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RESPONSE TO REVIEW AND SUPPLEMENTAL RECOMMENDATIONS
on
FOREST GREEN ESTATES
Wesley Way and La Crescenta Road
Richmond, California
for
GENERAL HOLDING, INC.

By
TERRASEARCH, inc.

Project No. 7707.G
3 August, 2005

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PLANNING DEPARTMENT

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TERRASEARCH INC.
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Project No. 7707.G
3 August 2005

TECHNICAL
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SPECIAL
SPECTIONS
ATERIALS
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AN JOSE:
Via Del Oro
Suite 110
ose, CA 95119
3) 362-4920
408) 362-4926

VERMORE:
ght Brothers Ave.
nore, CA 94551
5) 243-6662
925) 243-6663

RAMENTO:
Freeway Blvd.
Suite 2
ento, CA 95834
5) 564-7809
916) 564-7672

Mr. James Santurro
Land Research & Management
673 James Drive
Placerville, CA 95667

SUBJECT: Forest Green Estates
Wesley Way and La Crescenta Road
Richmond, California
RESPONSE TO REVIEW AND SUPPLEMENTAL RECOMMENDATIONS

References:

1) Geologic and Geotechnical Investigation Report
By TERRASEARCH, Inc.
Dated 19 March 2003

2) Geologic Review
By Earth Investigation Consultants
Dated July 1 2004

Dear Mr. Santurro:

In accordance with your authorization, ***Terrasearch, Inc.,*** has performed additional subsurface work to respond to the geologic and geotechnical review comments contained in reference 2. The additional investigation work has been developed to provide a better understanding of some of the geologic and geotechnical concerns raised in reference 2, and provide additional data for mitigation.

Based on a review of reference 2, and on discussions from several meetings held between the project team and the City of Richmond's EIR consultant and their team, the main geologic and geotechnical concerns requiring supplemental analyses and recommendations centered mainly on groundwater conditions.

Our additional subsurface investigation work and analyses consisted of;

- Installing ten nested piezometers within the site to characterize the groundwater conditions,
- Installing three inclinometers within the site to evaluate if any landslide related movement exists. The inclinometers were also converted into piezometers,
- Advancing four borings at two locations within an active and potentially active landslide that exists within the Park District site to the west and encroaches onto the subject site. At each of the two boring locations, a nested piezometer and one inclinometer was installed. The borings were advanced to evaluate the depth of the landslide and perform slope stability analyses to determine earth movement loads on reinforced concrete piers planned along the west property line,
- Performing simple pump tests within the piezometers to evaluate groundwater discharge rates into drainage shafts proposed at the south end of the property,
- Perform an analysis of the stability of the buttress excavation side slopes,
- Provide supplemental mitigation recommendations for both groundwater and slide repair grading

Groundwater Conditions

The nested piezometers consisted of three standpipe piezometers in one hole at depths of 40 feet, 80 feet and 120 feet, below current ground surface, at the locations shown on Figure 1, attached. The ground water measurements in the piezometers was monitored over time. The results of the monitoring is presented in the attached Table I. The monitoring data indicates that several zones of perched water exist within the landslide mass. The data suggests that more water is present along the south and west parts of the site than in the center of the site. A regional groundwater table does not seem to exist. It should be noted that during the drilling of the six 100 foot deep large diameter holes, no groundwater table was encountered.

It was initially hypothesized that the difference in groundwater conditions across the site may be influenced by geologic structures such as inactive bedrock faults underlying the site. These inactive bedrock faults have been mapped by Bishop et al (1979) and are shown on Figure 1. The data is not conclusive to support the likelihood that these bedrock faults may be acting as an aquiclude that dams up water behind it, but it is not discounted. The inactive bedrock fault may not have undergone enough displacement to create a clay gouge barrier. In addition, the actual location of the mapped bedrock faults may be different due to the landsliding events.

The observed groundwater conditions may be due to water generated form the higher elevation entering the landslide mass within more permeable zones and dissipating through the site. The high piezometric head within the 120 foot stand pipe of P1 may be a result of the peizometer being located within the axis of a broad swale feature. Swale features generally show higher concentrations of groundwater as surface water is channeled rather than sheet flowed. Cross section EE, FF and GG were generated across the site to show groundwater conditions, and are attached as Figure 2.

