ATTACHMENT 17
ZON06-00019

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

February 28, 1983 E-1802

Western Realty
Lincoln Center Building
515 116th Avenue N.E., Suite 225
Bellevue, Washington 98004

Attention: Mr. Gordon Hart

Subject: Preliminary Geotechnical Engineering Study
Commercial Development on 9 Acre Site
West of 132nd Place N.E.
Between N.E. 126th & 128th Place
Kirkland, Washington

Gentlemen:

We are pleased to submit this report presenting the results of our preliminary geotechnical engineering study for the proposed commercial building development in Kirkland, Washington.

The project site is generally covered by one to seven feet of slope wash materials consisting of loose brown silty sands. Underlying the surficial slope wash are recessional deposits consisting of medium dense to dense sands above approximately Elev. 245. Below this elevation, the slopewash materials are underlain by glacially consolidated, very dense to hard clayey silts with interbedded sands and clays.

The major geotechnical considerations affecting development of the site are 1) drainage and groundwater seepage at the site, 2) erosion of surficial soils and 3) relative stability of large cuts at the site. Foundation support can be provided by continuous or spread footings founded on undisturbed hard clayey silts or very dense sands. Alternately, the foundations can be supported on engineered fill which in turn is keyed into competent materials.

Based on the findings and recommendations presented herein, the project is geotechnically feasible as proposed. It should be noted that once the plans and design concepts for the proposed buildings are finalized, Earth Consultants, Inc. should be allowed to review these plans with respect to the preliminary recommendations presented in this report.

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If you have any questions or further comments, please call this office.

Respectfully submitted,

EARTH CONSULTANTS, INC.

Anil Butail, P. E.
Chief Engineer

WC/AB/jg

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INTRODUCTION

GENERAL

This report presents the results of our preliminary geotechnical engineering study for the proposed commercial building development on the west side of 132nd Place N.E., between N.E. 126th and 128th Place in Kirkland, Washington.

The purpose of this study was to explore the subsurface soil conditions in order to provide conclusions regarding the stability of slopes and recommendations for grading, foundations and retaining wall design. Work for this study included borings, laboratory tests, geotechnical engineering analysis and the preparation of this report.

PROJECT DESCRIPTION

The project site is located on the west side of 132nd Place N.E. between N.E. 126th and 128th Place in Kirkland. At the time our study was performed, the site layout was as shown schematically on the Boring Location Plan, Plate 1. This is based on a topographic survey dated February 1981 prepared by Moore, Wallace & Kennedy, Inc.

Development of the site will consist of one or more, one to two-story commercial structures, although no site layout or building details have been finalized.

We recommend that as design concepts are developed, Earth Consultants, Inc. be allowed to review the plans to aid in the interpretation of the preliminary recommendations presented in this report.

SITE CONDITIONS

SURFACE

The site is located on the west side of 132nd Place N.E., between N.E. 126th and 128th Place, in the Totem Lake area of Kirkland, Washington. The site is bordered on the north by existing single-family residences, on the west by undeveloped land and on the south by an existing light industrial building. The site is part of the upper two-thirds of the northern slope of a broad valley that extends from the Sammamish Valley to Lake Washington. The single-family residences described above are at the top of this slope; the existing light industrial structure is located at the toe of this slope.

The site slope is dissected by two ravines; a broad ravine along the western property line, and a sharper ravine through the center of the site. Previous grading on the site is evidenced by a broad level bench in the southwest portion of the site. Above this bench, a cut up to thirty (30) feet in height, with a slope inclination on the order of 65 degrees, is present. Immediately south of the site are two ten foot high cuts with a thirty (30) to forty (40) foot wide bench in between the cuts. A broad excavated swale directs runoff from the central ravine into the ditch along the west edge of 132nd Place N.E.

Natural slopes on the site are as steep as 30 to 45 degrees with steeper inclinations in the previously mentioned cut areas. A broad, nearly level area is present above the slope in the north-eastern portion of the site. The site is covered by an open to dense cover of native trees up to thirty-six (36) inches in diameter. Beneath the trees, dense brush provides nearly continuous ground cover.

Surficial seepage was noted on the slope immediately below the southeast half of the site and in a fresh cut on the west side of the site. At the time of our field exploration, a small creek was present in the central ravine, as shown on Plate 1.

Based on our site observations and the existing topographic survey by Moore, Wallace and Kennedy, Inc., no slump block features nor landslide scarps were noted. In addition, the borings that we performed at the site did not reveal any weak layers at depth that could be interpreted as existing or potential landslide failure planes.

Although no evidence of deep seated instability was noted at the site, leaning tree trunks generally indicate that shallow surficial soil creep/erosion is occurring on the slopes at the site.

SUBSURFACE

The borings and soil exposures indicate that the site is covered by one (1) to twenty-five (25) feet of brown silty sands that grade from loose to medium dense on the top five feet to dense and very dense at depths greater than five feet.

Underlying the sands is a thick deposit of hard clayey silt that is interbedded with thin layers of clays, silts and sands that are hard to very dense.

GROUNDWATER

Groundwater observation wells were installed in Borings B-1 through B-4. In Borings B-2 through B-4, the drilling fluids and cuttings were flushed from the borings with fresh water, following the completion of the borings. Measured groundwater levels are presented on the individual boring logs. Generally, it is our experience that groundwater on this slope occurs as a surficial, perched groundwater table. This condition occurs as runoff and precipitation, upon infiltrating the relatively loose near surface soils, encounters and subsequently becomes perched above the relatively impermeable clays and silts that underlie the slope. These surficial perched water tables generally fluctuate with the amount of rainfall during a particular season of the year. It is possible that some of the sandier layers in the clays and silts are water-bearing. We will continue to monitor our groundwater observation wells to delineate the extent and variations in the level of groundwater.

GEOLOGY

The project site is located on the northern slope of a broad east-west trending valley that extends between the north-south trending Sammamish Valley and the trough formed by Lake Washington.

The thick deposit of very dense to hard silts, sands and clays encountered beneath Elev. 245 in Boring B-2 were lacustrine deposits (sediments deposited in a lake) that were subsequently overridden by many thousands of feet of ice during one of the many glacial periods. The weight of the ice had compressed these lake deposits into their present compact state. The east-west trending valley that the project site is located on was probably one of the outflow channels that glacial Lake Sammamish carved out as the Vashon Glacier receded (T.A. Curran, 1965).

The medium dense to dense brown silty sands encountered in Boring B-2 above Elev. 245 are recessional materials deposited during the last glacial retreat of the Puget Sound Basin approximately 15,000 years ago. The loose silty sands in the other borings are slope wash materials that were encountered and carried downhill by erosional processes.

DISCUSSION AND RECOMMENDATIONS

1.0 GENERAL

As described earlier in this report, the site is basically underlain by glacially consolidated silts at relatively shallow depths. This dense overconsolidated strata should provide adequate bearing for the proposed structures supported on conventional footings. Floor slabs may also be supported on grade. The surficial loose topsoil materials are not suitable for support of building loads. Building loads, must, therefore, be extended beneath these materials. Foundations for the buildings will be primarily in excavated areas. All footings should be extended through any fills and surficial loose soils to the firm soils below.

The following sections of this report present more detailed recommendations for various geotechnical engineering aspects of the project which should be incorporated into the project design and construction. This report has been prepared for specific application to this project in accordance with generally accepted geotechnical engineering practices for the exclusive use of Western Realty and their representatives. No other warranty, expressed or implied, is made.

2.0 SEISMIC DESIGN CONSIDERATIONS

2.1 MAXIMUM CREDIBLE EARTHQUAKE

A maximum credible earthquake is the maximum earthquake that a given tectonic mechanism appears capable of generating. While it is highly unlikely, it is still an event that would occur within the geologic framework as it is presently understood.

The maximum credible earthquake that could affect the project site would be one of Richter magnitude 7.5 occurring approximately twenty-five (25) miles beneath the surface, according to the U.S. Geological Survey Report (1975) for the Puget Sound area. The maximum credible earthquake would produce an average value of maximum acceleration in rock near the surface of 0.23g, according to the correlations developed by Schnabel and Seed (1972).

