relatively level, with a slight slope to the east, with gradual to moderate fill slopes (maximum 2:1 [horizontal to vertical]) beyond the remaining three (3) sides of the building pad. Near surface soils were generally observed to be moist to nearly saturated, most likely due to frequent watering of the cultivated lawn that currently exists.

### **Observed Distress**

During our field evaluations in 1994 and 2000, brief visual observations of the existing improvements surrounding the Building #3 site revealed that they have performed fairly since their construction approximately eighteen (18) years ago. Some “doming” was evident in many of the units, and tilting was evident in many of the buildings. Minor movement of many of the patio slabs and low (two feet [2'] or less) site retaining walls or patio boundary walls was observed. Other patio slabs exhibited more significant movement with “bulging”, “crowning”, and/or cracking generally evident towards the center of the slabs. Some out-of-plane rotation and deflection of the site walls were observed. These distresses typically occur at cut/fill transition lines, at downslope conditions at “steps” between adjacent units, or immediately adjacent to well-matured trees with extensive root systems. Several of the isolated pads supporting the wood-constructed decks exhibited some differential movement in similar near slope or near tree conditions. Evidence of lateral “creep”, in the soils to the west of the Building #3 site and the pool area, was exemplified in the “pistol handle” shape of some of the more mature vegetation in these areas. Rotation of fences and retaining walls along the northern property boundary and the southeastern area of the property provide additional evidence.

## **Subsurface Evaluation**

Two (2) exploratory borings were drilled during our subsurface evaluation (see Figure 3, "Site Plan/Location of Exploratory Borings"). The borings were accomplished by a CME 55 truck-mounted drill rig due to the anticipation that suitable foundation materials would be found at relatively significant depths. The borings were located in areas that were not obstructed by existing surface hardscape. Subsurface soils were reviewed and logged during drilling of the borings, and both disturbed and undisturbed samples were obtained for laboratory testing.

As encountered within our subsurface explorations, the subject site was found to be underlain by undocumented fills, residual soils, formational deposits, and granite. In addition, groundwater was encountered in one (1) of the borings. Soils and groundwater encountered within the respective exploratory excavation locations are described as follows:

### **Fill Soils:**

Fill soils appear to be generated primarily from the original residual soils on or immediately surrounding the site. Generally, these soils consist of dark gray and brown, soft to firm, moist, silty clays with scattered root hairs and organics. Fill soils classify as CH/MH (high plasticity clays and silts) according to the Unified Soils Classification System and, based on laboratory testing, have a medium to high potential for expansion, with an Expansion Index of 89.1.

### **Residual Soils:**

These soils consist of gray, brown, and olive green, firm to stiff, moist, silty clays. Residual soils classify as CH/MH (high plasticity clays and silts) according to the Unified Soils Classification System, and based on laboratory testing of the similar fill soils above, have a medium to high potential for expansion.

### **Formational Materials:**

Residual soils were found to be underlain by siltstone and sandstone formational deposits. Formational deposits consist of olive- to yellow-green, moist, very stiff/dense, cemented silts and sands with fine gravel. They historically possess a low to medium potential for expansion.



**Granite:**

Formational materials were found to be underlain by granitic rock. The granite generally consists of gray, brown, and black, moist to damp, dense to very dense, variably weathered granite. Granite historically possesses a very low potential for expansion.

**Groundwater:**

Groundwater was encountered in Boring B-1 (near the southwestern corner of the proposed building). Water was first encountered during retrieval of a sample collected at a forty foot (40') depth, and was observed as water on the sampling rod at an approximate depth of thirty eight feet (38'). Upon completion of the boring (after the forty foot [40'] sample was observed), standing water was observed in the hole. The hole was subsequently left open, and the water level measured at a twelve foot (12') depth upon completion of Boring B-2 (approximately one and one-half [1 ½] hours later).

**LABORATORY TESTING**

Laboratory tests were performed on the disturbed and undisturbed soil samples to determine their physical and mechanical properties and their ability to perform appropriately for their intended use. The following tests were conducted on the sampled soils:

- Classification (ASTM D2487)
- Moisture Density (ASTM D2216)
- Expansion Index (UBC Standard 29-2)
- Atterberg Limits (ASTM D4318)

A thorough review of laboratory testing, including a description of the purpose and methodology utilized for the tests, is provided along with the quantitative and graphical (where applicable) test results (see Appendix C, "Laboratory Testing"). Use of the quantitative results of laboratory test data, a thorough visual inspection of the primary soil types on the property, and previous experience with laboratory testing of similar soils have aided in developing the "CONCLUSIONS AND RECOMMENDATIONS" section contained within this report.

## ANALYSIS AND DISCUSSION

In deriving recommendations for this site, the subsoil conditions, proposed construction, and conditions of the former Building #3 and the surrounding existing structures were evaluated. Considerations were given to the possibility for failure of the foundation soils, or the build up of detrimental supplemental stress in the structural elements due to differential, vertical, or lateral movement of the foundation soils.

Generally, it is advisable to support a structure entirely on similar materials. When competent formational materials are present at economic depths, it is best to support a structure on this material to minimize movement of the foundation. In fact, a deep foundation is frequently used in place of a shallow foundation to achieve this optimal bearing condition. On the other hand, when formational materials are not present at economic depths, a structure could alternatively be founded on existing fill materials or other soil types, depending on site conditions. In such cases, especially in the case of undocumented fill materials, settlement of the foundation can occur over time, resulting in the potential for cosmetic distresses within the structure. The rate of settlement will depend on how and when the fills were placed, and will vary from site to site. If a structure cannot be cost effectively founded on competent formational material, the compaction of bearing materials along with other guidelines should be followed strictly to minimize the likelihood of such distresses.

When cut and fill operations are performed at a site, formational materials may be present at significant shallower depths on one (1) side of the site than the other. In this case, a combination of shallow and deep foundation systems may be used in order to support the entire structure on competent formational material. At some "borderline" sites, a percentage of the structure may be founded on formational material while the remainder of the structure is founded on fill material. Although this approach is strongly discouraged, it may be acceptable if the depths of the fills are relatively shallow or uniform, or if the fills appear to provide exceptional bearing in their present state. The best approach, in this case, would be to overexcavate the proposed building footprint such that a compacted fill building pad may be constructed to uniformly support the entire structure. Other sites, despite cut and fill operations, may only possess suitable foundation materials at significant depths due to relatively thick residual soil layers, requiring the use of a deep foundation system beneath the entire structure.

Due to the possibility of differential settlement within the existing undocumented fill materials, evidence of previous settlement in these same materials, and the presence of topsoils and/or soft lenses or residual and formational soils that are not "normally" (completely) consolidated, that suggest a weak zone that will not only be more likely to consolidate in the future, but may also act as a source of lateral instability related to "creep", we believe that the foundations should not be

constructed on the fills, residual soils, or formational deposits, but rather be placed on the undisturbed granitic rock beneath the formational deposits. Additionally, there were expansive soils encountered on-site that are likely to cause “heave” of the surface improvements, if subjected to increased moisture content. Therefore, the area of concern at this site is not limited to vertical settlement, but must also include lateral stability of the soils above and within the zone of soft soils, and surface and subsurface drainage related to stability and heave of expansive soils.