The implications of a high groundwater table is that it can create low factors of safety against stability. This can be mitigated by draining the water form the ground to a lower level. Drill Tech and Drilling Shoring has proposed to excavate two 25 to 30 foot diameter shafts to a depth of 120 feet, which have a series of horizontal drains radiating out a distance of up to 300 feet from the shaft at various elevations. These two shafts will be located at the southern end of the site, where the groundwater conditions are greater. A plan view of this scheme is shown on Figure 5 Mitigation Plan attached. The water would be collected into the shaft and either pumped out to a surface storm drain facility or gravity drained to an onsite natural swale at the lower levels of the site.

In an attempt to determine possible water flows into the shafts, simple pump test were performed in inclinometers I-1, I-2, & I-3. These were selected instead of the piezometers as the inclinometer pipes and provide better data. The pump test was performed by pumping out almost all the water form the pipe and measuring the increase in groundwater elevation with time. Inclinometer I-1 recharged at a rate of 0.16 gallons/minute while inclinometers I-2 and I-3 recharged at a rate of approximately 0.03 gallons/minute, for an 8 inch diameter hole.

Analysis and Mitigation of Landslide on Park District Property

As indicated in reference 1, a large creeping landslide and a smaller active landslide upon it exist on the Park District Property to the west. Approximately 200 feet of the eastern edges of the two landslide encroach onto the subject site. It was proposed to construct a row of reinforced concrete piers along the west property line to separate the landslide mass and prevent landslide movement from affecting the subject project. The majority of the piers are aligned nearly parallel to the direction of landslide movement and will be subject to mainly shear loads with a minor component of landslide driving loads. A short portion of the property line jogs in an east west direction and the piers in this section are perpendicular to the direction of the main landslide movement and will be subject to full driving loads.

Two large diameter holes W-1 and W-2 were drilled within the eastern flank of these landslides, and the depth of landslides, and the depth of landsliding in both holes was found to be 50 feet.

In order to provide a better evaluation of landslide conditions and therefore the loads on it was proposed to drill three borings within the landslide on the Park District Property. Due to difficult drilling conditions only two borings could be completed. The locations of the borings are shown on the attached Figure 2 and the logs are attached in boring PD-1 the base of the large creeping slide was encountered at 65 feet depth and in boring PD-2, the base of the smaller active landslide and the base of the creeping landslide were encountered at 48 feet and 60 feet respectively. These depths are consistent with those encountered in large diameter holes W-1 and W-2. Groundwater was encountered at a depth of approximately 25 feet in boring PD-1 and at 40 feet in PD-2. Some shallower perched water was encountered at depths of 15 feet in both borings

Based on the above data, the slide cross section was developed (cross section H-H) at the location shown on Figure 3. A slope stability back analysis was performed to evaluate the shear strength for the slide plane assuming the large creeping slide has a current factor of safety of 1.0 (i.e actively moving). A slide plane shear strength of C=0 and 0=14° was calculated. Since the slide is not actively moving the actual factor of safety is slightly greater than 1.0. The angle of internal friction would be higher than 14°. In addition to construction of the piers, the recent landslide debris material within the subject site will removed and recompacted as engineered fill. The extent of this regarding is shown on Figure 5. Mitigation Plan. It is noted that the slide removal and recompaction will not extend to the full extent in some areas due to environmental restrictions in the creeks areas.

Based on the above results a slope stability analysis was performed on the slide and if a load of 400,000 lbs inclined at 37.5° from the horizontal is applied at the property line jog, the slide factor of safety would be 1.5. The slope stability analysis of the cross section is shown as Figure 4. The piers located along the west property line in a north-south direction (downhill) will only be subjected to 77,000 lbs of normal force inclined at 37.5° form the horizontal. This includes the effects of buttressing that will occur as described below.

The material excavated during grading is only allowed to be stockpiled in areas designated for grading.

Excavation Stability of Buttress

A 40 foot deep buttress is planned through the center of the site as shown of Figure. A slope stability analysis of the uphill excavation was performed to evaluate its stability during construction. The analysis shows that the excavation is unstable at a 1:1 slope inclination and the construction of the buttress is to proceed in stages. We recommend that the entire buttress be excavated to 20 feet depth and the lower 20 feet be excavated and recompacted in stages approximately 75 feet in length.

Should you have any questions or require additional information, please contact our office at your convenience.

Very truly yours,
TERRASEARCH, inc.