Attenuation of the bedrock motion through soil strata has been evaluated by the use of the relationships proposed by Seed et al (1975) and peak soil accelerations at the ground surface of 0.18g are expected. Structural elements should be designed to withstand a pseudo-static lateral acceleration of 0.12g (two-thirds of the peak acceleration).

The maximum credible earthquake will have less than 10 percent chance of occurring during the estimated 50 year design life of the proposed facility.

2.2 LIQUEFACTION POTENTIAL

Soil liquefaction is a phenomenon where loose granular soils beneath the water table are subject to a temporary loss of strength usually associated with ground shaking.

Since the groundwater tables at the site are located within the very dense to hard materials, the site will not be affected by the liquefaction phenomenon.

3.0 SLOPE STABILITY ANALYSIS AND EVALUATION

The relative stability of the slopes has been evaluated by use of topographic surveys, site reconnaissance, boring information and slope stability analysis based on laboratory soil strength parameters.

As described in the Site Conditions section of this report, the topographic surveys and visual observations were used to determine if any large earth movements have occurred at the site, and none were found. Nor did our borings reveal any weak layers at depth that could be interpreted to be failure planes. In addition, we have performed slope stability analyses on Sections A-A' and B-B' across the project site. The location of the sections is on Plate 1 and the sections are presented on Plate 2.

Slope stability of deep circular failure surfaces were evaluated using the computer program SLOPE developed at the Massachusetts Institute of Technology by Whitman and Bailey (1967) which uses Bishops Simplified Method (1955). A total of 174 circular surfaces were evaluated. The two circles with the lowest factor of safety are 1.72 and 1.73 for cross sections A-A' and B-B' respectively, as shown on Plate 2.

Shallow slope instability was evaluated using procedures detailed by Duncan and Buchignani (1975). Variations in soil strength parameters and perched groundwater seepage conditions were analyzed. The results of which indicate that a minor cohesive strength or slight cementation in the soils has a great effect upon the shallow slope stability, the same is true for water seepage parallel to the slopes. Therefore, we can conclude that surficial stability of the slopes can be greatly improved by not disturbing the in-situ soils outside of the building area, and by channelling water runoff away from the slopes as well as avoiding disruption to the natural drainage patterns, as detailed in Section 5.2 - Surface Drainage.

4.0 PROPOSED BUILDING

4.1 FOUNDATIONS

The proposed structures may be supported on conventional continuous and/or spread footings supported on very dense silty sands or the hard glacially consolidated clayey silts. Exterior footings should be bottomed a minimum depth of eighteen (18) inches below the adjacent final grade. Footings extending into hard or very dense undisturbed clayey silts may be designed for an allowable bearing pressure of four thousand (4000) pounds per square foot (psf), for dead plus live loads. We understand that these bearing values will provide minimum footing sizes. Bearing values can be increased to six thousand (6000) psf with a minimum width of twenty-four (24) inches at a depth of twenty-four (24) inches below the final adjacent grade. Continuous footings should have a minimum width of sixteen (16) inches. A one-third increase in the bearing pressures may be used when considering wind or seismic loads. The edge of all footings should be at least ten feet horizontally from the face of any slope.

Footing excavations should be examined by a representative of Earth Consultants, Inc. to verify that encountered conditions are as anticipated. Filter protected drains should be placed along all perimeter footings and connected to a positive discharge system.

4.2 LATERAL FORCES

Short term wind or seismic forces may be resisted by passive pressures, and/or friction between concrete and the supporting subgrade. The passive resistance may be considered as an equivalent fluid pressure of three hundred (300) pounds per cubic foot (pcf). This value assumes that all footing backfill is compacted in accordance with the Site Preparation recommendations in this report. A coefficient of friction of 0.35 may be considered between concrete and soil.

4.3 RETAINING WALLS

Basement and retaining walls should be designed to resist lateral earth pressures imposed by the soils retained by these structures. Walls that are free to rotate one-thousandth of their height at the top should be designed to resist lateral earth pressures imposed by an equivalent fluid with a unit weight of thirty-five (35) pcf. If walls are restrained from free movement at the top, they should be designed for an additional uniform pressure of one hundred (100) psf.

The above pressures assume a maximum wall height of ten feet and that no surcharge slopes or loads will occur above the walls. If deviations from these criteria are expected, we should be contacted for the appropriate design parameters.

All walls should be provided with adequate provisions for subsurface drainage.

4.4 FLOOR SLABS

Slab-on-grade floors may be supported on the compacted subgrade or on structural fill. In cut areas, the upper twelve (12) inches of subgrade should be compacted to 95 percent of maximum density to provide uniform conditions beneath the slab. The slab should be provided with a minimum of four inches of free draining sand or gravel. In areas where moisture is undesirable, a vapor barrier such as a plastic membrane should be placed beneath the slab. Two inches of sand may be placed over the membrane for protection during construction and to aid in curing of the concrete.

5.0 SITE PREPARATION

5.1 GRADING

The building and pavement areas should be stripped and cleared of trees, surface vegetation, all organic matter and any other deleterious material. It is anticipated that a stripping depth of approximately six (6) to twelve (12) inches will be required.

Stripped materials should be removed from the site or stockpiled for later use in landscaping, if desired. The stripped materials should not be mixed with any materials to be used as structural fill.

Following the stripping operation, the remaining surface in building and paved areas and in areas where structural fill is to be placed should be proofrolled under the observation of a representative of Earth Consultants, Inc. Any loose areas found should be removed and replaced with structural fill to a depth that will provide a stable base beneath the structural fill. The toe of all fills should be keyed into firm ground.

Structural fill should be placed in horizontal lifts not exceeding eight inches in uncompacted thickness. The fill should be benched into the slopes if the latter are steeper than 4:1. The fill should be compacted to a minimum of 95 percent of the maximum dry density in accordance with ASTM Test Designation D-1557-70 (Modified Proctor). The site soils contain an excessive amount of fines that will make them difficult to compact or work when wet. An approved granular imported fill may be required if grading operations are performed during wet weather. It should consist of a granular material with no more than 5 percent fines, passing the No. 200 sieve.

The proofrolling, structural fill placement and compaction should be observed and tested by a representative of Earth Consultants, Inc.

5.2 SURFACE DRAINAGE

Positive surface gradients should be provided to direct surface runoff away from the buildings towards suitable discharge facilities. Tight-lines and other non-erosive devices should be used for conveyance of surface runoff. Ponding of water should not be permitted. Slopes should be covered with an impervious membrane, or planted with a fast growing ground cover. Ditches should be provided at the top of all slopes to prevent surface water from running over slopes. If the proposed building is built across the existing creek, a sufficiently large tightline should be provided to channel the water beneath the building site.

We recommend all temporary slopes be cut no steeper than 1:1. Permanent slopes should be sloped at 2:1. We recommend that all excavated slopes be examined by a representative of Earth Consultants, Inc. to evaluate the stability of the exposed soils.

We did not encounter any groundwater in our test pits which were excavated during a relatively dry period. Although we did not encounter any groundwater, we believe that a perched condition may exist above the relatively impervious silt, or may occur within sand lenses in the silts. If present, groundwater should be controlled as outlined in the following section.

5.3 GROUNDWATER CONTROL

The subject site contains fine grained soils that will make grading operations difficult during wet weather. For this reason, it is important that groundwater be controlled wherever possible. Seepage should be anticipated from cuts during rainy weather. Surface interceptor ditches may have to be placed along the top of all cuts. Subsurface drains may have to be placed either along the toe or top of all cuts, whichever location appears to be more feasible. We suggest that appropriate locations of subsurface drains be established during grading operations by a representative of Earth Consultants, Inc., at which time the seepage areas, if present, will be more clearly defined. The site should be graded to drain at all times and all loose surfaces sealed at night to prevent the infiltration of rain into the soils. After a rainfall, equipment should remain off the soils until they have had a chance to dry sufficiently.

