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Foster Gambee
GEOTECHNICAL, PC
Geotechnical & Geological Engineering Services

GT-000047

INVEST0047

August 7, 2000

318 NW Lomita Terr
1N 1E 32 DA 03900

Dr. Mark and Cindy Terry
c/o RJR Construction, Inc.
9200 SE Rodlun Road
Gresham, OR 97080

SUBJECT: GEOTECHNICAL INVESTIGATION, RESIDENTIAL ADDITION, 318 NW LOMITA TERRACE, PORTLAND, OREGON

At your request, Foster Gambee Geotechnical has conducted a geotechnical investigation for a new addition to the above-referenced single-family residence. The purpose of our investigation was to evaluate site conditions with respect to the development plans and to provide geotechnical-related guidelines and criteria for design and construction of the addition.

The scope of work was limited to a review of the available geologic literature for the property area, a reconnaissance of the property, shallow subsurface explorations at the proposed building site, limited laboratory testing, and engineering analyses. Our fee for the above work and terms under which services were provided are in accordance with our July 10, 2000 proposal. This letter report describes the work accomplished and provides our conclusions and recommendations regarding site preparation, foundation support, and new retaining walls.

PROJECT DESCRIPTION

The Site Plan, Figure 1, shows the footprint of the proposed addition with respect to that of the existing residence. Based on discussions with Randy Russell of RJR Construction, we understand the approximately 14 by 21 ft addition will be situated on the north side of the existing residence and consist of a two- or three-story, wood-frame structure. The lower floor of a three-story addition would be established at about the grade of the existing deck. The lower level of a two-story addition would be approximately 8 ft above existing deck grade. As currently planned, the existing foundation on the north side of the residence may be utilized to support the south side of the addition.

We understand additional improvements may include removal of the westernmost (i.e., upslope) stone retaining wall that appears to have experienced some damage, as evidenced by cracking, and replacement with a conventional cast-in-place concrete wall.

SITE CONDITIONS

Geologic Setting and Hazards

A review of the available geologic literature indicates the property is mantled by wind-deposited silt, referred to as Portland Hills Silt, which is underlain by the Columbia River Basalt.[1] The Portland Hills Silt consists of brown silt containing variable amounts of clay and fine-grained sand. The Columbia River Basalt is a dense, fine-grained igneous rock that is typically dark gray where fresh, and brown or reddish-brown where weathered. Severe weathering of the basalt results in a brown or reddish-brown, clayey silt residual soil that contains basalt gravels and cobbles near the contact with the underlying weathered bedrock.

On the Relative Earthquake Hazard Map of the Portland Metro Region, Clackamas, Multnomah and Washington Counties, Oregon, the property is mapped in zone A.[2] (Range: A–D, with A being the highest relative hazard.) This designation is due to the risks of ground motion amplification and slope instability during a relatively strong seismic event. Although it is now widely accepted that damaging earthquakes much larger than any in the historical record are possible in the Portland area, it is difficult to accurately predict their magnitude, location, and probability due to the lack of a complete historical record. For this reason, the Relative Earthquake Hazard Maps do not quantify the earthquake hazard at any given site, but are limited to depicting general areas with relatively higher risk of earthquake damage due to local geologic and topographic conditions.

Surface Conditions

A ground-level reconnaissance of the property was conducted on July 20, 2000. The purpose of the reconnaissance was to observe and evaluate materials exposed at the ground surface, indications of slope instability, the condition of foundations for the existing residence, site drainage, and any other conditions that might affect property development.

The property is situated on an east-facing hillside and is bordered by NW Lomita Terrace to the west and NW Beuhla Vista Terrace to the east. The existing residence is a two-story structure on top of a daylight basement. The exterior finish on the residence is stucco. The area of the proposed addition is currently covered by a deck. As shown on the cross section A-A' depicted on Figure 2, the ground surface in the proposed addition area slopes steeply down to the east from Lomita Terrace to Beuhla Vista Terrace and is terraced with a series of stone retaining walls. The overall slope between Lomita Terrace and Beuhla Vista Terrace within the addition area is on the order of 1.5H:1V. The approximate location of section A-A' is shown on Figure 1.