## **CONCLUSIONS AND RECOMMENDATIONS**

### **General**

In general, it is our opinion that the proposed improvements, as described, are feasible from a geotechnical standpoint, within the limitations expressed herein, provided the recommendations of this report and generally accepted construction practices are adhered to. It is also our opinion that the site could be subjected to moderate to severe ground shaking in the event of a major earthquake along any of the faults mentioned above, or other faults in the Southern California region; however, the seismic risk at this site is not significantly greater than that of the surrounding developed area. We believe that the proposed development will have no more negative geologic consequence than the existing or surrounding development, if the guidelines in this report are followed and other customary development techniques are used.

Recommendations are provided for each of the following areas of concern:

- Seismicity
- Earthwork
- Foundations
- Structural Slab-on-Grade
- Concrete Slabs-on-Grade (Exterior Hardscape)
- Surface Drainage
- Underdrain System
- Retaining Walls

- Construction Observation

### **Seismicity**

The seismic hazard most likely to impact the site is ground shaking, resulting from an earthquake on one of the major active regional faults. A maximum probable event (Richter Magnitude 6.5) on the Rose Canyon Fault, considered the design earthquake for this site, could produce an estimated peak horizontal bedrock acceleration of .25g, and a repeatable high ground acceleration of .16g, at this site. The adverse effects of seismic shaking can be reduced by using acceleration values provided herein, other code requirements given in the most recent edition of the Uniform Building Code, and design recommendations of the Structural Engineers Association of California. The following seismic parameters (per UBC, Volume 2, 1997) may be used to determine the seismic coefficients  $C_a$  and  $C_v$ , to be used in the structural design:

Soil Profile Type =  $S_D$ ; Near-Source Factor  $N_a = N_v = 1.0$

### **Earthwork**

It is anticipated that no major earthwork will be required for the proposed construction. Earthwork, where required, should be performed in accordance with pertinent city standards, Appendix D, "Grading Specifications", and the following recommendations:

#### **Site Preparation**

Prior to grading, areas of proposed improvement should be cleared of surface and subsurface debris, and stripped of vegetation. Removed vegetation and debris should be properly disposed of off-site, prior to the commencement of any fill operations. Holes resulting from the removal of debris, existing foundations, or other underground improvements, which exist within or below the proposed foundation depths or below the undercut depths noted in the "Removals" section, should be filled and properly compacted using on-site material or a non-expansive import material.

#### **Removals**

Existing fill and residual soils found to mantle the site in the exploratory borings are not desirable for the support of structures or settlement sensitive improvements in their present state. Because a deep foundation with a structural slab is anticipated, removals will not be required for support of the building itself; however, where other movement sensitive

improvements are to be constructed (such as exterior hardscape), the unsuitable soils should be removed and replaced with properly compacted fill. Soils with an expansion index of fifty (50) or above should not be used for fill within two feet (2') of finish subgrade.

No equipment, material, soil stockpile, other loads, or surcharge should be placed at the top of slopes within a horizontal distance from the top of the slope equal to one-half (1/2) the height of the excavation. Our office should be contacted to observe all temporary slopes during construction to determine if any adverse geologic conditions are exposed which would affect the stability of the slope.

### **Fills**

Areas to receive fill and/or support shallow (surface) improvements (such as exterior hardscape) should be scarified to a minimum depth of eight inches (8"), brought to near optimum moisture content, and properly recompact to at least ninety percent (90%) relative compaction (based on ASTM D1557). All fill slopes (if required), should be properly compacted to ninety percent (90%) relative compaction in order to avoid erosion and sloughage. A minimum overall slope of 2:1 (horizontal to vertical) should be maintained. When fills are required to support any area of a slab or exterior hardscape, then the entire slab (or hardscape) should be supported by a minimum of twenty four inches (24") of fill to avoid differential movement.

Fills should generally be placed in lifts not exceeding eight inches (8") in thickness. If importing soil is planned, soils should be non-expansive and free of debris and organic matter. Prior to importing, soils should be visually observed, sampled, and tested at the borrow pit area to evaluate soil suitability as fill.

### **Foundations**

The project and site are not well suited for the use of continuous strip footings or isolated spread footings, since the fill and residual soils encountered are not capable of supporting settlement sensitive improvements, as evidenced by the significant foundation movement experienced by the previously demolished Building #3. Therefore, since the depth to suitable soils is not economically obtainable for using the above shallow foundation types, a deep foundation system consisting of drilled piers and grade beams may be used. This system will be suitable if the following guidelines are used:

## **Pier Foundation**

1. Piers embedded a minimum of five feet (5') into granite may be designed based on a maximum allowable end bearing pressure of seven thousand five hundred (7,500) psf (neglecting pier weight). Bearing values may be increased by thirty three percent (33%), when considering wind, seismic, or other short duration loadings. The depth to granite will likely range from approximately twenty one feet (21') at the northeastern corner of the proposed building, up to approximately forty feet (40') at the southwestern corner of the proposed building. The depth to competent granitic materials beneath remaining portions of the building are believed to fall within this range; however, granite may exist at greater depths within western portions of the building footprint.
2. Piers may also be designed for a skin friction value of ten percent (10%) of the bearing pressure specified above (seven hundred fifty [750] psf), based on the length of the pier embedment in competent granitic material.
3. Piers should also be designed for down drag forces of two hundred (200) psf due to continued settlement of on-site fill and residual soils. Down drag should be considered to act over the upper thirty feet (30') of the pier.
4. Grade beams shall be installed between all piers. The grade beams should be capable of resisting all vertical and lateral loads between the piers. Grade beams for unrestrained retaining walls should be designed to resist torsional forces imposed on them and adequately "moment connected" to the piers.
5. Piers should not be out of plumb by more than two percent (2%) of their total length.
6. Due to the presence of groundwater near the formational/granite contact at some areas of the site (as encountered in Boring B-1), a thickened slurry consisting of drill cuttings and/or bentonite may be required to "seal" the holes during drilling at or below the groundwater level. If excessive water is still encountered using the above methodology, casing of some holes may be required.
7. Pier excavations should be cleaned of all loose soil debris, subsequent to excavation and prior to the placement of reinforcing steel. Pier excavations should then be visually observed under the direction and supervision of a licensed geotechnical engineer to verify depth of embedment into formational materials and cleanliness of the excavation bottom. If excessive slough is observed, hand cleaning will be required at the discretion of the geotechnical engineer.

8. Piers should be designed with a minimum diameter of twenty four inches (24") to facilitate inspection and cleaning, and be reinforced in accordance with the requirements of the structural engineer.
9. Concrete should be placed as soon after pier excavations as possible, especially when considering the groundwater conditions at this site. The excavations should not be allowed to remain open overnight.
10. For piers constructed within or adjacent to slopes, a minimum of seven feet (7') horizontal setback, as measured horizontally from the bottom of the pier to slope daylight within formational materials, should be maintained.

