

GEOTECHNICAL INVESTIGATION REPORT
2ND REVISED DETAIL VESTING TENTATIVE TRACT MAP NO. 53072
(SCALE OF 1 INCH = 100 FEET)
CITY OF LOS ANGELES, CALIFORNIA

Prepared for:

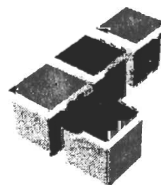
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Leighton and Associates, Inc.

In addition to these three borings, two seismic refraction survey lines (SL-4 and SL-5) were performed across the width and the length of this feature to further characterized its subsurface conditions (SubSurface Surveys, 2002). In general, the results appear to indicate a relatively irregular thickness of this feature that pinches in and out laterally as compared with better defined slide surface signature obtained from the seismic lines that transected the existing landslides (Qls-1, through Qls-4), located on the western ridge. In addition, the topography in this area lacks typical geomorphic indicators of a landslide (such as bulging or hummocky topography); rather, the topography is hollowed with steep slopes (at approximate slope gradients of 1:1 / h:v), suggesting relatively higher rates of erosion than the adjacent slopes to the north and south of this area. Based on our field and down-hole observations, and the results of the seismic refraction surveys conducted within this feature, the materials observed in within this feature appear to be disturbed by down slope bedrock creep rather than by landsliding. However, because of the thickness observed within this feature, averaging between 20 to 30 feet, this feature appears to be too thick to define it as a slump. Hence, our interpretations in calling this feature a questionable slump/landslide deposit. However, in the slope stability analyses for this natural slope, this feature was treated as a landslide for conservative purposes (see Section 10.6 for additional discussion).

- **Landslides (Qls):** Nine landslides (Qls-1 through Qls-9) have been mapped at the project site. The majority of these landslides occur on the west-facing slopes and appear to have been facilitated by the pervasive, westerly-dipping foliation and clay seams in the Santa Monica Slate Formation bedrock.
 - Landslide Qls-1 is located in the vicinity of the northwestern perimeter of the proposed development at the site. This landslide descends to the west-northwest of Lot 29. Leighton's Boring LB-7 was drilled in the upper portion of this feature and it encountered approximately 20 feet of landslide materials overlying undisturbed Santa Monica Slate Formation bedrock. However, this landslide could reach as much as 30 feet in thickness as shown on Cross-Section A-A' (Plate 2).



Landslide Qls-2 and its subsidiary Landslide Qls-2a are located in the vicinity of the western-northwestern perimeter of the proposed development, northwest of Lot 28. These two landslides appear to be the northern most landslides of a much larger landslide complex mapped in these area, which includes Landslides Qls-3, Qls-3a, and Qls-4 (see Plate 1, Geotechnical Map). Three G. A. Nicholl and Associates, Inc.'s borings (B-5, B-10 and B-14) were drilled in the upper portion of Landslide Qls-2 and encountered approximately 19 feet, 56 feet and possibly 11 feet of landslide materials (respectively). Leighton's Boring LB-19, drilled within the upper portion of Landslide Qls-2a, encountered approximately 46 feet of landslide materials associated with Qls-2a and approximately 10 feet of landslide materials associated with Qls-2. The basal rupture surfaces of these two landslides consist of a well-developed, medium to dark gray clay. The rupture surfaces ranged in thickness between ¼-inch and 2-inches thick and were logged as moist, firm to stiff, with polished surfaces. The subsurface configuration of these landslides is shown on Cross-Sections B-B', BB-BB', and C-C' (Plate 2).

- Landslide Qls-3 and its subsidiary Landslide Qls-3 are located to the west of Lot 28 and to the south of, and adjacent to, Landslides Qls-2 and Qls-2a at the western perimeter of the proposed development. The general area of Qls-3 was previously mapped as slump deposits by G. A. Nicholl and Associates, Inc., as also described in the log of Boring B-11 drilled within this feature. Leighton drilled three additional borings (LB-10, LB-11, and LB-18) to further characterize this slump feature. Borings LB-10, LB-11, and LB-18 encountered approximately 22 feet, 68 feet and 12 feet (respectively) of landslide materials overlying undisturbed Santa Monica Slate Formation bedrock. The basal rupture surface observed in Borings LB-10 and LB-11 at 22 feet and 67.8 feet below the ground surface consisted of 1/8-inch and 2- to 3-inches thick clay and gravelly clay, respectively. Boring LB-18 could not be advanced below the slide due to very hard conditions and auger refusal encountered during the drilling.