6.0 ADDITIONAL SERVICES

It is recommended that Earth Consultants, Inc. be provided the opportunity for a general review of the final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and construction.

The analyses and recommendations submitted in this report are based upon the data obtained from the borings. The nature and extent of variations between borings may not become evident until construction. If variations then appear evident, Earth Consultants, Inc. should be allowed to reevaluate the recommendations of this report prior to proceeding with the construction.

It is also recommended that Earth Consultants, Inc. be retained to provide geotechnical services during construction. This is to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event subsurface conditions differ from those anticipated prior to the start of construction.

We trust the information presented herein is adequate for your requirements. If you need additional information or clarification, please call.

Respectfully submitted,

EARTH CONSULTANTS, INC.

William Chang, P. E.
Project Engineer

Anil Butail, P. E.
Chief Engineer

WC/AB/jg

REFERENCES

Bishop, A.W., 1955, "The Use of the Slip Circle in the Stability Analysis of Earth Slopes", Geotechnique, Vol. 5.

Curran, T.A., 1965, "Surficial Geology of the Issaquah Area, Washington", a thesis submitted in partial fulfillment of the requirements for a degree of Master of Science, University of Washington.

Duncan, J.M., Buchignani, A.L., 1975, "An Engineering Manual for Slope Stability Studies", Department of Civil Engineering, University of California, Berkeley.

Schnabel, P.B., and Seed, H.B., 1972, "Accelerations in Rock for Earthquakes in the Western United States", Earthquake Engineering Research Center, University of California, Berkeley.

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APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

FIELD EXPLORATION AND LABORATORY TESTING

Our field exploration was performed during the last two weeks of May, 1982. Subsurface conditions at the site were explored by drilling five borings to a maximum depth of sixty-five (65) feet below the existing grade. The borings were drilled by Pacific Testing Laboratory using a small track-mounted drill rig. Rotary drilling equipment using a "revert" drilling fluid was used to advance the boreholes. The boring locations are shown on the Boring Location Plan, Plate 1. They were determined by tape and compass measurements from prominent trees located on the topographic map. Elevations of borings were determined by hand level and were interpolated between plan contours. The locations and elevations of the borings should be considered approximate only.

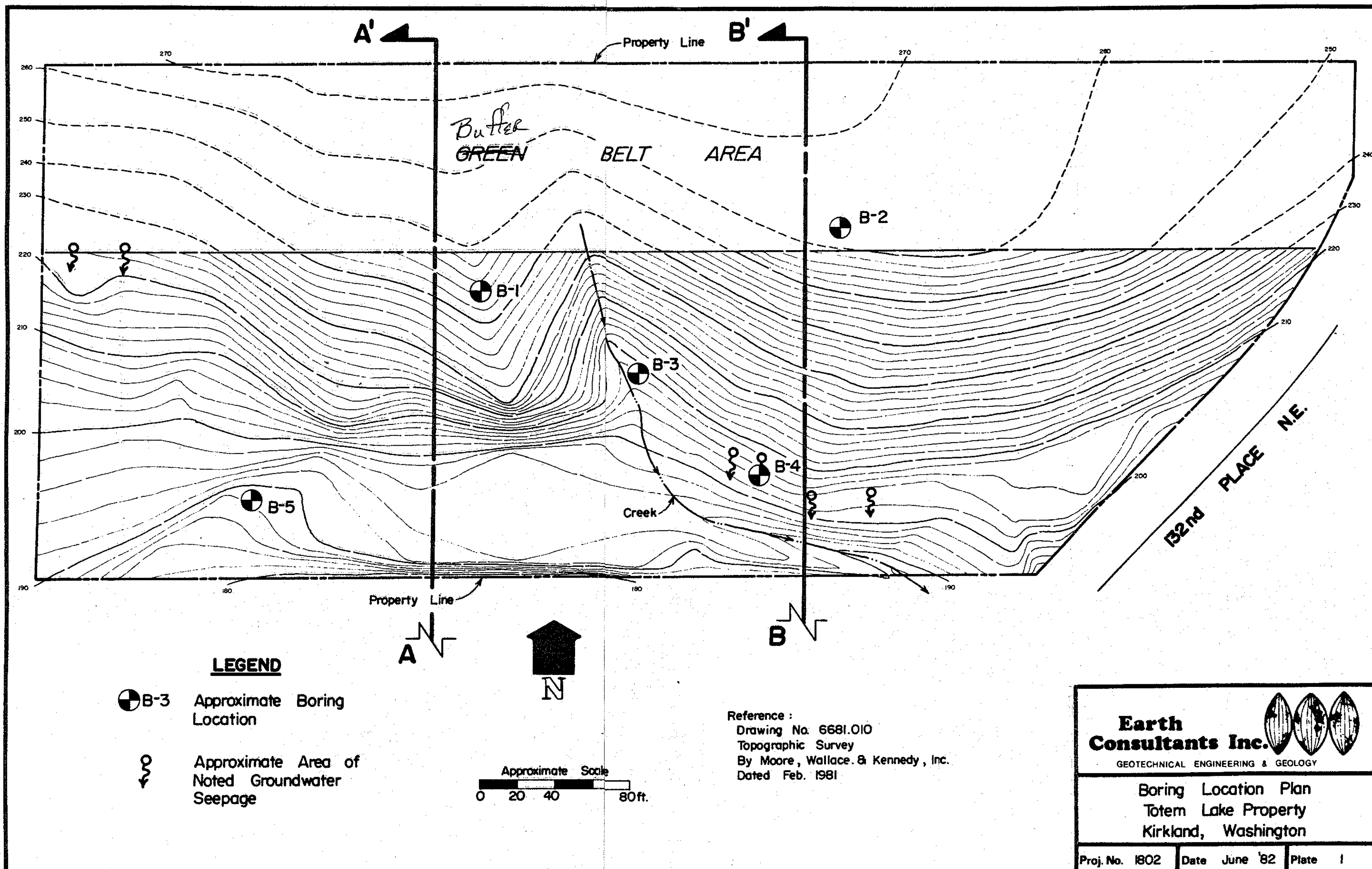
The field exploration was continuously monitored by an engineering geologist from our firm who classified the soils encountered, maintained a log of each boring, obtained representative samples, measured groundwater levels, and observed pertinent site features. Observation wells were installed in Borings B-1 through B-4 so that groundwater levels could be monitored. All samples were visually classified in accordance with the Unified Soil Classification System which is presented on Plate 3, Legend. Logs of the borings are presented on Plates 4 through 8. The final logs represent our interpretation of the field logs and the results of the laboratory examination and tests of field samples.

In each boring, Standard Penetration Tests (SPT) were performed at selected intervals in accordance with ASTM Test Designation D-1586. In addition, a 2.4 inch I. D. ring sampler was used to obtain relatively undisturbed soil samples at selected depths. Blow counts for this sampler have been adjusted to equivalent SPT values. All blow counts are shown on the boring logs at the appropriate depths.

Shear strengths of undisturbed soils were measured where practical in the field with a penetrometer or a torvane. These results are recorded on the boring logs at the appropriate sample depth.