#### **Alternate Drilled Small Diameter Pile Foundation**

An alternate to the above-described drilled pier system, consisting of smaller diameter drilled piers with inserted pipe piles, is acceptable. The diameter of the hole should not be less than ten inches (10"). A four inch (4") outside diameter, Schedule 40 pipe, should be installed in the hole to act as reinforcement, and the concrete shall be poured around and inside of the pipe pile. Using the smaller diameter pipe piles, an end bearing value of fifteen thousand (15,000) psf can be utilized for the entire diameter of the hole. Skin friction values, as described in the previous section of the report, may also be used. Embedments, down drag forces, requirements for grade beams and structural slab, as described in the "Pier Foundation" section of this report, should also be adhered to.

The preceding foundation recommendations are based on foundations embedded in granite, and grading of the site performed in accordance with the recommendations in the "Earthwork" section of this report. We recommend that we be called to observe the pier excavations, prior to placing concrete. In order to avoid excessive water infiltration, delays, or extra costs, placement of reinforcement or forms should not occur until after the excavations have been observed, but should be placed immediately after, so that concrete can be placed while we are at the site.

#### **Structural Slab-on-Grade**

We recommend that a structural concrete slab be considered to span the distance between grade beams and to help tie the entire pier and grade beam system together. Other foundation/floor systems may be reviewed and/or considered if desired; however, we feel that the above recommendations are best suited for the project and site when considering the subsurface soil and groundwater conditions and the potential for disturbance to the surrounding buildings/tenants

within the complex. None of the above recommendations should preclude more stringent engineering requirements by the project designer or the project engineer reviewing the structural composition of the building.

### **Concrete Slabs-on-Grade (Exterior Hardscape)**

Since a deep foundation system will require the use of a structural slab for support of the building, interior slabs-on-grade will not be utilized at this site. Exterior concrete slabs-on-grade will be suitable, if the grading recommendations of this report are closely adhered to. The following recommendations are based on the assumption that slabs are placed on uniform soils. Slabs will be suitable if the following guidelines are closely adhered to:

1. Concrete slabs-on-grade should have a nominal thickness of four inches (4") and should be doweled into the building (where possible) using #3 epoxied dowels in conjunction with a minimum of #3 steel reinforcing bars spaced at eighteen inches (18") o.c. in each direction. A twelve inch (12") turned-down edge should be considered where hardscape borders pervious surfaces to minimize horizontal water migration to underslab soils.
2. The existing fill and residual soils are not suitable for the support of slabs due to their settlement and expansion tendencies; therefore, a minimum of twenty four inches (24") of these materials should be removed and replaced with properly compacted suitable fill material where slabs are to be constructed in order to minimize differential movement.
3. Adequate control joints should be installed to control the unavoidable cracking of concrete that takes place when undergoing its natural shrinkage during curing. The control joints should be well located to direct unavoidable slab cracking to areas that are desirable by the designer.

The aforementioned precautions will not prevent slab movement if the underlying soils become moistened; however, they will minimize the damage if such movement occurs.

### **Surface Drainage**

Adequate drainage precautions at this site are imperative. Under no circumstances should water be allowed to pond against or adjacent to footings, foundation walls, or retaining walls. The ground surface surrounding the building should be relatively impervious in nature, and slope to drain away from the building in all directions, with a minimum slope of five percent (5%) for a horizontal distance of ten feet (10'). Area drains or surface swales should then be provided to accommodate runoff and avoid any ponding of water. Roof gutters, downspouts, and drains should be considered



on the proposed structure, and discharged to flow to suitable outlets away from the foundation. Surface and area drains should not be connected to any wall drainage or underdrain system. Drainage should be diverted away from the top of slopes to avoid erosion. Surfaces should be adequately vegetated or otherwise covered and provided with appropriate energy dissipaters, where applicable to avoid pending erosion.

### **Underdrain System**

As we understand, there are no crawlspaces or subterranean habitable spaces being considered at this site. When considering the proposed development and subsoil conditions, we believe that no underdrain requirements are therefore required. Should crawlspace construction or habitable underground space (underground could mean as little as one foot [1'] below grade) be required at this site, underdrain system recommendations may be required and this office should be consulted accordingly.

### **Retaining Walls**

We understand that no retaining walls (other than those associated with a crawlspace, if used) will be required at this site. Should retaining walls be desired, please contact this office for additional recommendations regarding their design and construction.

### **Construction Observation**

The following services should be conducted under the direct supervision of a qualified geotechnical engineer during construction of the proposed apartment building (if applicable):

1. Grading and foundation plan review, prior to grading.
2. Observation of any conditions that vary from the conditions as described within this report.
3. Observation of all subgrade preparation, subsequent to removals prior to fill placement.
4. Observation and testing of any fill placement and preparation of compaction report (see Appendix D, Figure D-7, "DPL-73 Form").
5. Observation of pier excavations, during drilling and prior to placement of steel reinforcement.

It is probable that jurisdictional agencies may require additional services for documentation during construction, where applicable. These requirements may include the review or observation of one (1) or more of the following:

- Exposed undercuts
- Reinforcing placement in slabs
- Strip footing excavations
- Isolated pad excavations
- Finish rough grade of slopes
- Waterproofing
- Subdrain installation
- Area drain installation
- Reinforcing placement in footings
- Finish grade of landscaping

The owner/builder should consult the governing agencies to determine the extent of their requirements prior to commencing work, to avoid costly delays during construction, and to have the required services included in the construction budget for the project. We are available to assist you in these services, should they be required.

## **MISCELLANEOUS**

### **General**

Properties, in general, and hillside developments, in particular, need maintenance to continue to function and retain their value. Many property owners are unaware of this and allow deterioration of their property. It is important to familiarize property owners with some guidelines for maintenance of their properties and make them aware of the importance of maintenance.

Some governing agencies require hillside property developers to utilize specific methods of engineering and construction to protect those investing in improved lots or constructed homes. For example, the developer may be required to grade the property in such a manner that rainwater will be drained away from the lot and to plant slopes so that erosion will be minimized. The developer may also be required to install permanent drains.

However, once the lot is purchased, it is the buyer's responsibility to maintain these safety features by observing a prudent program of lot care and maintenance. Failure to make regular inspection and maintenance of drainage devices and sloping areas may cause severe financial loss. In addition

to his/her own property damage, he/she may also be subject to civil liability for damage occurring to neighboring properties as a result of his/her negligence.

### **Maintenance Guidelines for Property Owners**

The following maintenance guidelines are provided for the protection of the property owner's investment:

- Surface drainage must be directed away from structural foundations to prevent ponding of storm waters or irrigation adjacent to footings.
- Care should be taken that slopes, terraces, berms (ridges at crown of slopes) and proper lot drainage is not disturbed. Surface drainage should be conducted from the rear yard to the street through the side yard, or to naturally drainage ways within the property boundary.
- In general, roof and yard runoff should be conducted to either the street or storm drain by non-erosive devices such as sidewalks, drainage pipes, ground gutters and driveways. Drainage systems should not be altered without expert consultation.