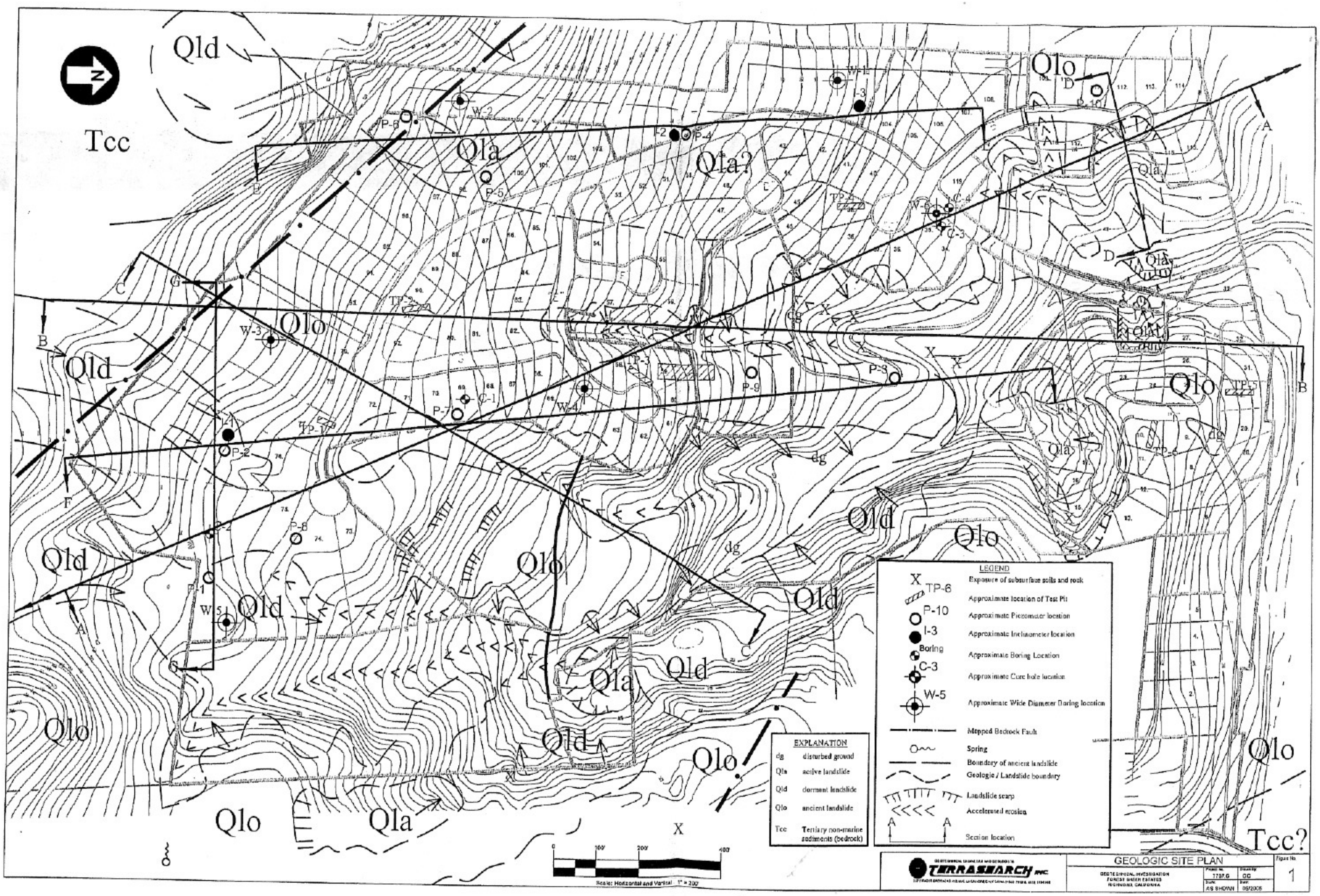
Simon Makdessi, P.E., G.E.
Senior Engineer