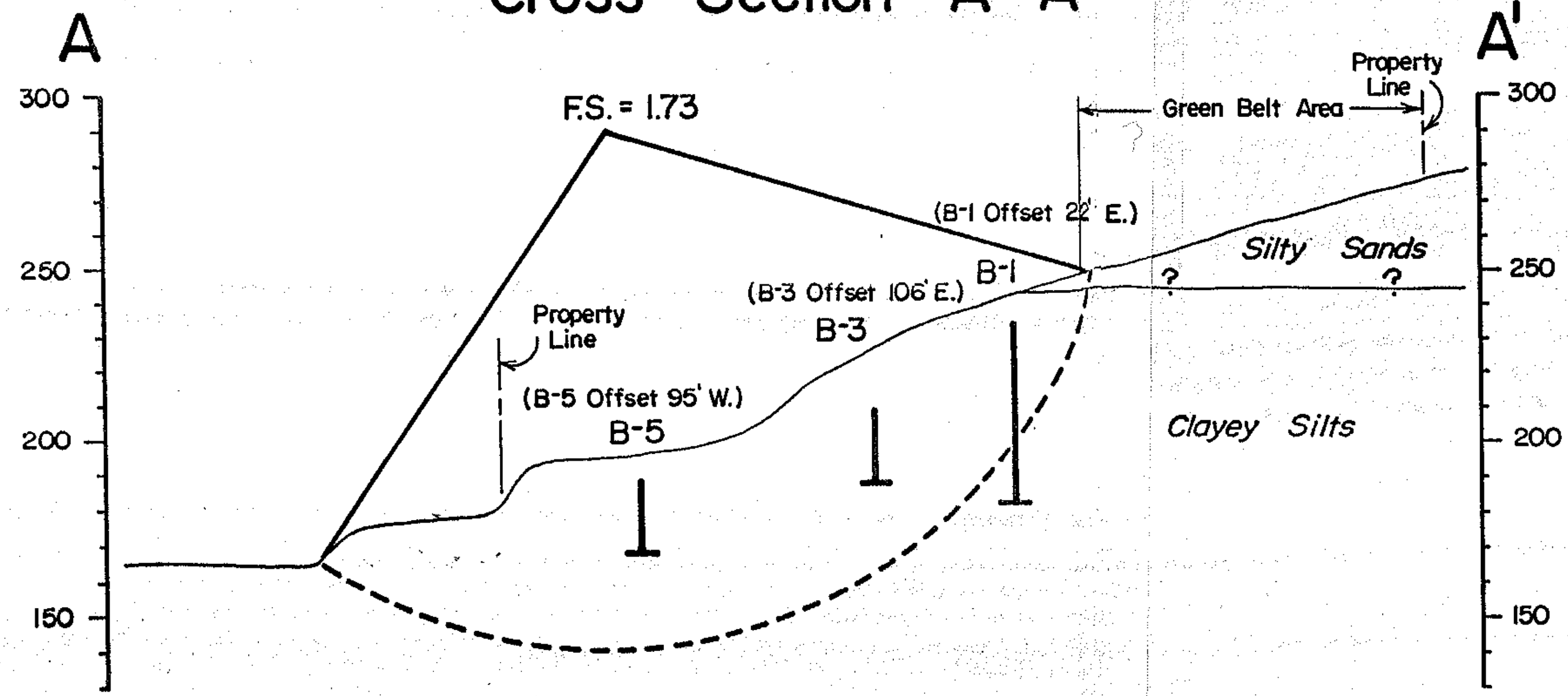
Representative soil samples were placed in closed containers and returned to our laboratory for further examination and testing. Visual classifications were supplemented by index tests such as sieve and hydrometer analyses and Atterberg Limits on representative samples. Field unit weight and moisture determinations were performed on all undisturbed ring samples, and moisture contents on all disturbed samples. Results of density and moisture determinations, together with classifications, are shown on the boring logs included in this report. The results of sieve and hydrometer analyses are illustrated on Plates 9 and 10.

Direct shear tests were performed on representative undisturbed ring samples to evaluate the strength parameters of the site soils. The results of these tests are graphically illustrated on Plate 11, Direct Shear Test Data.

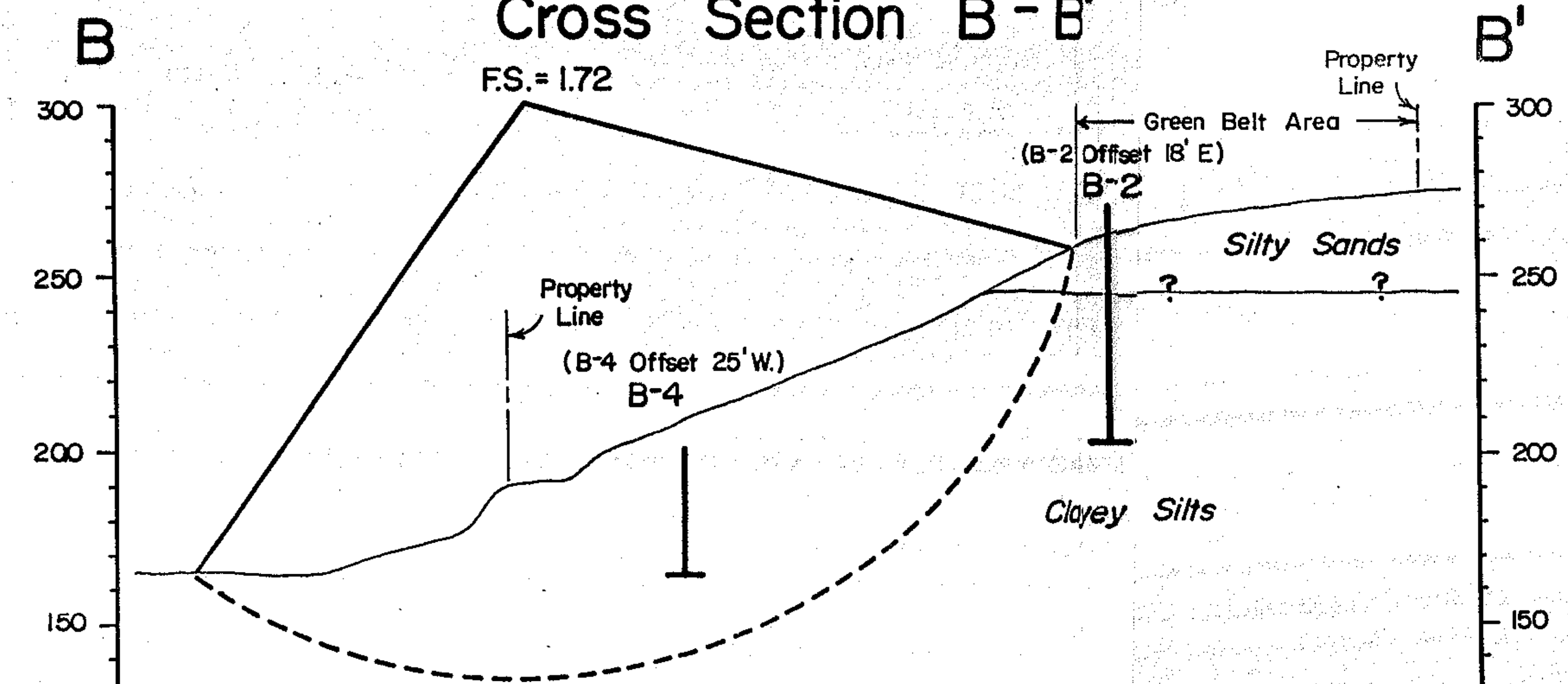


A'
B'
Property Line
270
260
250
240
230
220
210
200
190
180
Buffer
GREEN BELT AREA
B-1
B-2
B-3
B-4
B-5
Creek
132nd PLACE N.E.
Property Line
A
B
N
LEGEND
B-3 Approximate Boring Location
Approximate Area of Noted Groundwater Seepage
Approximate Scale
0 20 40 80ft.
Reference :
Drawing No. 6681.010
Topographic Survey
By Moore, Wallace & Kennedy, Inc.
Dated Feb. 1981
Earth Consultants Inc.
GEOTECHNICAL ENGINEERING & GEOLOGY
Boring Location Plan
Totem Lake Property
Kirkland, Washington
Proj. No. 1802
Date June '82
Plate 1

Cross Section A - A'



Cross Section B - B'



Horizontal Scale
0 25 50 100 ft.

Vertical Scale
0 25 50 100 ft.

LEGEND

B-3 Approximate Location of Offset Boring

The depth and thickness of the subsurface strata indicated on the section was generalized from and interpolated between the test borings. Information on actual subsurface conditions exists only at the location of the test borings and it is possible that subsurface conditions between the test borings may vary from those indicated.