### **Limitations**

It must be noted that no structure or slab should be expected to remain totally free of cracks and minor signs of cosmetic distress. The flexible nature of wood and steel structures allows them to respond to movements resulting from minor unavoidable settlement of fill or natural soils, the swelling of clay soils, or the motions induced from seismic activity. In addition, products containing cement also shrink during natural curing. All of the above can induce stresses that frequently result in cosmetic cracking of brittle wall surfaces, such as stucco or interior plaster or interior brittle slab finishes. This is especially true when considering an addition or modification to an existing building or repair of an existing condition.

Data for this report was derived from surface observations at the site, knowledge of local conditions, and a visual observation of the soils exposed in the subsurface excavations. The recommendations in this report are based on our experience in conjunction with the limited soils exposed at this site and neighboring sites. We believe that this information gives an acceptable degree of reliability for anticipating the behavior of the proposed improvements; however, our recommendations are professional opinions and cannot control nature, nor can they assure the soil profiles beneath or adjacent to those observed; therefore, no warranties of the accuracy of these recommendations, beyond the limits of the obtained data, is herein expressed or implied. This

report is based on the evaluation at the described site and on the specific anticipated construction as stated herein. If either of these conditions is changed, the results would also most likely change.

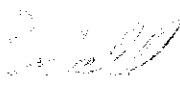
Man-made or natural changes in the conditions of a property can occur over a period of time. In addition, changes in requirements due to state-of-the-art knowledge and/or legislation are rapidly occurring. As a result, the findings of this report may become invalid due to these changes; therefore, this report for the specific site is subject to review and not considered valid after a period of one (1) year, or if conditions as stated above are altered. This report is not meant to imply nor does it offer any warranty whatsoever as to the future performance or value of the property. Use of this report is for the sole purpose of the client. It is understood that Accutech Engineering Systems, Inc. will be compensated in full for any costs of litigation that may arise from the use of this report, including, but not limited to, fees for staff, attorneys, and/or expert witness testimony.

It is the responsibility of the owner or his representative to insure that the information in this report be incorporated into the plans and/or specifications and construction of the project. It is advisable that a contractor familiar with construction details typically used to deal with the local subsoil and seismic conditions, be retained to build the structure.

If you have any questions regarding this report, or if we can be of further service, please do not hesitate to contact us. We hope the report provides you with necessary information to continue with the development of the project.