Boring LB-20 was drilled in the upper portion of Landslide Qls-3a and approximately 62 feet (total depth of the boring) of landslide, materials were observed in this boring. This boring could not be advanced below the slide materials due to the drill depth limitations of the limited access rig used to excavate this boring.

The subsurface configuration of these landslides is shown on Cross-Sections D-D', DD-DD', and W-W' (Plates 2 and 4).



- Landslide Qls-4 is located approximately 200 feet to the west of the proposed development and to the south of, and adjacent to, Landslides Qls-3 and Qls-3a. Leighton's Boring LB-9 was drilled in the upper portion of this landslide and approximately 26 feet of landslide materials were observed in this boring. The basal rupture surface of Landslide Qls-4 consists of a ½-inch thick clay that was logged as moist and firm to stiff. The subsurface configuration of this landslide is shown on Cross-Sections L-L' and LL-LL' (Plate 3).
- Landslide Qls-5 is located to the southeast of Lots 26 and 27 at the western portion of the site. This landslide has not been explored by drilling. Its estimated subsurface configuration is shown on Cross-Section F-F' (Plate 2).
- Landslide Qls-6 is located to the southeast of Lot 23 at the western portion of the site. Leighton's Boring LB-12 was drilled in the upper portion of this landslide and encountered approximately 44 feet of landslide materials overlying undisturbed Santa Monica Slate Formation bedrock. The basal rupture surface of Landslide Qls-6 consists of a ¼- to ½-inch thick olive gray and well-developed clay. The subsurface configuration of this landslide is shown on Cross-Section F-F' (Plate 2).
- Landslide Qls-7 descends to the south on the northern margin of the tract, south of the existing Mountain Crest Lane, and does not impact the planned development. Three borings have been previously drilled in this landslide (DH-1, DH-2 and DH-3 by Geotechnical Associates, in 1979, as referenced by G. A. Nicholl and Associates, Inc., 1987b) although these borings were not located for review during this study. The northern portion of the landslide was stabilized with a shear key and fill during grading for the off-site development (G. A. Nicholl and Associates, Inc., 1981b). The subsurface configuration of this landslide is shown on Cross-Section T-T' (Plate 4)
- Landslide Qls-8 descends to the west on the west flank of the eastern ridge and underlies portions of the proposed Lots 17 through 20. Boring B-5-03, drilled near the upper portion of this landslide, encountered approximately 18 feet of landslide materials overlying undisturbed Santa Monica Slate Formation bedrock. Boring B-2 drilled down-slope of Boring B-5-03, encountered at least 96 feet of landslide material. Undisturbed bedrock was not encountered. (G. A. Nicholl and Associates, Inc., 1987b). Leighton's Borings LB-14 and LB-15 encountered approximately 67 and 78 feet of landslide materials (respectively) overlying undisturbed Santa Monica Slate Formation bedrock. The basal rupture surface of Landslide Qls-8 consists of a 1- to 3-inch thick dark gray and well-developed gravelly clay that was logged as moist, firm to stiff, and moderately plastic. The subsurface configuration of this landslide is shown on Cross-Sections H-H' and N-N' (Plate 3)