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Generalized Subsurface Cross Section
Totem Lake Property
Kirkland, Washington

Proj. No. 1802	Date Jan. '83	Plate 2

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (little or no fines)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (appreciable amount of fines)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (little or no fines)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO 200 SIEVE SIZE				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (appreciable amount of fines)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

TOPSOIL		Humus and Duff Layer
FILL		Uncontrolled with Highly Variable Constituents

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOIL CLASSIFICATION CHART

THE DISCUSSION IN THE TEXT OF THIS REPORT IS NECESSARY FOR A PROPER UNDERSTANDING OF THE NATURE OF THE MATERIAL PRESENTED IN THE ATTACHED LOGS

- I — 2" O.D. Split Spoon Sampler
- II — Ring or Shelby Sample
- P — Sampler Pushed
- ✱ — Sample Not Recovered
- ▽ — Water Level (date)
- Ts — Torvane Reading
- qu — Penetrometer Readings
- ▮ — Water Observation Well

Earth Consultants Inc.

LEGEND

Proj. No. 1802 | Date Mar. '83 | Plate 3

BORING NO. 1

Logged By CRL

Date 5/24/82

ELEV. 244±

Graph	US CS	Soil Description	Depth (ft.)	Sample	(N) Blows Ft.	W (%)	
	SM	(6" duff) Brown silty SAND, moist, loose					
			5		50/6"		
			10		93	20 25	q_u>4.5 tsf
			15		81	20	
			20		50	29	q_u>4.5 tsf
	ML CL	Brown thinnly bedded clayey SILT with beds of silty CLAY, SILT & silty fine SAND, moist, hard to very dense	25		74	26	
		(Grades gray below 20')	30		86	26	LL=29, PI=5 q_u>4.5 tsf
			35		76	23	q_u>4.5 tsf
			40 ▽ 6/17		82/7"	22	LL=43=PI=20 q_u>4.5 tsf
			45▽ 7/12		90/9"	24	
			50		50/5"	23	q_u>4.5 tsf
			55		50/5"	25	
			60		88	24	

Boring terminated at 61.5 feet below existing grade.
Groundwater observation well installed to bottom of boring.

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BORING LOG

TOTEM LAKE PROPERTY
KIRKLAND, WASHINGTON

Proj. No. 1802 | Date Mar. '83 | Plate 4

BORING NO. 2

Logged By CRL

Date 5/25/82

ELEV. 268±

Graph	USCS	Soil Description
	SM SP	Brown silty fine SAND to coarse to medium SAND with silt and fine to medium SAND with silt, moist, loose grading medium dense below 5', grading dense to very dense below 10'
	ML CL	Brown grading gray interbedded silty CLAY and clayey SILT, with layers of silty fine SAND and SILT, moist, hard (Bedding angle varies from 0° to 5°) (Possible wet silt layers at 60')

Depth (ft.)	Sample	(N) Blows Ft.	W (%)	
5	I	22	9	
10	I	59	8	
15	I	43	12	
20	I	24	15	
25	I	37	26	q_u>4.5 tsf
30	I	35/8"		
6/13 ▽				
35 ▽	II	65		
7/12				
40	II	75	28	124 pcf LL=43 PI=20
45	I	78/9"	26	q_u>4.5 tsf q_u>4.5 tsf
50	I	78/11"	25	LL=34 PI=11 q_u>4.5 tsf
55	I	84/11"	22	
60	I	90/10"	22	q_u>4.5 tsf
65	I	50/6"	30	q_u>4.5 tsf

Boring terminated at 66 feet below existing grade. Groundwater observation well installed. Drilling fluid flushed from boring.

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GEOTECHNICAL ENGINEERING & GEOLOGY

BORING LOG
TOTEM LAKE PROPERTY
KIRKLAND, WASHINGTON

Proj. No. 1802 | Date Mar.'83 | Plate 5

BORING NO. 3

Logged By CRL

Date 5/27/82

ELEV. 208±

Graph	US CS	Soil Description	Depth (ft.)	Sample	(N) Blows Ft.	W (%)	
	SM ML	Brown silty SAND with clay and gravel, wet, loose to: Brown sandy clayey SILT, wet, medium stiff	5 6/13 ▽	I 7/12	7	25	q_u=0.5 tsf
	GP	Brown sandy GRAVEL, loose, wet	10	I	31	24	
	CL ML	Gray interbedded clayey SILT and silty CLAY, moist, hard	15	I	45	26	q_u>4.5 tsf LL=35 PI=11
			20	I	83	24	q_u>4.5 tsf

Boring terminated at 21.5 feet below existing grade. Groundwater observation well installed to bottom of boring. Bentonite seal placed at approximately 15 feet.

Earth Consultants Inc.
GEOTECHNICAL ENGINEERING & GEOLOGY

BORING LOG
TOTEM LAKE PROPERTY
KIRKLAND, WASHINGTON

Proj. No. 1802	Date Mar. '83	Plate 6

BORING NO. 4

Logged By CRL

Date 5/28/82

ELEV. 202±

Graph	US CS	Soil Description	Depth (ft.)	Sample	(N) Blows Ft.	W (%)	
	SM	Brown silty gravelly SAND with clay, wet, loose to medium dense					
	ML CL	Gray interbedded clayey SILT, SILT, and silty CLAY, moist, hard to very dense	5 (7/12)		25		
			10 (7/12)		25	25	q_u>4.5 tsf
			15		69	23	
		(Possible wet silt layers at 15 to 26')	20 (6/13)		52		
			25		76/11"	26	LL=27, PI=5
			30 (6/13)		84/11"	22	q_u>4.5 tsf
			35		61	26	q_u>4.5 tsf

Boring terminated at 36.5 feet below existing grade. Groundwater observation well installed to bottom of boring. Bentonite seal placed at 20 feet. Second groundwater observation well installed at 18 feet.