Surface soils observed during the reconnaissance consist primarily of brown silt containing variable amounts of clay and fine-grained sand. In general, the surface soils in the vicinity of the planned addition appear moderately well drained, with no springs or ponded water observed in this area. Water was observed entering the uphill portion of the addition area from the irrigation system of the adjacent residence, which is currently for sale. It appears the adjacent residence is vacant and the irrigation system was inadvertently left on.

No obvious indications of large-scale, active or recent landsliding, such as fresh ground breaks or scarps, were observed in the proposed addition area. However, cracks up to ½ in. wide were observed in the uppermost rock retaining wall. These cracks, along with supplemental support of one of the intermediate rock walls with small diameter pipe piles, indicate some movement of the surficial soils has likely occurred.

The existing residence appears to be supported by conventional spread footing foundations. The exposed portion of the perimeter foundation and the exterior stucco walls are free of significant cracking or other indicators of excessive settlement or slope instability.

Subsurface Exploration and Conditions

Subsurface conditions at the site were explored on July 20, 2000 with two hand-auger borings, designated B-1 and B-2, drilled to depths of 10.5 and 6.0 ft, respectively. Approximate boring locations are shown on Figure 1. The relative consistency of subsurface materials was evaluated by observing auger cuttings and noting the relative ease of auger advancement. Detailed logs of conditions and materials encountered in the borings were maintained, and representative soil samples were obtained for further examination in our laboratory, where their physical characteristics were noted and field classifications modified where necessary. The natural moisture content of each soil sample was determined in our laboratory in substantial conformance with ASTM D 2216. Materials and conditions encountered in the borings are summarized in Table 1. Terms used to describe soil materials are defined in Table 2.

Soils encountered in the two borings are relatively uniform and consist of brown to brown and gray silt containing a trace to some clay and fine-grained sand. The upper 6 in. or so of the soil profile has been disturbed and contains some organics. The relative consistency of the silt increases from medium stiff in the upper 3 ft to stiff below a depth of about 3 ft. The natural moisture content of the silt soils is in the range of 24 to 35%.

Groundwater was not encountered in either boring. The regional groundwater level at the site is expected to be relatively deep; however, it should be anticipated that a perched water condition will develop within the silt overburden soils during periods of prolonged or intense precipitation.

CONCLUSIONS AND RECOMMENDATIONS

General

The site of the proposed addition slopes steeply down to east and is underlain by medium stiff to stiff silt soils. The hillside in the area of the proposed addition has been terraced with rock retaining walls that exhibit some indication of surficial ground movement.

In our opinion, the site is suitable for support of the proposed addition from a geotechnical standpoint. However, due to the steeply sloping nature of the site and the potential for downslope movement of the near-surface soils, we recommend foundation support for the proposed addition be provided by drilled piers. In our opinion, a deep foundation system is prudent to reasonably limit the risk of potential slide damage. A "reasonably limited risk" is defined as a low (but not absent) risk of slide occurrence during the design life (60 to 80 years) of the structure, and a risk no higher than that of the existing residence and many of the developed properties in the surrounding neighborhood. Quantification (numerical analysis) of this risk is beyond the scope of this investigation.

Specific recommendations for site preparation, foundation support, and new retaining walls are provided in the following paragraphs.

Site Preparation

Due to the presence of fine-grained, moisture-sensitive soils (soils that when wet are easily disturbed, rutted, and weakened by construction activities), all site preparation, grading, and foundation excavation work should be limited to the drier periods of the year, late spring to early fall, if feasible.

Disturbance of the existing, steeply sloping hillside should be minimized during construction of the addition. In this regard, removal of existing rock retaining walls that will not be replaced should be limited to those areas where conflicts with the addition exist, such as at footing locations.