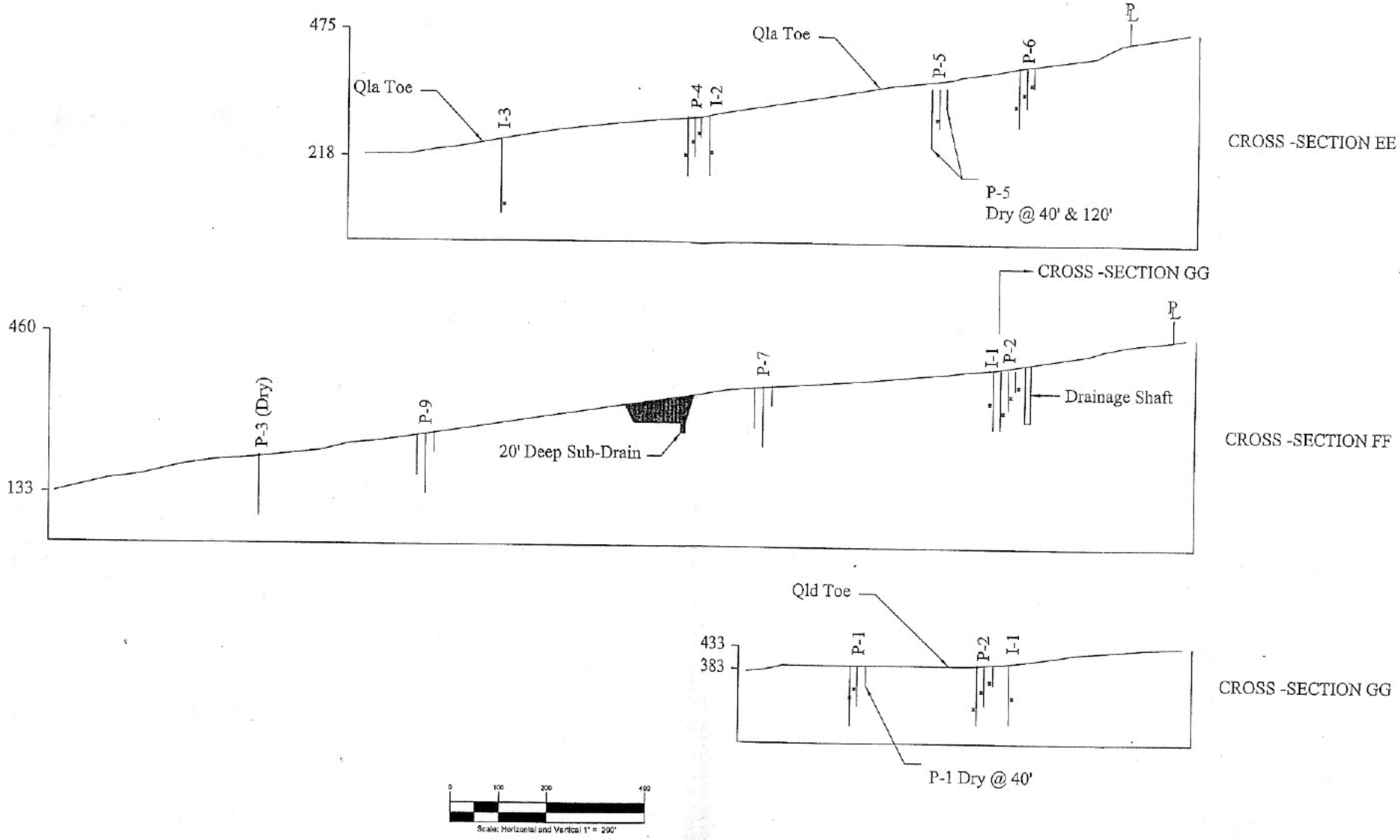
Copies: 1 to Land Research and Management
1 to LAK Associates (Attention: Mr. Sean Kenning)