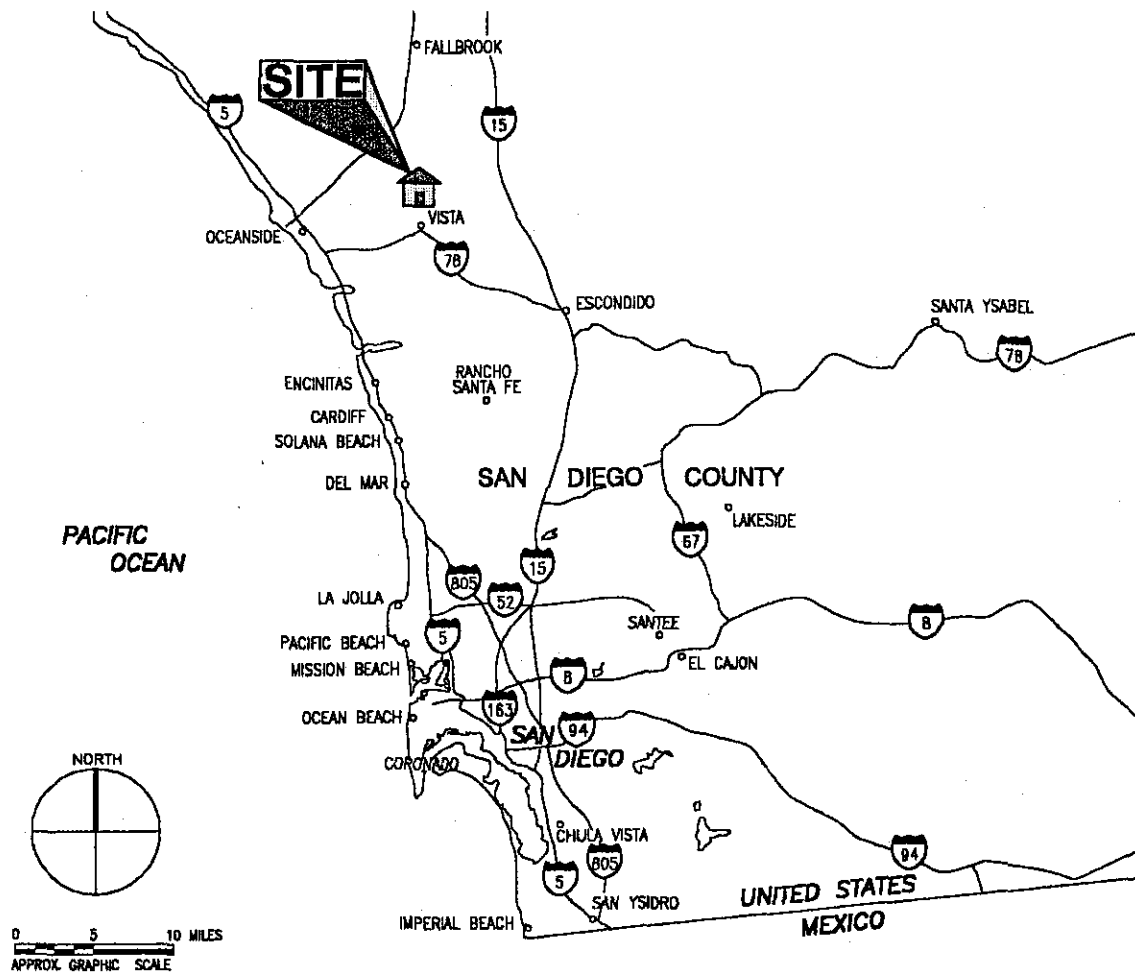
Very truly yours,

**ACCUTECH ENGINEERING SYSTEMS, INC.**

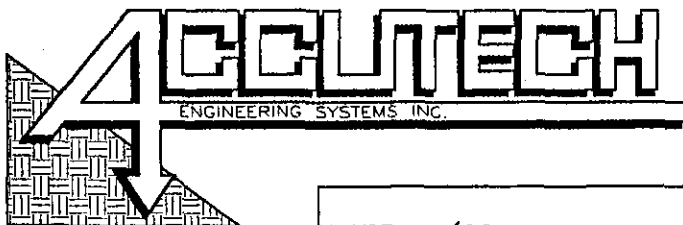
  
**Robert J. Randall**  
**President**  
**RGE#000707**

RJR/GDH:dh





## SITE VICINITY MAP

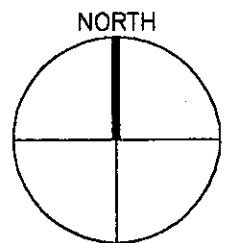
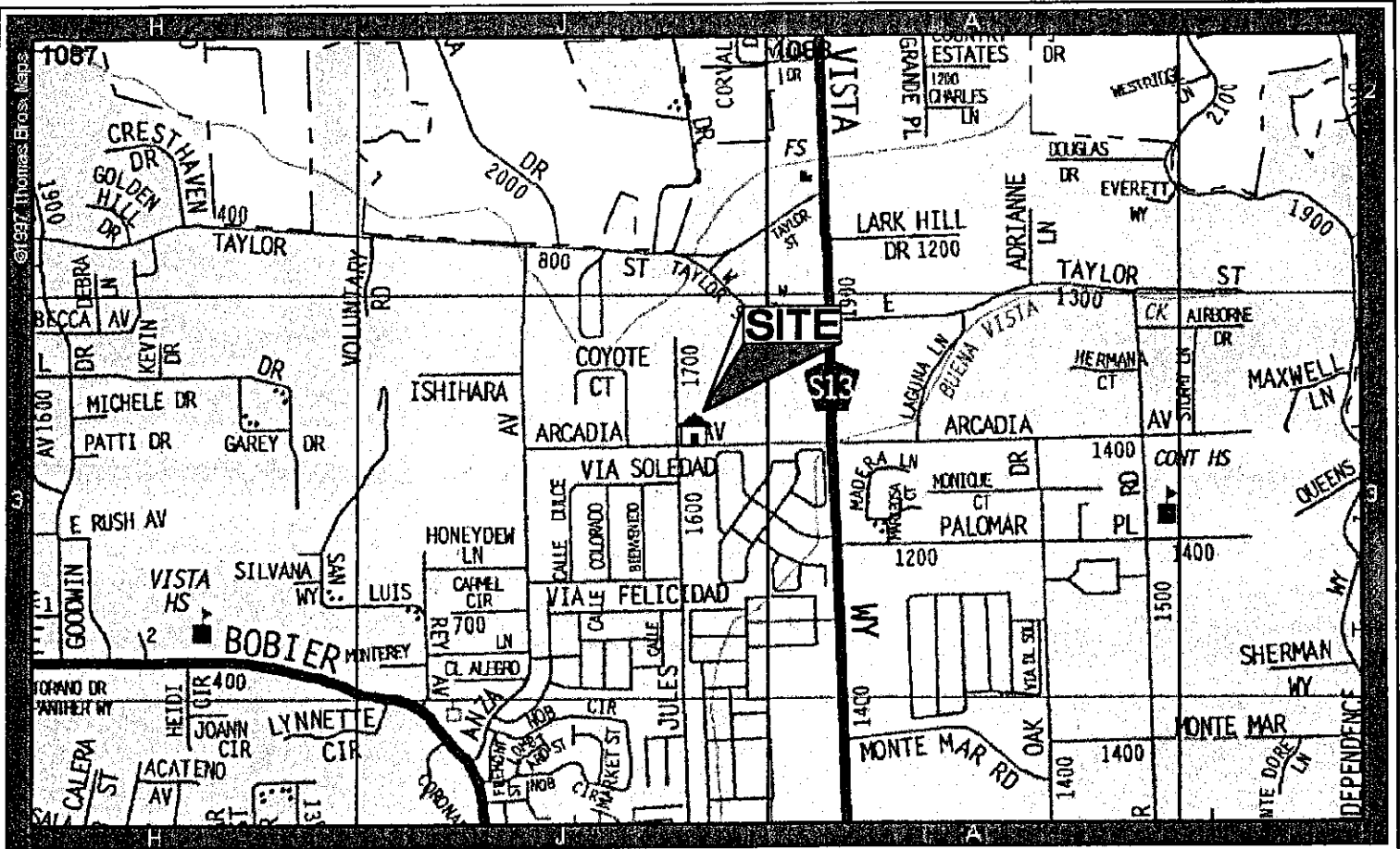


ARCADIA PINES APARTMENTS  
1701-1759 CALLE JULES  
VISTA, CA

DATE: 2/00

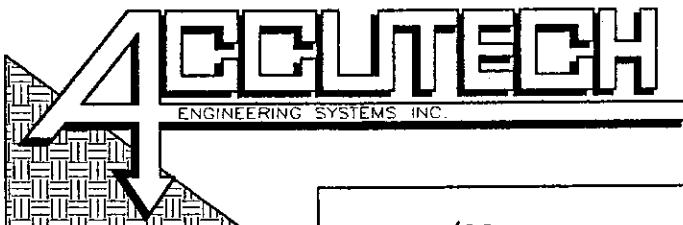
FIGURE#: 1

PROJ. REF#: 002041-



## SITE LOCATION MAP

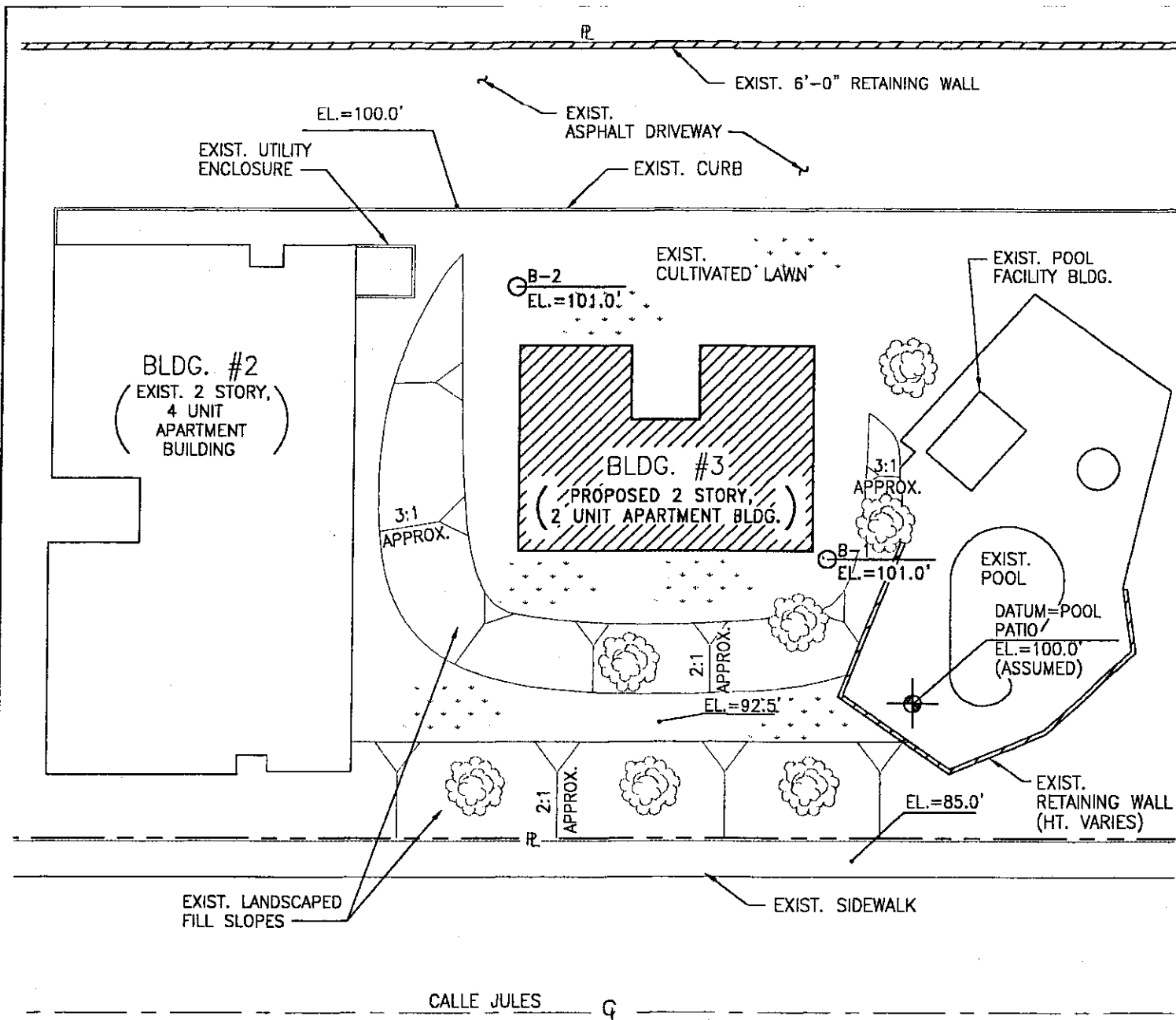
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VISTA, CA