Temporary cut slopes greater than 4 ft high should be made no steeper than about ½H:1V. Permanent cut slopes should be no steeper than existing surrounding slopes. Excavation spoils that are not used to backfill foundations or walls should be removed from the site.

Foundation Support

In our opinion, foundation support for the proposed addition and new retaining walls can be most effectively provided by cast-in-place concrete piers. We recommend the piers have a minimum diameter of 18 in. and extend to a depth of at least 16 ft below the existing ground surface.

An allowable compressive capacity on the order of 20 kips can be obtained with drilled piers meeting the above minimum diameter and embedment requirements. The allowable compressive capacity is appropriate for piers with a center-to-center spacing of at least three times the pier diameter and can be increased by one-third for transient loads, such as wind and seismic. The allowable capacity includes an estimated factor of safety of at least two, based on soil-supporting properties. We anticipate that the settlement of drilled piers installed in accordance with the recommended criteria will be less than 1 in. If required, greater capacities can be achieved by increasing the pier diameter and/or increasing the length of embedment.

Prior to inserting the steel reinforcing cage and placing concrete, the bottom of each pier shaft should be cleaned of loose cuttings until no more than 1 in. of loose material remains. Prior to the placement of concrete, each pier shaft should be examined by a qualified geotechnical engineer to observe the condition and overall quality of the shaft.

Embedded Walls

The following embedded wall design recommendations assume both that the wall backfill is level and compacted to 90 to 95% of ASTM D 698, and that the embedded wall is fully drained, i.e., hydrostatic pressure cannot act on the wall. Non-yielding walls (walls that are supported at the top and bottom) should be designed using a lateral earth pressure based on an equivalent fluid having a unit weight of 45 pcf. Walls that are allowed to yield by tilting about their base should be designed using a lateral earth pressure based on an equivalent fluid having a unit weight of 35 pcf. Where the ground surface or wall backfill slopes up at 2H:1V, walls should be designed using a lateral earth pressure based on an equivalent fluid having a unit weight of 80 pcf for non-yielding walls and 55 pcf for yielding walls. We further recommend that horizontal earth pressures due to surcharge loads be taken as an additional uniform pressure (rectangular pressure diagram) of 0.5 times the intensity of the surcharge load acting over the entire height of the wall.

A subsurface drain should be installed behind any new embedded walls. We recommend the drain consist of a minimum 4-in.-diameter perforated line placed at the foundation grade and covered with a minimum 1-ft-wide column of clean (containing less than 2% finer than the No. 200 sieve) drain rock that extends up to within 1 ft of the finished ground surface grade. The drain rock and drain line should be encapsulated in filter fabric (AMOCO 4545 or similar) to prevent soil contamination of the drain.

Plan Review and Construction Observation

A qualified geotechnical engineer should review final foundation plans prior to the start of construction and should examine the shafts of drilled piers prior to the placement of concrete.

LIMITATIONS

Foster Gambee Geotechnical has prepared this report to aid in the design of this project. The scope is limited to the specific project and location described herein. Our description of the project represents our understanding of significant aspects relevant to the design and construction of an addition at the specified location. If changes are planned in the design and location of the addition, as outlined in this report, we should be given the opportunity to review those changes and to modify or reaffirm, in writing, our conclusions and recommendations.

Our conclusions and recommendations are based on data obtained from the borings made at the locations indicated on Figure 1 and from other sources of information discussed herein. In the performance of subsurface explorations, specific information is obtained from specific locations at specific times. However, it is acknowledged that variations in soil conditions may exist away from the boring locations. This report does not reflect any variations that may occur away from these explorations, the nature and extent of which may not be evident until construction. If, during construction, subsurface conditions different from those found in the explorations are observed or encountered, we should be advised at once so that we can observe and review those conditions and reconsider our recommendations if necessary. Please contact us if you have any questions.

Sincerely,

FOSTER GAMBEE GEOTECHNICAL, P.C.