Earth Consultants Inc.
GEOTECHNICAL ENGINEERING & GEOLOGY

BORING LOG

TOTEM LAKE PROPERTY
KIRKLAND, WASHINGTON

Proj. No. 1802 | Date Mar. '83 | Plate 7

BORING NO. 5

Logged By CRL

Date 5/27/82

ELEV. 188±

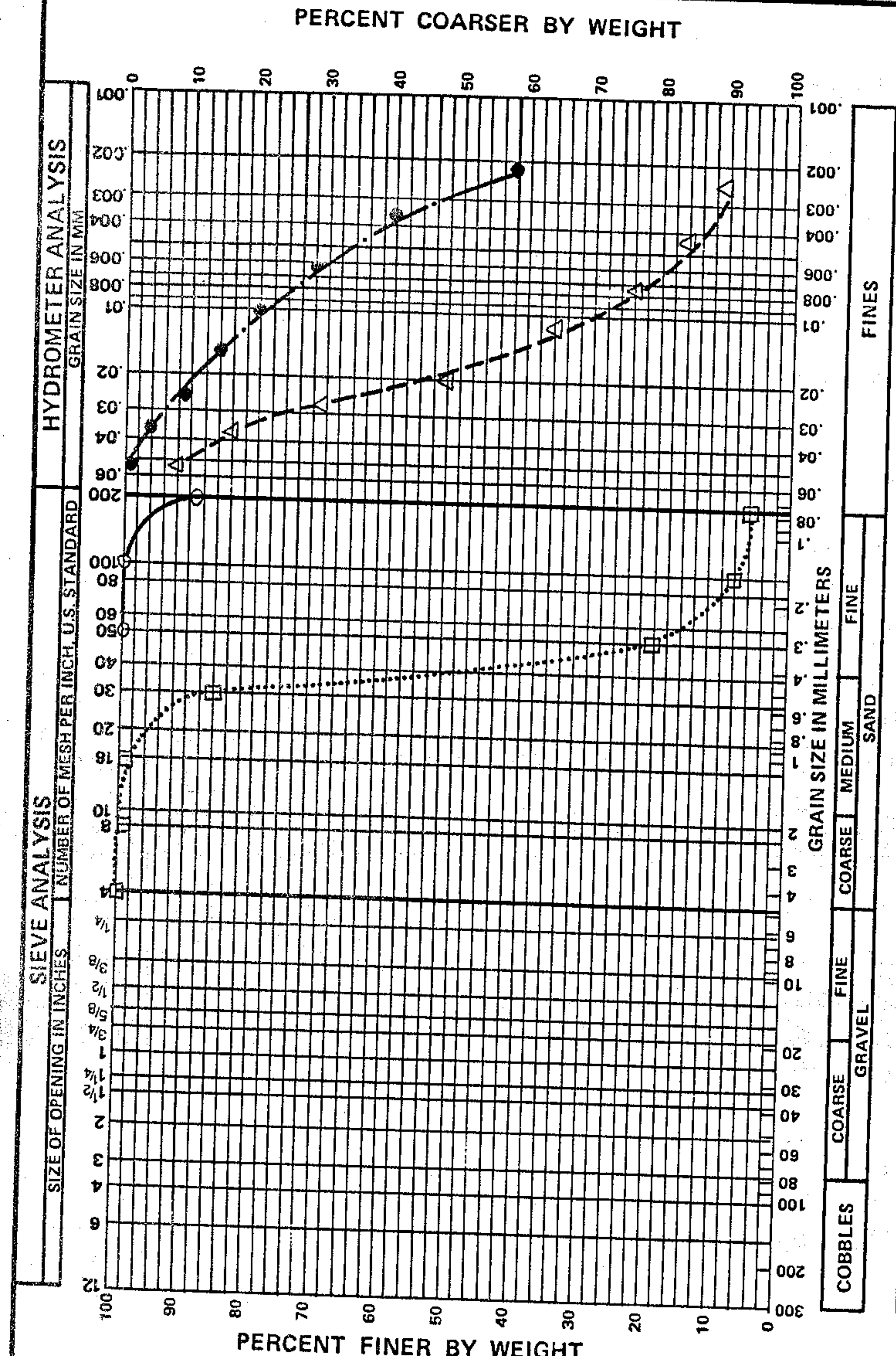
Graph	USCS	Soil Description	Depth (ft.)	Sample	(N) Blows Ft.	W (%)	
	ML	Brown SILT, moist, loose					
			5	I	52	24	q_u>4.5 tsf
	CL ML	Gray thinnly bedded SILT with clay, clayey SILT and silty CLAY, moist, hard to very dense	10	I	73	23	
			15	I	39	16	q_u>4.5 tsf LL=49 PI=24
			20	*	79		

Boring terminated at 21.5 feet below existing grade.
No groundwater noted during drilling.

Earth Consultants Inc.
GEOTECHNICAL ENGINEERING & GEOLOGY

BORING LOG
TOTEM LAKE PROPERTY
KIRKLAND, WASHINGTON

Proj. No. 1802 | Date Mar.'83 | Plate 8

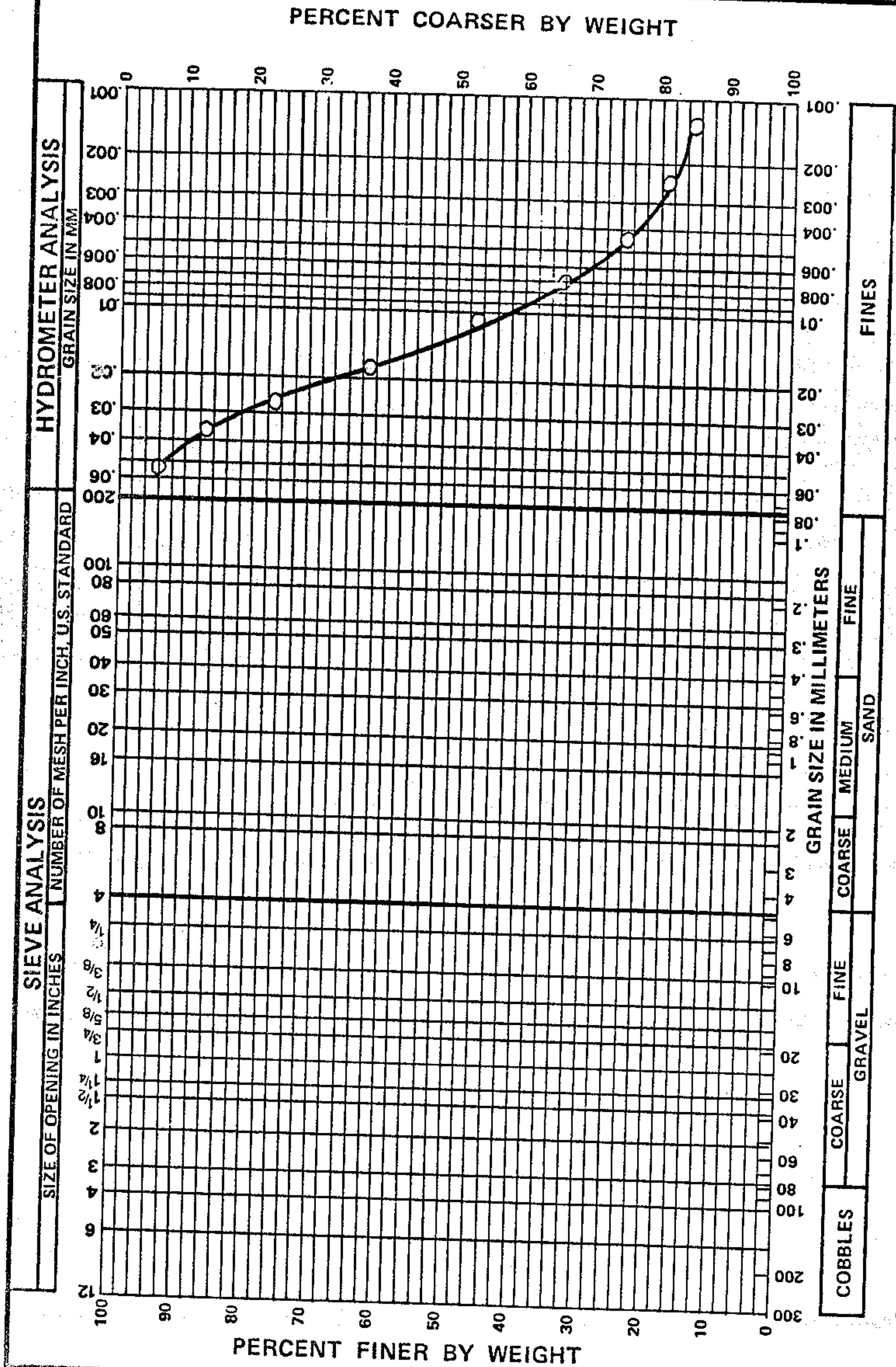


KEY	Boring or Test Pit No.	DEPTH (ft.)	USCS	DESCRIPTION	Moisture Content (%)	LL	PL
○ ——	B-1	15.0	ML	fine sandy SILT	20		
△ — —	B-1	30.0	ML	clayey SILT	26	29	24
□ ······	B-2	20.0	SM/SP	fine to medium SAND with silt	15		
● —·—	B-4	25.0	ML/CL	clayey SILT to silty CLAY	26	27	22