DATE: 2/00

FIGURE#: 2

PROJ. REF#: 002041-1



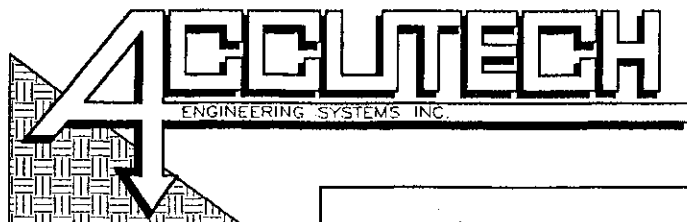
### NOTES:

⊙ B-1  
EL. = INDICATES LOCATION OF EXPLORATORY BORING, IDENTIFICATION NUMBER & ELEVATION



⊙ EL. = 85.0' INDICATES ELEVATION. NOTE THAT SPOT ELEVATIONS ARE APPROXIMATE AND ARE BASED ON ASSUMED DATUM ELEVATION.

## SITE PLAN/LOCATION OF EXPLORATORY BORINGS



ARCADIA PINES APARTMENTS  
1701-1759 CALLE JULES  
VISTA, CA

DATE: 2/00

FIGURE#: 3

PROJ. REF#: 002041-1

# **APPENDIX A**

## ***REFERENCES***



## REFERENCES

1. Bowles, J.E., 1982, *Foundation Analysis and Design*, 3rd Edition, McGraw Hill.
2. Department of the Navy, *Naval Facilities Engineering Command Design Manual 7.2*, May 1982.
3. Department of Public Works, County of San Diego, California, 1977, *Faults and Epicenters*, Scale of 1 inch:2 miles.
4. Greensfelder, R. W., 1974, *Maximum Credible Rock Acceleration from Earthquakes in California*.
5. Harris, M.E., 1987, *Geology of San Diego County, California, A Bibliography with Subject Index*, California Division of Mines and Geology, Special Publication 96.
6. Hart, Earl W., 1990, *Fault-Rupture Hazard Zones in California*, California Division of Mines and Geology, Special Publication 42, Revised 1990.
7. Jennings, C.W., 1977, *Geologic Map of California*, California Division of Mines and Geology, Scale 1:750,000.
8. Jennings, C.W., 1992, *Preliminary Fault Map of California*, California Division of Mines and Geology, Revision of the 1975 Fault Map of California, Scale 1:750,000, Open File Report 92-03.
9. *Landslide Hazard Identification Program*, California Division of Mines and Geology, Annual Report 1990.
10. Pacific Section, 1991, *Eocene Geologic History San Diego Region*, Society of Economic Paleontologists and Mineralogists, Book 68.
11. San Diego County - SR086, 098, 153; SP096; MS040, 041, 042; OFR80-16, 82-12, 84-33, 59, 86-08, 15, 88-16, 89-15.
12. San Diego P-C Region - SR153.
13. San Diego - B200; MS029, 040, 041; SP100; OFR68-10, 69-13, 14, 15, 17
14. San Diego Planning Department, County of San Diego, California, 1974, *Landslides*, Scale of 1 inch:2 miles.
15. Weber, Harold F. Jr., 1982, *Recent Slope Failures, Ancient Landslides, and Related Geology of the North-Central Coastal Area, San Diego County, California*, California Division of Mines and Geology, Open File Report 82-12.








# **APPENDIX B**

## ***FIELD EXPLORATION***

# SUB-SURFACE EXPLORATION TERMS

UNIFIED SOILS CLASSIFICATION - IDENTIFICATION AND DESCRIPTION							
Primary Divisions			Symbols		Secondary Divisions		
Coarse Grained Soils More Than Half of Material Is Larger Than #200 Sieve Size	Gravels, more than half of coarse fraction is larger than #4 sieve	Clean Gravels with <5% 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 >5% Fines		GM	Silty gravels, gravel-sand mixtures, non-plastic fines.		
				GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.		
	Sands, more than half of coarse fraction is smaller than #4 sieve.	Clean Sands with <5% Fines		SW	Well graded sands, gravelly sands, little or no fines.		
				SP	Poorly graded sands or gravelly sands, little or no fines.		
		Sands with >5% Fine		SM	Silty sands, sand-silt mixtures, non-plastic fines.		
				SC	Clayey sands, sand-clay mixtures, plastic fines.		
Fined Grained Soils More Than Half of Material Is Smaller Than #200 Sieve Size	Silts and Clays  Liquid Limit is 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, lean clays.		
				OL	Organic silts and organic silty clays of low plasticity.		
	Silts and Clays  Liquid Limit is More 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.		
Grain Sizes							
Silts & Clays	Sands			Gravels		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		
	200	40	10	4	3/4"	3"	12"
	U.S. Standard Size Sieve				Clear Square Sieve Openings		

## LEGEND

Symbol	Description
	Groundwater level or groundwater seepage at the time of drilling could vary seismically.
	Location of sample taken using a standard split tube sampler, 2 inch O.D. 1 3/8 inch I.D. driven using a hydraulically engaged and released free falling "mobile safety hammer." See Blow Count.
	Location of bulk sample taken from auger cuttings in borings or shovel in test pits.
	Location of undisturbed sample taken using a 2 3/8 inch I.D. modified California Split Tube Sampler liner rings, driven using a 140 pound hydraulically engaged and released free falling "mobile safety hammer." See Blow Count.
	Location of undisturbed sample taken using a 2 3/8 inch I.D. "California" liner ring and hand drive adapter.
	Location of carved chuck or block sample.
	Location of undisturbed sample taken using a 3 inch O.D. thin-walled tube sampler (Shelby Tube) hydraulically pushed.
D	Sample disturbed during sampling such that accurate natural densities or strength properties may not be reliably obtained in the laboratory.
U	Sample relatively undisturbed during sampling so that natural densities or other strength properties may be obtained in the laboratory.
Blow Count	<p>Number of drives of sampling device for 6 inch sample, unless noted otherwise. For example:</p> <p style="margin-left: 40px;">14        =        14 blows of the sampling device were required to drive the sample 6 inches.</p> <p style="margin-left: 40px;">25/4      =        25 blows of the sampling device were required to drive the sample 4 inches.</p> <p style="margin-left: 40px;">(25/26) =        Blow count converted to SPT when other samplers are used. See attached "Blow Count Conversion".</p>