John E. Gambee, P.E.
Principal

1 Trimble, D.E., 1963, Geology of Portland, Oregon, and adjacent areas: U.S. Geological Survey Bulletin 1119.

2 Mabey, Matthew A. and others, Relative Earthquake Hazard Map of the Portland Metro Region, Clackamas, Multnomah, and Washington Counties, Oregon, IMS-1, State of Oregon Department of Geology and Mineral Industries, 1997.

Table 1

Subsurface Materials and Conditions

Boring No.	Depth Range, ft	Material Description	Moisture content, (ASTM D 2216)
B-1	0 to 10.5	Medium stiff, brown and gray SILT; trace to some clay and fine-grained sand	w = 26% @ 2.0 ft
		....soft/disturbed with some organics in upper 6 in.	w = 32% @ 4.5 ft
		....stiff below 3 ft	w = 35% @ 8.0 ft
		....trace clay below 4 ft	w = 32% @ 10.5 ft
		Bottom of boring 10.5 ft (7/20/00). Groundwater not encountered. Irrigation water flowing into area from neighboring residence.	
B-2	0 to 6.0	Medium stiff to stiff, brown SILT; trace clay and fine-grained sand	w = 24% @ 2.0 ft
		....disturbed with some organics in upper 6 in.	w = 34% @ 5.0 ft
		....stiff, brown and gray below 3 ft	w = 32% @ 6.0 ft
		Bottom of boring 6.0 ft (7/20/00). Groundwater not encountered.	

Table 2
Guidelines for Classification of Soil

Description of Relative Consistency for Fine-Grained (Cohesive) Soils

Relative Consistency	Standard Penetration Resistance (N-values), blows/ft	Torvane Undrained Shear Strength, psf
Very soft	2	Less than 0.125
Soft	2 to 4	0.125 to 0.25
Medium stiff	4 to 8	0.25 to 0.50
Stiff	8 to 15	0.50 to 1.0
Very stiff	15 to 30	1.0 to 2.0
Hard	Over 30	Over 2.0

Sandy silt materials which exhibit general properties of granular soils are given relative density description.