Earth Consultants Inc.
GEOTECHNICAL ENGINEERING & GEOLOGY

GRAIN SIZE ANALYSES
TOTEM LAKE PROPERTY
KIRKLAND, WASHINGTON

Proj. No. 1802 | Date Mar. '83 | Plate 9



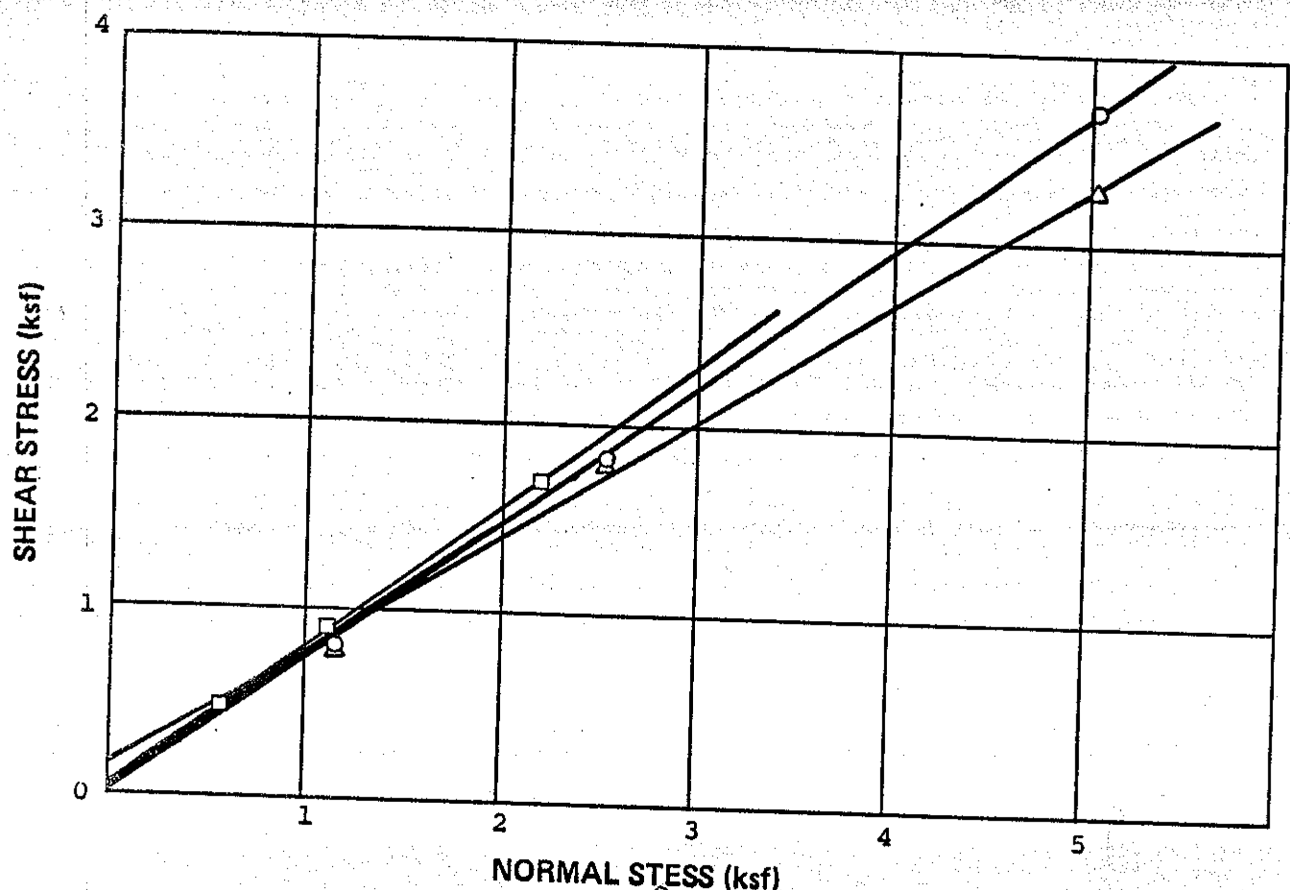
KEY	Boring or Test Pit No.	DEPTH (ft.)	USCS	DESCRIPTION	Moisture Content (%)	LL	PL
O——	B-2	40.0	CL	silty CLAY	28	43	23

Earth Consultants Inc.
GEOTECHNICAL ENGINEERING & GEOLOGY

GRAIN SIZE ANALYSIS

TOTEM LAKE PROPERTY
KIRKLAND, WASHINGTON

Proj. No. 1802	Date Mar.'83	Plate 10



Key	Boring or Test Pit No.	Depth (ft.)	USCS	Soil Description	Cohesive Strength (ksf)	Internal Friction Angle	Moisture Content (%)	Dry Density (pcf)
○	B-2	35.0	SM	silty fine SAND	0.0	36	24	104
△	B-2	40.0	CL	silty CLAY	0.2	32	28	97
□	B-4	10.0	ML	SILT with clay	0.0	38	25	99

Earth Consultants Inc.
GEOTECHNICAL ENGINEERING & GEOLOGY

DIRECT SHEAR TEST DATA
TOTEM LAKE PROPERTY
KIRKLAND, WASHINGTON

Proj. No. 1802	Date Mar. '83	Plate 11

Earth Consultants Inc.
Geotechnical Engineering and Geology

December 5, 1983 E-1802-1

City of Kirkland
Planning and Community Development
123 Fifth Avenue
Kirkland, Washington 98033

Attention: Ms. Stephanie Warren

Subject: City of Kirkland Environmental Checklist
Proposed Office and Light Industrial Building
132nd Place N.E.
Kirkland, Washington

Reference: 1) City of Kirkland Letter dated October 28, 1983 to Bazemore Associates, Architects concerning the subject property.

2) Bazemore Associates, Architects plans entitled "Hart/Kost/Dash, Property Development" dated October 3, 1983 and June 21, 1983 for the site plan and schematic elevations, respectively.

3) Earth Consultants, Inc. Report E-1802 dated February 28, 1983 entitled "Preliminary Engineering Study, Commercial Development, Kirkland, Washington".

Gentlemen:

This letter has been prepared to address the issues presented by Stephanie Warren's letter for the City of Kirkland concerning the subject project, Reference 1.

The following responses correspond to the items presented in the City's letter:

1) The impact of the proposed cuts on the stability of the slope can be addressed by the following statements:

a) Based on the referenced plans, the proposed cuts will be located along the southern portion of the site. The cuts will be supported by retaining walls and buildings as shown on the current plans.

b) The impact of the proposed cuts on the properties above and below the site are contingent upon the care by which the contractor performs his work and the adequacy of the proposed shoring systems, foundations and drainage facilities. We at Earth Consultants, Inc. are of the opinion that with proper design and construction of the proposed facilities, no adverse affect will result to the areas above and below the proposed cuts.

c) Excavations within the building area will expose very dense and competent soils. The potential impact of disturbing the in-situ soils has been a concern by the City of Kirkland. We at Earth Consultants, Inc. hold the opinion that disturbing the in-situ soils may result in foundation/slab settlements. We have recommended that Earth Consultants, Inc. be present during the construction period to observe earthwork as described in page 12 of the referenced report.

2. Potential erosion problems and mitigating measures:

a) Based on the plans for the proposed project, we do not anticipate any changes in the long-term erosional characteristics of the hillside due to the new construction. During the construction period, soil erosion can be minimized by the provision of geotextile filters behind temporary slope retention systems and silt fences to prevent siltation of sewers and drainage systems.

3. Potential impacts of placing surface interceptor ditches at the top of cuts:

a) The impact of placing drainage ditches at the top of cuts will be the control of surface drainage, with its attendant benefits. No adverse affects can be envisioned for the proposed project.

4. Potential drainage problems resulting from intercepting springs, seeps and groundwater:

a) The interception of springs and seepage areas will reduce erosion and increase stability.

b) With the specific project plans, there will be no cut slopes exposed and therefore potential erosion problems due to seeps will be minimal.

c) The natural drainage pattern of the existing creek has not been disrupted by the current plans.

d) Drainage plans for the site have not been finalized. However, all water from drains, culverts and the creek will be directed to storm drains off the property as it is presently accomplished.

5. The impact of changes in absorption rates by increasing the amount of impervious surface on the site:

a) No adverse impact on the slope stability is expected due to an increase in impervious surfaces at the site. The runoff from the impervious will be directed to the storm drainage system, thus reducing the amount of absorption and increasing the stability of the slope.

6. The potential impacts to slope stability and drainage at the site by removal of vegetation due to construction processes.

a) The stability of the slopes due to construction can be addressed by the shoring design. If temporary cut slopes are contemplated in lieu of shoring, the removal of vegetation will not affect the slope stability but could result in increased erosion on the exposed slopes. Removal of vegetation within the building areas and parking lots will have no affect on the stability of the slopes. All finished slopes will be planted with ground cover.

b) The amount of water flowing across the site due to removal of vegetation within the building areas and parking lots will increase during periods of rain. Therefore, it is recommended that drainage ditches be provided to collect and channel this water for proper discharge, during construction and on a permanent basis.