## DEFINITION OF TERMS

Term	Definition
$\phi$	Angle of internal friction (degrees)
-200	Material passing the #200 sieve (%)
App Dnsty	Apparent Density is the estimated density of the soil, at the depth noted, during field observation and classification (pounds per cubic foot).
App Moist	Apparent Moisture is the estimated moisture content, at the depth noted, during field observation and classification (%).
DD	Dry Density of soil (pounds per cubic foot)
EI	Expansion Index
HP	Unconfined compressive strength (hand penetrometer, tsf)
ID	Inside Diameter
ksf	Kips per square foot
LL	Liquid Limit (%)
M	Moisture Content, estimated or determined in laboratory as a percent of dry weight
MSL	Mean sea level
NP	Non-Plastic
OD	Outside Diameter
PI	Plastic Index (%)
PL	Plastic Limit (%)
SPT	Standard Penetration Test
tsf	Tons per square foot
UC	Unconfined compressive strength (cohesion intercept, ksf)
USCS	United Soil Classification System
WD	Wet Density of soil (pounds per cubic foot)

## BLOW COUNT CONVERSION (N-VALUE)

The blow count representation of the penetration resistance of a soil (N-Value) is achieved by driving a standard 2 inch O.D. split-barrel sampler utilizing a drive weight of 140 pounds impacting the sampler from a fall of 30 inches. This method is known as the Standard Penetration Test (SPT) and is also used to obtain disturbed samples. Frequently, a larger sampler with brass rings is used to obtain undisturbed samples. A correlation between SPT blow count and blow count from a larger diameter ring lined sampler used may be obtained by considering drive energy created by the fall of the 140 pound weight over the effective cross sectional area of the samplers. The drive energy of a larger 3 inch diameter sampler (133 ft-lb/in<sup>2</sup>) divided by the drive energy of the standard 2 inch diameter sampler (211 ft-lb/in<sup>2</sup>) results in a conversion factor of 0.630. The blow count of the 3 inch diameter sampler may be multiplied by this conversion factor to equate it to SPT blow count.

Correlation of blow count between SPT and ring lined split-barrel drive sampler:

Given: Standard drop hammer weight of 140 pound drop of 30 inches

O.D. SPT 2 in.  
I.D. SPT 1.375 in.

O.D. Split-barrel 3 in.  
I.D. Split-barrel 2.375 in.

Effective Area of SPT:

$$A = \pi d^2/4$$
$$A = \pi(2 \text{ in})^2/4 - \pi(1.375 \text{ in})^2/4$$

$$\text{Effective Area} = 1.657 \text{ in}^2$$

Drive Energy SPT:

$$(140 \text{ lb})(2.5 \text{ ft})/1.657 \text{ in}^2$$

$$\underline{211 \text{ ft-lb/in}^2}$$

Effective Area of Ring Lined Split-Barrel Sampler:

$$A = \pi d^2/4$$
$$A = \pi(3 \text{ in})^2/4 - \pi(2.375 \text{ in})^2/4$$

$$\text{Effective Area} = 2.638 \text{ in}^2$$

Drive Energy Ring Lined Split-Barrel Sampler:

$$(140 \text{ lb})(2.5 \text{ ft})/2.638 \text{ in}^2$$

$$\underline{133 \text{ ft-lb/in}^2}$$

∴ Conversion (C):

$$C = 133 \text{ ft-lb/in}^2 \div 211 \text{ ft-lb/in}^2$$

$$C = 0.630$$

# BORING LOG NO. B-1

Equipment: CME 55 Truck-Mounted Drill Rig	Type: Hollow Stem Auger Dimension: 8" diam. x 40' 2 1/2" deep	Date Logged: 2/11/00
--	--	----------------------

Hole Elevation: 101.0' ± Datum: Pool Patio = 100.0'	Groundwater Depth: Encountered @ 38' / 12' @ 1.5 hours	Logged By: GDH
--	---	----------------

Depth (ft)	Symbol	Location: From northernmost corner of pool facility bldg.: 24' NW		Field				Laboratory
				Sample	Blow Count 6"	App Dnsty (pcf)	App Moist (%)	Other
0 -		CH	CLAY; silty, dark gray-brown very moist, soft to firm, scattered root hairs and organics					
1 -		MH						
2 -								
3 -								
4 -								
5 -								
6 -								
7 -								
8 -								
9 -								
10 -			FILL					
11 -		CH	CLAY; silty, gray-brown to gray, very moist, firm, rootlets and organics @ 10' ±			95.0	26.0	
12 -		MH						
13 -								
14 -								
15 -								
			Gradual color change to gray-green CONTINUED RESIDUAL SOIL					

Project Name: Arcadia Pines	Project Reference: 002041-1
Project Location: 1701-1759 Calle Jules, Vista, CA 92084	Figure No.: B-1

# BORING LOG NO. B-1 CONT.

Equipment: CME 55 Truck-Mounted Drill Rig			Type: Hollow Stem Auger Dimension: 8" diam. x 40' 2 1/2" deep			Date Logged: 2/11/00		
Hole Elevation: 101.0' ± Datum: Pool Patio = 100.0'			Groundwater Depth: Encountered @ 38' / 12' @ 1.5 hours			Logged By: GDH		

Depth (ft)	Symbol	Location: From northernmost corner of pool facility bldg.: 24' NW		Field				Laboratory
		US CS	Field Description and Classification	S m p l	Blow Count 6"	App Dnsty (pcf)	App Moist (%)	Other
15 -		CH	AS BEFORE					
16 -		MH						
17 -								
18 -								
19 -				Becoming firm to stiff				
20 -							100.0	24.0
21 -				Color change to tan-brown				
22 -								
23 -								
24 -				Color change to light olive-green				
25 -							104.0	22.0
26 -								
27 -								
28 -				RESIDUAL SOIL				
29 -								
30 -			CONTINUED FORMATIONAL			110.0	18.0	

Project Name: Arcadia Pines		Project Reference: 002041-1	
Project Location: 1701-1759 Calle Jules, Vista, CA 92084		Figure No.: B-2	



# BORING LOG NO. B-1 CONT.

Equipment: CME 55 Truck-Mounted Drill Rig		Type: Hollow Stem Auger Dimension: 8" diam. x 40' 2 1/2" deep		Date Logged: 2/11/00	
Hole Elevation: 101.0' ± Datum: Pool Patio = 100.0'		Groundwater Depth: Encountered @ 38' / 12' @ 1.5 hours		Logged By: GDH	