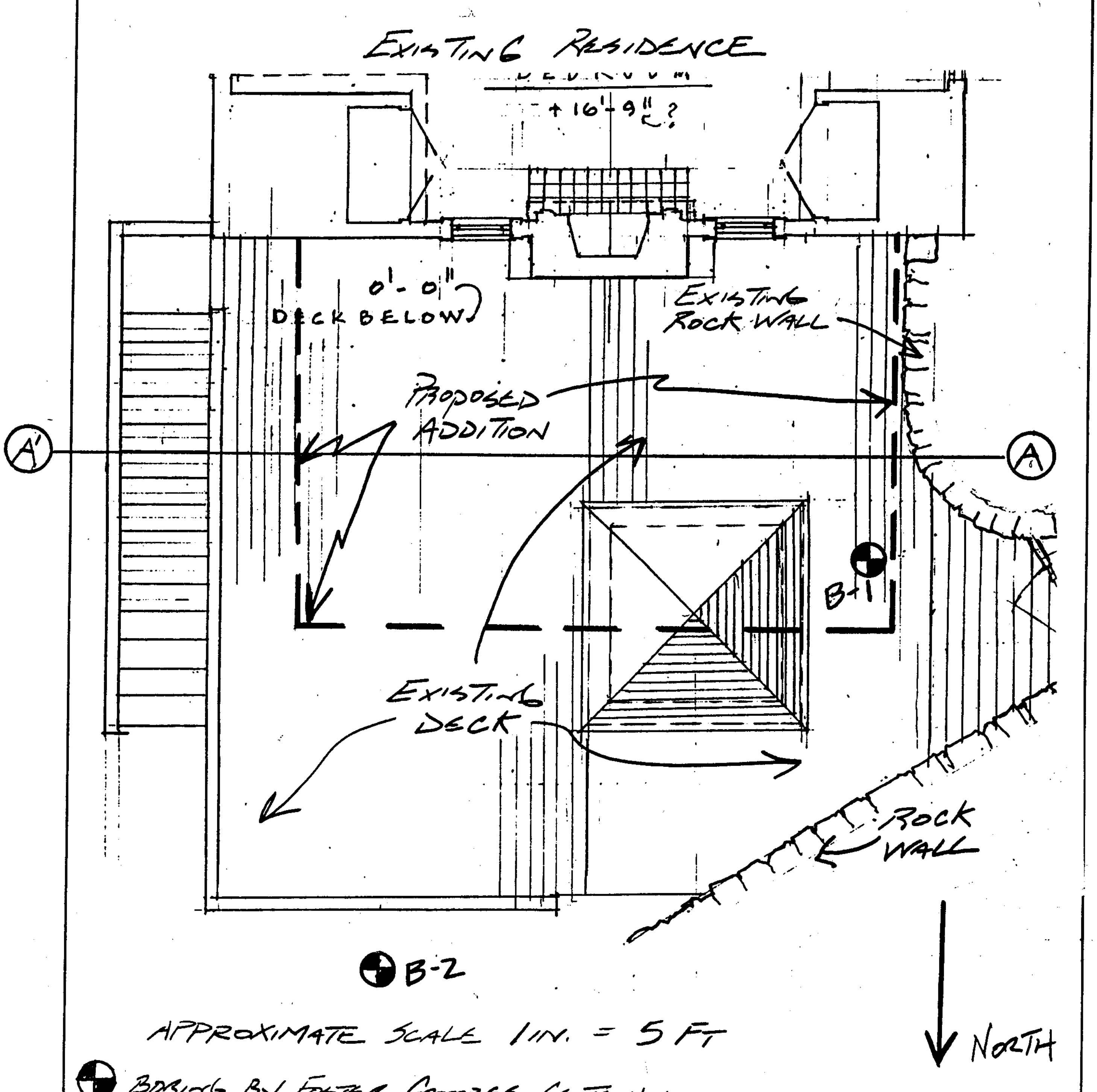
Description of Relative Consistency for Granular Soils

Relative Density	Standard Penetration Resistance (N-values), blows/ft
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	over 50

Grain-Size Classification	Modifier For Subclassification	
Boulders		**Percentage of**
12 to 36 in.		**Other Material**
Cobbles	**Adjective**	**In Total Sample**
3 to 12 in.	Clean	0 to 2
Gravel	Trace	2 to 10
¼ to ¾ in. (Fine)	Some	10 to 30
¾ to 3 in. (Coarse)	Sandy, Silty	30 to 50
Sand	Clayey, etc.	
No. 200 to No. 40 sieve (Fine)		
No. 40 to No. 10 sieve (Medium)		
No. 10 to No. 4 sieve (Coarse)		
Silt/Clay		
Pass No. 200 sieve		

Foster Gambee
GEOTECHNICAL, PC
Geotechnical & Geological Engineering Services
(503) 621-1233 | Fax (503) 621-3450

Subject SITE PLAN FIGURE 1	By JEG	Page No. 9/10	
Project TERRY RESIDENCE	Date 8/7/00	Job No. 0047	



APPROXIMATE SCALE 1 IN. = 5 FT

BORING BY FOSTER GAMBEE GEOTECHNICAL, PC (8/20/00)

SITE PLAN FROM DRAWING BY
ANDREW C. WHEELER ARCHITECT & PLANNER (UNDATED)