REGISTERED PROFESSIONAL ENGINEER
SIMON MAKDESSI
NO. 2548
Exp. 6-30-2007
GEOTECHNICAL
STATE OF CALIFORNIA

Piezometer	Depth	10/13/2004 Water Levels	11/30/2004	12/1/2004 Water Levels	1/7/2004 Water Levels	3/31/2005 Water Levels	4/26/2005	5/4/2005	7/14/2005
P-1	40	40.2		Dry	39.9	40.5	14.5	14.7	21.1
	80	36.5		49.5	36.2	28.3	27.2	27.3	28.8
	120	8.6		64.9	7.5	4.8	3.8	3.6	3.6
P-2	40	35.4		38.1	21.8	13.7	13.1	13.5	16.7
	80	77.8	H	79.3	40.3	39.5	39.2	39.2	38.9
	120	57	O	89.6	34.4*	61.6	52.7	52.7	52.7
P-3	40	38.4	L	39.4	not accessible	40.1	40.1	40.1	40
	80	Dry	E	Dry	not accessible	Dry	DRY	DRY	DRY
	120	Dry	S	Dry	not accessible	119.1	118.9	118.8	118.1
P-4	40	31.9		35.8	4.2	12.5	18.2	15.3	19.4
	80	40.2	P	53.2	21.4	12.8	19.4	20.8	21.5
	120	38	U	81.4	8.7	11.7	17.1	18.1	22.4
P-5	40	38.1	R	Dry	34.3	32.6	30.4	30.1	31.5
	80	44.7	G	67.1	40.8	39.8	38.1	37.9	40.9
	120	Dry	E	Dry	117.8	111.8	108.5	108.4	75
P-6	40	33.8	D	36.9	29.5	16.9	15.9	16.2	22.3
	80	31.3		56.2	31	21.9	20.6	20.5	23.2
	120	53.6		81.1	53.1	49.5	51.2	51.1	50.6
P-7	40							11.2	11.8
	80							78.6	20.7
	120							33.1	29.9
P-8	40							10.4	14.7
	80							29.7	24.4
	120							28.7	29.8
P-9	40							31.5	38.1
	80							DRY	DRY
	120							76.4	77.9
P-10	40							9.2	9.9
	80							15.5	10.6
	120							17.2	18.9
PD-1	40								16.3
	80								24.3
	120								23.9
PD-2	45								15
	65								40.7
	95								45
I-1	120	56.6		71.1	52.9	53	50.6		52.8
I-2	120	44.6		77	68.2	12.6	17		23.9
I-3	150	126.5		133.2	40	35.5	35		34.1

Note: * PVC opening below 6" of standing water in casing, not accurate reading


Qld
Tcc
Qla
Qla?
Qlo
dg
Tcc?
LEGEND
Exposure of subsurface soils and rock
Approximate location of Test Pit
Approximate Piezometer location
Approximate Inclinometer location
Approximate Boring Location
Approximate Core hole location
Approximate Wide Diameter Boring location
Mapped Bedrock Fault
Spring
Boundary of ancient landslide
Geologic / Landslide boundary
Landslide scarp
Accelerated erosion
Section location
EXPLANATION
dg disturbed ground
Qla active landslide
Qld dormant landslide
Qlo ancient landslide
Tcc Tertiary non-marine sediments (bedrock)
Scale: Horizontal and Vertical 1" = 200'
TERRASEARCH INC
GEOLOGIC SITE PLAN
GEOTECHNICAL INVESTIGATION
FOREST GREEN ESTATES
RICHMOND, CALIFORNIA
GC
AS SHOWN
Figure No.
1