D e p t h  (ft)	S y m b o l	Location: From northernmost corner of pool facility bldg.: 24' NW		Field				Laboratory
				S m p l	Blow Count 6"	App Dnsty (pcf)	App Moist (%)	Other
		US CS	Field Description and Classification					
30 -			AS BEFORE					
31 -			SILTSTONE/SANDSTONE; clayey,	☒	U	45/6"	110.0	18.0
32 -			light olive- and yellow-			50/3"		
33 -			green, moist, very stiff/					
34 -			dense, with fine gravel and					
35 -			iron staining				105.0	20.0
36 -								
37 -								
38 -			Wet on rod @ 38' ±					
39 -								M=19.0
40 -			FORMATIONAL	☒	U			DD=106.8
41 -			GRANITE; slightly weathered,		*	50/		M=17.0
42 -			light gray-brown and black			2.5"		DD=112.0
43 -			with iron staining, moist,					HP>4.5
44 -			dense, slightly friable					*Slightly
45 -			GRANITE					disturbed
			Boring terminated @ 40' 2 1/2"					
			due to contact between					
			FORMATIONAL and GRANITE					
			Water in hole @ 12' @ 1.5 hrs					

Project Name: Arcadia Pines	Project Reference: 002041-1
Project Location: 1701-1759 Calle Jules, Vista, CA 92084	Figure No.: B-3

# BORING LOG NO. B-2

Equipment: CME 55 Truck-Mounted Drill Rig		Type: Hollow Stem Auger Dimension: 8"diam. x 25'4"deep		Date Logged: 2/11/00	
Hole Elevation: 101.0'± Datum: Pool Patio=100.0'		Groundwater Depth: Not Encountered		Logged By: GDH	

Depth (ft)	Sym bol	Location: 33'S of adjacent Bldg#2; 48'W of E property line/retaining wall		Field				Laboratory
				S m p l	Blow Count 6"	App Dnsty (pcf)	App Moist (%)	Other
0 -		CH	CLAY; silty, dark gray-brown very moist, soft to firm, scattered root hairs and organics <span style="float: right;">FILL</span>					
1 -		MH				86.0	32.0	
2 -								
3 -		CH	CLAY; silty, gray-brown to gray, very moist, firm, scattered root hairs and organics					
4 -		MH				95.0	28.0	
5 -								
6 -			Color change to gray-green					
7 -								
8 -								
9 -								
10 -			Color change to tan-brown					
11 -								
12 -								
13 -			Rapid color change to light olive-green, becoming stiff					
14 -								
15 -			CONTINUED <span style="float: right;">RESIDUAL SOIL</span>			105.0	20.0	

Project Name: Arcadia Pines	Project Reference: 002041-1
Project Location: 1701-1759 Calle Jules, Vista, CA 92084	Figure No.: B-4

# BORING LOG NO. B-2 CONT.

Equipment: CME 55 Truck-Mounted Drill Rig		Type: Hollow Stem Auger Dimension: 8" diam. x 25' 4" deep		Date Logged: 2/11/00				
Hole Elevation: 101.0' ± Datum: Pool Patio = 100.0'		Groundwater Depth: Not Encountered		Logged By: GDH				
Depth (ft)	Sym- bol	Location: 33'S of adjacent Bldg#2; 48'W of E property line/retaining wall		Field				Laboratory
		US CS	Field Description and Classification	S m p l	Blow Count 6"	App Dnsty (pcf)	App Moist (%)	Other
15 -		CH	AS BEFORE					
16 -		MH						
17 -								
18 -			RESIDUAL SOIL					
19 -			SILTSTONE/SANDSTONE; clayey, light olive-green, moist, very stiff/dense, with fine gravel and iron staining			114.0	14.0	
20 -			FORMATIONAL					
21 -			GRANITE; decomposed to slightly weathered, dark gray-brown and black with abundant iron staining, moist to damp, dense to very dense, friable					M=7.5 DD=118.7 HP>4.5 *Slightly Disurbed
22 -			GRANITE					
23 -								
24 -								
25 -								
26 -			Boring terminated @ 25' 4" in GRANITE	U	50/4"			
27 -			Hole dry upon completion	*				
28 -								
29 -								
30 -								
Project Name: Arcadia Pines					Project Reference: 002041-1			
Project Location: 1701-1759 Calle Jules, Vista, CA 92084					Figure No.: B-5			

# **APPENDIX C**

## ***LABORATORY TESTING***

## **LABORATORY TESTING**

Laboratory tests were performed in general accordance with the accepted practice of the American Society for Testing and Materials (ASTM), the Uniform Building Code (UBC), and other suggested methods. A brief description of the tests performed is as follows:

· **CLASSIFICATION** - Field classifications are prepared in the field and are verified in the laboratory by a visual examination per (ASTM D2487). Further classification is provided with the aid of supplemental laboratory testing of selected samples obtained in the field. Samples are classified, as coarse or fine grained, well or poorly graded, high or low plasticity, per the Unified Classification System.

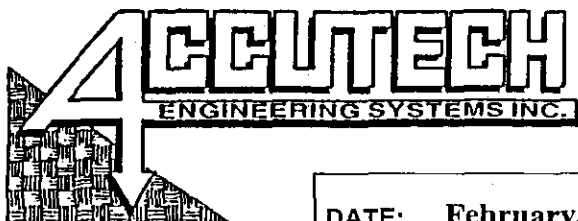
· **MOISTURE DENSITY** - Moisture contents and dry densities are determined for representative soil samples in accordance with ASTM D2216. This information is an aid to classification and assists in recognition of variations in material consistency with depth. The dry unit weight is determined in pounds per cubic foot, and the in-situ moisture content is determined as a percentage of the dry unit weight. The results are summarized in the excavation and/or boring logs and the summary of laboratory testing within this section of the report.

· **EXPANSION INDEX** - Expansion Index tests on remolded samples are performed on representative samples of soils per UBC Standard 29-2. The test is performed on the portion of the sample passing the #4 standard sieve. The sample and is then compacted in a 4-inch-diameter mold at a saturation of approximately 50 percent. The specimen is placed in a consolidometer with porous stones at the top and bottom, subjected to a total normal load of 12.63 pounds (144.7 psf), and the sample is allowed to consolidate for a period of 10 minutes. The sample is submerged in water and the change in vertical movement is measured and recorded until the rate of expansion becomes nominal. The expansion index is reported as the total vertical displacement in inches times 1000.

· **ATTERBERG LIMITS** - The plastic and liquid limits and the plasticity index are determined in accordance with ASTM D4318. This test is performed on the portions of the sample passing the #40 sieve, and assists in classifying the fine grained soils into low or high plasticity fines.

[illegible]

\*Sample slightly disturbed



**ARCADIA PINES**  
**1701-1759 CALLE JULES**  
**VISTA, CA 92084**

**DATE:** February, 2000

FIGURE #:            C-1

PROJ. REF. # 002041-1