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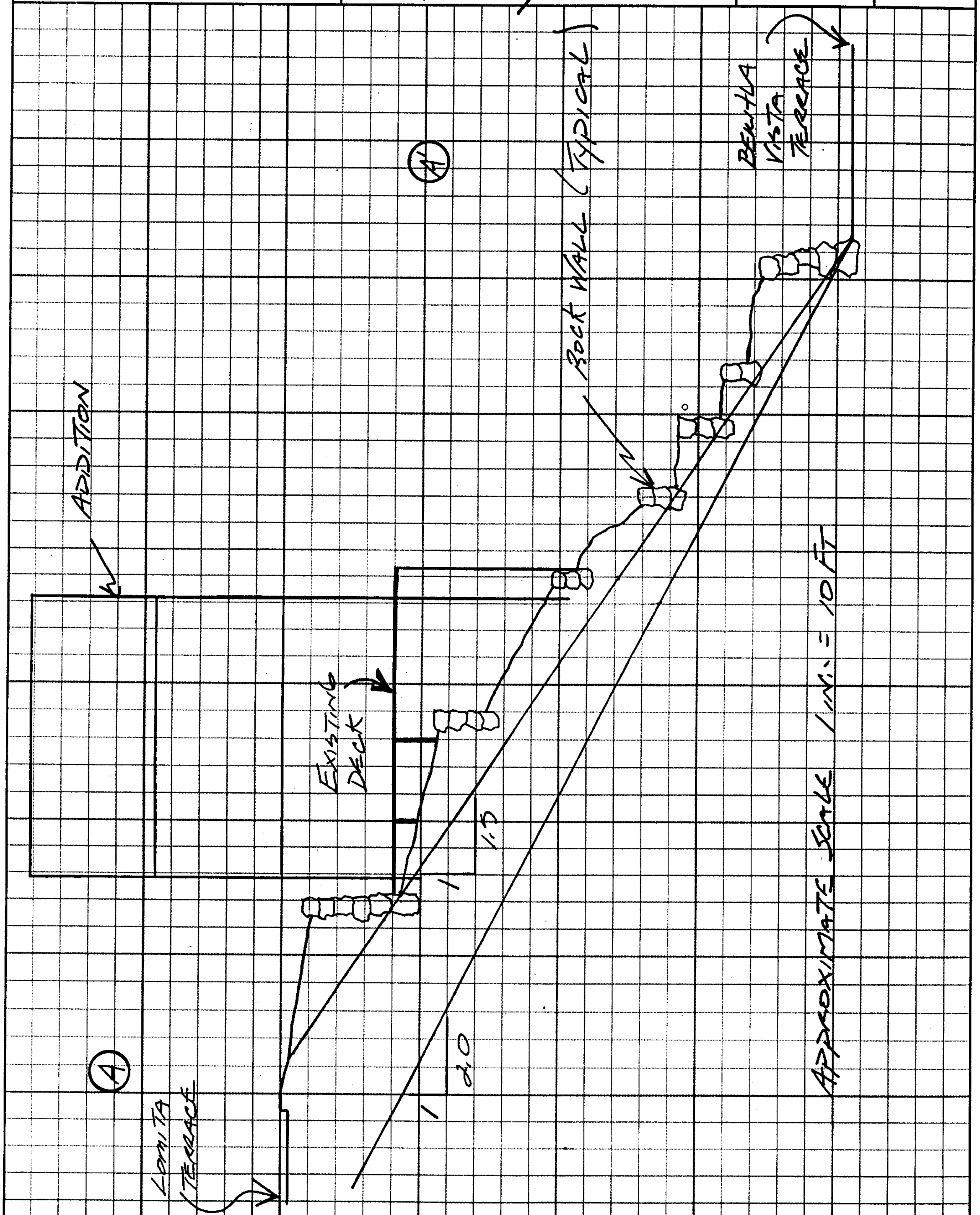
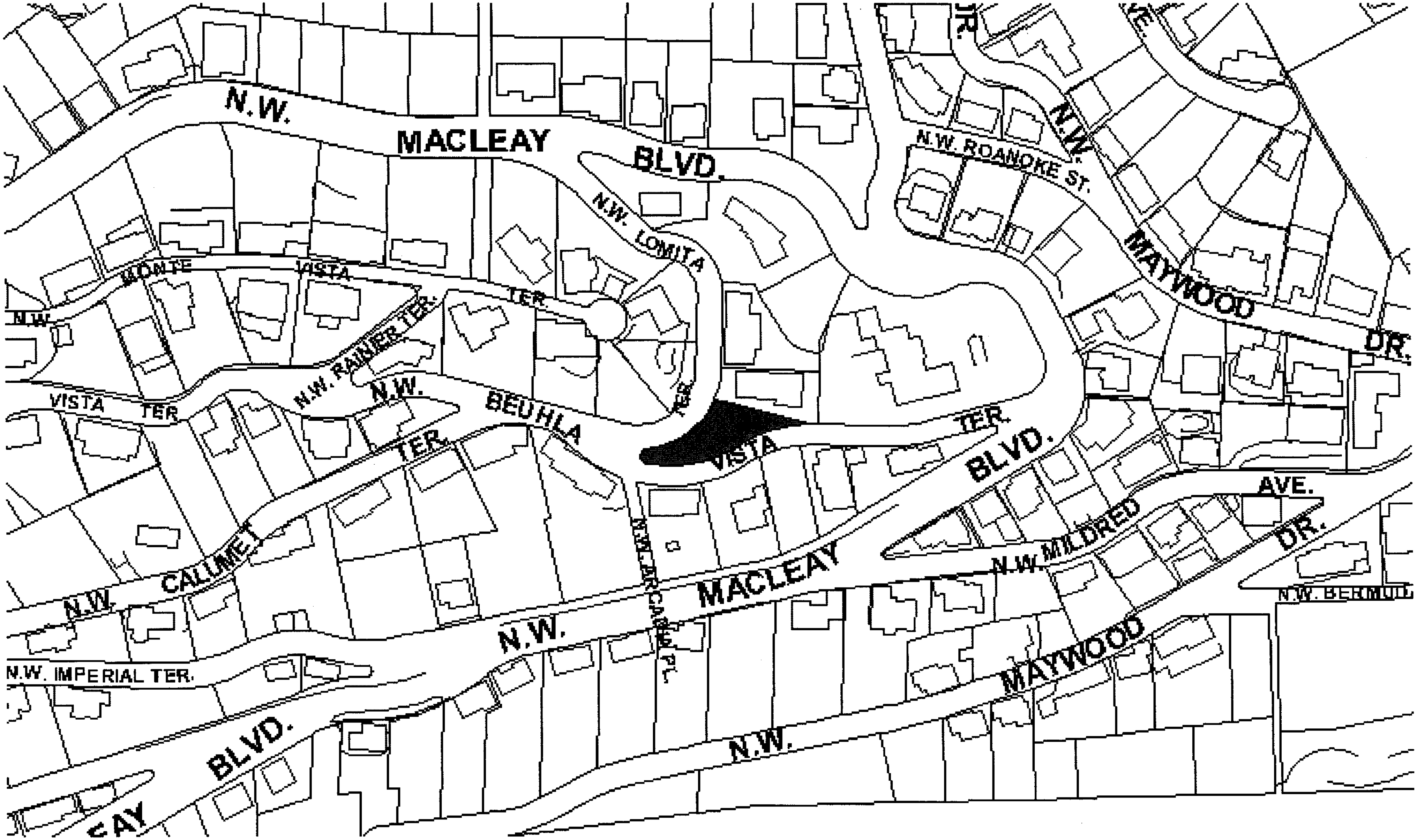
(503) 621-1233 | Fax (503) 621-3450

Subject: SECTION A-A' FIGURE 2	By: JEG	Page No. 10/10
Project: TERRY RESIDENCE	Date: 8/7/00	Job No. 0047

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N.W. ROANOKE ST.
N.W. MAYWOOD DR.
N.W. LOMITA TER.
N.W. MONTE VISTA TER.
N.W. RAINIER TER.
N.W. VISTA TER.
N.W. BEUHLA VISTA TER.
N.W. CALUMET TER.
N.W. ARCADIA PL.
N.W. MILDRED AVE.
N.W. IMPERIAL TER.
N.W. MACLEAY BLVD.
N.W. MAYWOOD DR.
N.W. BERMUD