- Landslide Qls-9 is located to the south of, and adjacent to, Landslide Qls-8, and it underlies portions of the proposed Lots 15, 16, and a small portion of Lot 14. Boring LB-2 encountered 39 feet of landslide materials overlying undisturbed Santa Monica Slate Formation bedrock. The basal rupture surface of Landslide Qls-9 consists of a 4- to 8-inch thick dark gray and orange brown silty clay that was logged as wet, firm, and plastic. The subsurface configuration of this landslide is shown on Cross-Section Q-Q' (Plate 4).
- **Modelo Formation (Tm):** The Modelo Formation bedrock caps much of the western ridge. The bedrock units of the Modelo Formation, as observed on the outcrops and in the exploratory excavations, consist of weakly to well cemented, hard to very hard, massively bedded, fine- to medium-grained sandstones and silty sandstones, with thinly bedded siltstones and clayey siltstones, with localized claystone interbeds.
- **Santa Monica Slate (Jsm):** The Santa Monica Slate Formation bedrock is stratigraphically the lowest and oldest unit that is exposed, and predominantly underlies the majority of the project site. This bedrock formation generally consists of medium to dark gray slate and phyllite. The unit varies from strongly foliated (due to remnant bedding and a preferred orientation of platy micaceous minerals) to weakly foliated and massive in appearance. As noted by G. A. Nicholl and Associates, Inc., (1987b), and as confirmed during this study, foliations are characteristically pervasive throughout the formation, but are not generally continuous planes. The Santa Monica Slate Formation was logged as hard to very hard with localized shearing and irregular quartzite veins sub-parallel to, and/or crosscutting, primary foliation structure. The formation was observed jointed and fractured, and weathers to dark orange-brown silt and clay along fractures and faults.

8.3 Ground Water

Regional ground water was not encountered during Leighton's field investigation, or during previous field investigations performed by others (G. A. Nicholl and Associates, Inc., 1987b). However, minor water seeps were encountered in G. A. Nicholl and Associates, Inc.'s Borings B-3 at 59 feet below the ground surface (bgs) and B-2-3 at 9 feet bgs; and in Leighton's Borings LB-3 at 79.5 feet bgs, LB-7 at 83 feet bgs, LB-11 at 65 feet bgs, LB-14 at several depths between 43 feet and 80 feet bgs, and in Boring LB-17 at 62 feet and 63 feet bgs. Heavy seepage was observed at the bottom of Boring LB-17 and the water level surface rose to 66 feet bgs.

No surface water was observed at the bottom of the deeply incised canyons during our field mapping at the site. However, relatively dense hydrophilic vegetation was observed along the canyon bottoms and it is expected that perched ground water of limited extent will be encountered during grading in these canyons.



TABLE 2
SUMMARY OF LANDSLIDES &
SLUMPS & RECOMMENDED MITIGATION MEASURES

Landslide(Qls) /Slump (Qs)	Cross-Sections	Affected Lots	Recommended Mitigation Measures
Qls-1	A-A'	29	Caissons required at rear of lot, outside the landslide limit to support 20 feet of material from the design grade to the failure surface.
Qls-2/2a	B-B', C-C', BB-BB'	24-28, Canyon Back Rd.	Setback line developed. Lots and road designed to be beyond the slope-stability-analysis-developed setback line. Caissons designed at rear of Lot 28 and adjacent to road, to support 40 feet of material from the design grade to the failure surface. Lots are planned outside the landslide limits. No grading within landslides.
Qls-3/3a	D-D', W-W', and DD-DD'	24-28, Canyon Back Rd.	Setback line developed. Lots and road designed to be beyond the slope-stability-analysis-developed setback line. Caissons designed at rear of Lot 28 and adjacent to road, to support 30 feet of material from the design grade to the failure surface. Lots are planned outside the landslide limits. No grading within landslides.
Qls-4	L-L', LL-LL'	Road to Tank Site	Setback line developed. Roadway designed to be beyond the slope-stability-analysis-developed setback line
Qls-5 and 6	F-F'	Maintenance Road Fill	Complete removal of Landslide Qls-6, and only removal of upper surficial materials of Qls-5. Only minor amount of fills planned over Qls-5, which does not directly support the maintenance road fill.
Qls-7	T-T'	Existing Residence	Side-hill shear key and buttress already constructed as mitigation for off-site development (G. A. Nicholl and Associates, 1981b).
Qls-8 and 9	H-H', Q-Q', N-N'	14-21	100-foot wide keyway 5-foot deep into competent material; remove all landslide material
Qs	Not Applicable	Existing Water Tank	Slump material outside the proposed development. Mitigation not required.
Qs?Qls?	M-M', S-S', U-U', UU-UU'	22 and existing three residential units at existing terminus of Stoney Hill Drive	Caissons required at rear of lots, outside the slump area to support 20 feet of material from the design grade to the failure surface. Minor grading is planned within slump. A 3 to 5 foot cap of clayey material or other low-permeable layer should be placed over slump area to reduce the water infiltration.