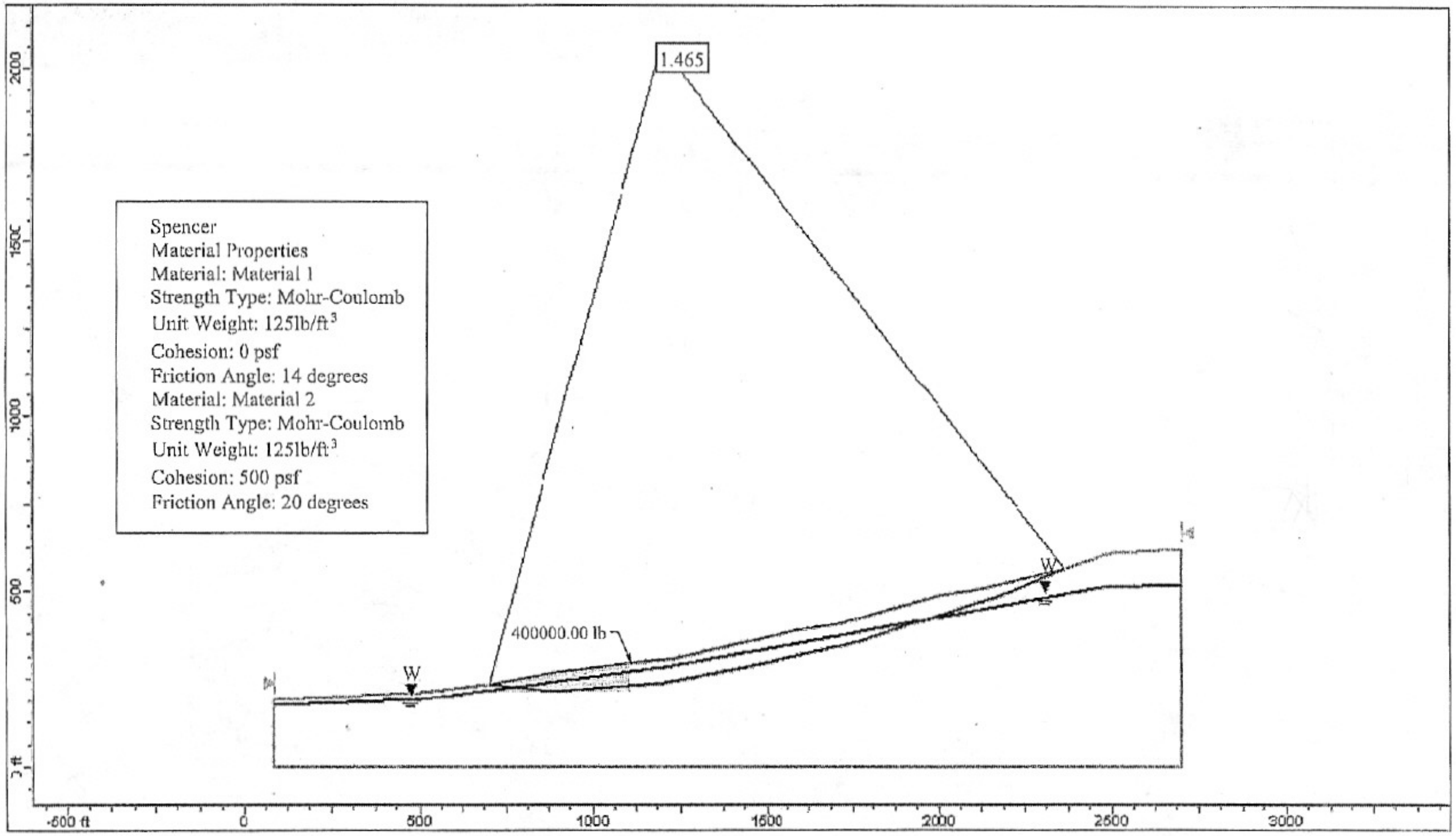


GEOTECHNICAL ENGINEERS AND GEOLOGISTS

TERRASEARCH INC.

257 WRIGHT BROTHERS AVENUE, LIVERMORE CALIFORNIA 94551 PHONE: (925) 243-6662

CROSS SECTIONS EE, FF, & GG			Figure No.
FOREST GREEN ESTATES RICHMOND, CALIFORNIA	Project No.: 7707.G	Drawn by: GC	2
	Scale: AS SHOWN	Date: 8/2005	



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TERRASEARCH INC.

257 WRIGHT BROTHERS AVENUE, LIVERMORE CALIFORNIA 94551 PHONE: (925) 243-6662

STABILITY ANALYSIS FOR SECTION H-H

FORREST GREEN ESTATE
RICHMOND, CALIFORNIA

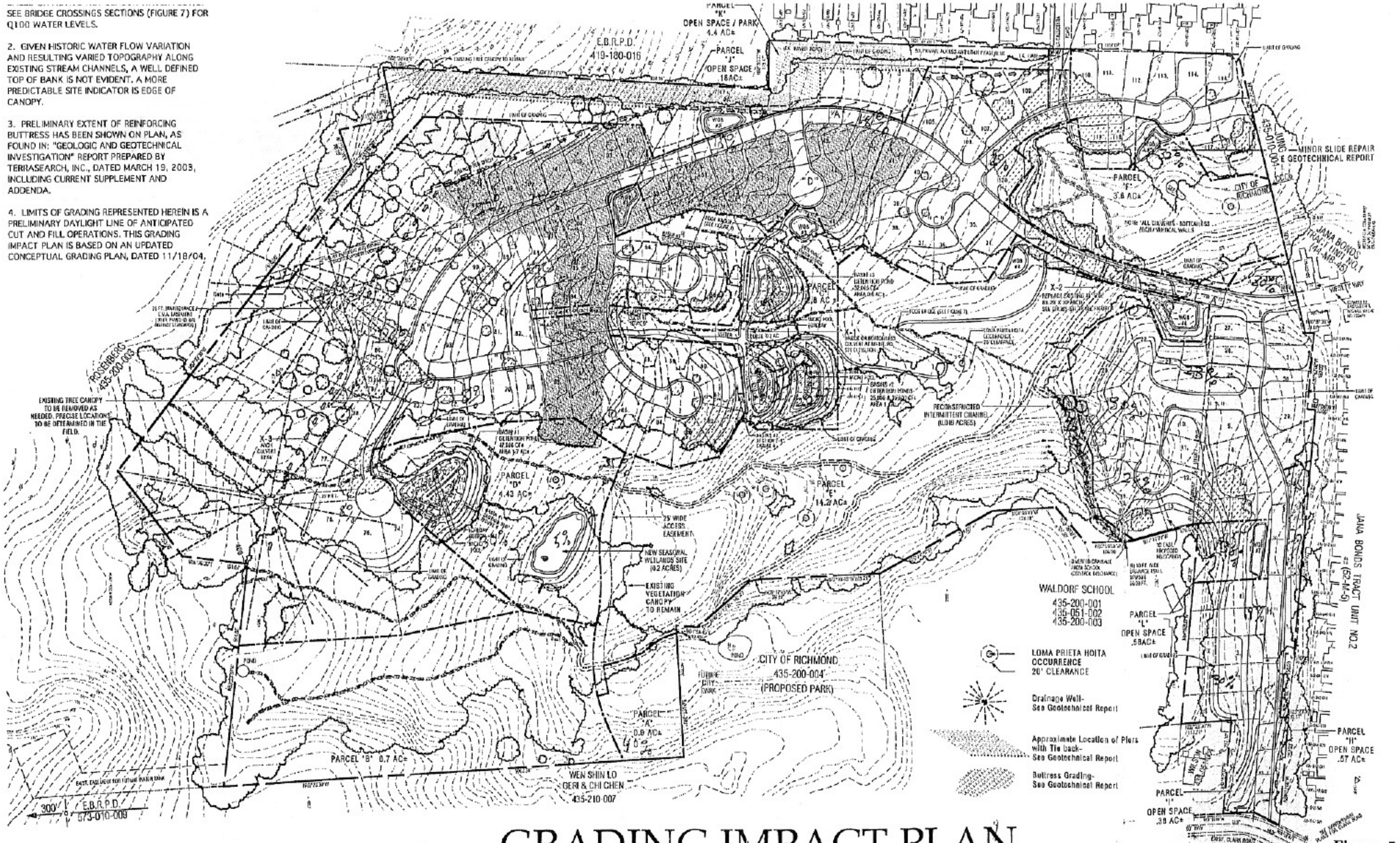
Project No.	Drawn by:	Figure No.
7707.G	GC	4
Scale: N.T.S.	Date: 8/2005	

SEE BRIDGE CROSSINGS SECTIONS (FIGURE 7) FOR Q100 WATER LEVELS.

2. GIVEN HISTORIC WATER FLOW VARIATION AND RESULTING VARIED TOPOGRAPHY ALONG EXISTING STREAM CHANNELS, A WELL DEFINED TOP OF BANK IS NOT EVIDENT. A MORE PREDICTABLE SITE INDICATOR IS EDGE OF CANOPY.

3. PRELIMINARY EXTENT OF REINFORCING BUTTRESS HAS BEEN SHOWN ON PLAN, AS FOUND IN: "GEOLOGIC AND GEOTECHNICAL INVESTIGATION" REPORT PREPARED BY TERRASEARCH, INC., DATED MARCH 19, 2003, INCLUDING CURRENT SUPPLEMENT AND ADDENDA.

4. LIMITS OF GRADING REPRESENTED HEREIN IS A PRELIMINARY DAYLIGHT LINE OF ANTICIPATED CUT AND FILL OPERATIONS. THIS GRADING IMPACT PLAN IS BASED ON AN UPDATED CONCEPTUAL GRADING PLAN, DATED 11/18/04.



GRADING IMPACT PLAN

Figure 5

FOREST GREEN ESTATES

0 50 100 200 400
FEET

RICHMOND, CALIFORNIA
08/23/05

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TERRASEARCH INC.
257 WRIGHT BROTHERS AVENUE, LIVERMORE CALIFORNIA 94551 PHONE: (925) 243-6662