7. The impact of placing the creek in a conduit, its impact on drainage and its discharge.

a) At the present time, we are not aware that the creek will be placed in a conduit.

b) The impact of the creek on water discharge from the site will be no different from the existing conditions. In fact, it may be reduced by diverting runoff from impervious areas into the storm drainage system.

In conclusion, we are of the opinion that the site can be developed as proposed. Concerns about slope stability and drainage can be mitigated by proper design and construction of shoring, walls, drainage and foundations.

If you have any questions, please call.

Respectfully submitted,

EARTH CONSULTANTS, INC.

William Chang, P. E.
Project Manager

Robert S. Levinson, P. E.
President

WC/RSL/bs

cc: Bazemore Associates Architects
Attention: Mr. Donald C. Bazemore

✓ Western Realty
Attention: Mr. Gordon Hart

Earth Consultants Inc.
Geotechnical Engineering and Geology

RECEIVED DEC 23

December 21, 1983 E-1802-1

City of Kirkland
Planning and Community Development
123 Fifth Avenue
Kirkland, Washington 98033

Attention: Mr. Scott Greenberg

Subject: City of Kirkland Environmental Checklist
Definition of "Creek" versus "Drainage Swale"
Proposed Office and Light Industrial Building
132nd Place N.E.
Kirkland, Washington

Reference: 1) Earth Consultants, Inc. (ECI) Letter E-1802-1 dated December 5, 1983 entitled "City of Kirkland Environmental Checklist, Proposed Office and Light Industrial Building, 132nd Place N.E., Kirkland, Washington".

2) City of Kirkland Letter dated October 28, 1983 to Bazemore Associates, Architects concerning the subject property.

3) Bazemore Associates, Architects plans entitled "Hart/Kost/Dash, Property Development" dated October 3, 1983 and June 21, 1983 for the site plan and schematic elevations, respectively.

4) ECI Report E-1802 dated February 28, 1983 entitled "Preliminary Engineering Study, Commercial Development, Kirkland, Washington".

Gentlemen:

This letter addresses the city's concern regarding the use of the term "creek", that was used on page 3 and on Plate 1 of the referenced report 4) for the subject property.

At the time that our study was conducted, (May, 1983), there was water present in the drainage swale near the center of the site and the word "creek" was used. However, when Ms. Stephanie Warren and Mr. Scott Greenberg from the City of Kirkland, Planning

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Phone: (206) 643-3780/Seattle (206) 464-1584

and Community Development visited the site in late summer, 1983, no surface water was observed in the drainage swale. Based on this information, we at Earth Consultants, Inc. are of the opinion that the term "drainage swale" should be used instead of "creek" for the subject property.

If you have any questions, please call.

Respectfully submitted,

EARTH CONSULTANTS, INC.

William Chang, P. E.
Project Manager

WC/bs

cc: Bazemore Associates, Architects
Attention: Mr. Donald C. Bazemore

✓ Western Realty
Attention: Mr. Gordon Hart

Earth Consultants Inc.
Geotechnical Engineering and Geology

April 26, 1984 E-1802-1

City of Kirkland
Planning and Community Development
123 Fifth Avenue
Kirkland, Wshington 98033

Attention: Mr. Joseph W. Tovar
Ms. Stephanie Warren

Subject: City of Kirkland Environmental Checklist
Proposed Office and Light Industrial Building
132nd Place N.E.
Kirkland, Washington

Gentlemen:

Earth Consultants, Inc. has reviewed your letter dated April 5, 1984, as well as the correspondence listed in the reference list. This report is a direct response to the City of Kirkland's concerns regarding the stability of slopes, erosion, drainage and groundwater seepage as it relates to the proposed development.

This report has been prepared for the exclusive use of Hart/Kost/Dash Property Development, Bazemore Associates, Architects and their agents in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

Item 1 - Slope Stability

A) Existing Conditions

The reference report 1) prepared by Earth Consultants, Inc. presents the findings of the exploration effort as well as the evaluation of slope stability at the site. We want to repeat again that no weak layers were found at depth beneath the site, therefore, we concluded that the existing slopes exhibited no signs of deep-seated instability. The shallow soil creep/erosion zone as indicated by leaning tree trunks is generally only one and one-half feet in thickness, although it could be up to five feet

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Phone (206) 643-3780 / Seattle (206) 464-1584

in thickness, as indicated in our boring logs for the project. This still does not indicate deep-seated movements. The above-mentioned zone of loose soils near the surface is common to the vast majority of sites encountered in the Puget Sound area, and is part of the natural process whereby vegetation establishes itself on a given slope.

B) Impact of Development

The proposed development at the site will consist of a light industrial/commercial building requiring cuts of up to twenty (20) feet in height. The City of Kirkland Planning Department has been concerned about the potential impacts of this development on adjacent sites.

As consulting geotechnical engineers, we are of the opinion that the proposed development can be built as planned, without adversely affecting properties north, south, east or west of the site, in fact, the proposed development with its drainage and retaining facilities will enhance the stability of adjoining properties.

All temporary excavations deeper than five feet will have to be sloped back at inclinations no steeper than 1:1 as recommended on page 11 of our reference report 1). Where such slopes are not practical, vertical cuts can be shored with soldier piles, lagging and tie-backs. The effectiveness of cut slopes at the site are self-evident as illustrated by the ten foot high cut benches at the south end of the site, or at the twenty (20) foot cut near the center of the site. The effectiveness of shored excavations in the local region have been demonstrated time and time again with each high-rise building basement excavation. The technology for performing tie-backs is well known, and its effectiveness is proven. For the parking areas, the same recommendations apply, with the added flexibility that for excavations less than ten feet in height, a cantilever soldier pile system is more economical and can be used to effectively retain any slopes.

The temporary shorings as discussed above will not adversely affect the slope stability on adjacent properties, but will enhance it. We recommend that a representative of Earth Consultants, Inc. be present during the excavation to observe that encountered soil conditions are as anticipated. This is a normal request made by most local geotechnical engineers because of widely-spaced borings.

Following the construction of the temporary shoring, permanent walls for the building and retaining walls for the parking lots will provide the permanent support for cuts into the hillside.

Item 2 - Erosion

A) Existing Conditions

As mentioned in our referenced report 1), the project site has some loose surficial soils, and the presence of leaning tree trunks generally indicates that shallow surficial soil creep/ erosion is occurring on the slopes at the site. These are natural processes that occur on virtually every slope with soil cover. This condition is no better or worse than most regional soil slopes. The erosion can be controlled more efficiently with normal drainage facilities than in a natural setting.

B) Impact of Development

The proposed development will contain buildings, parking lots and driveways. Outside of these areas, the hillsides will remain essentially the same as they are today. Therefore, we can conclude that the proposed development will not adversely affect existing patterns of erosion. It will improve the drainage of shallow soils near retaining walls due to the requirements for drainage behind these walls, thus reducing erosion in these areas. Temporary measures to reduce erosion during construction have been detailed in our referenced letter 4).

A comment was made on your list of concerns regarding the recommendations in our geotechnical report of site preparation during wet weather conditions. We must add that this is a fairly standard recommendation that is made, as most soils in the Puget Sound region are moisture sensitive and require that proper care be exercised during wet weather grading operations.

Item 3 - Drainage Swales

The present schematic site plan prepared by Bazemore Associates, Architects keeps the drainage swale in its present location, therefore, there is no change to this existing drainage course. In the building/pavement areas, surficial runoff will be collected by storm drains, reducing the runoff to the properties below the project site.

The potential impact of placing surface interceptor ditches at the top of cuts had been answered in our referenced letter 4).

Item 4 - Impact on Soils Outside Building Area

The proposed building and related parking lots will involve the following drainage improvements: provision of interceptor ditch on top of cut slopes and retaining walls. This measure will reduce the amount of erosion by channelling water runoff from cut slopes, if any are present, into the storm water system. The provision of a drainage ditch behind retaining walls is always a positive measure recommended to reduce the possibility of water standing behind walls and increasing the loads to the wall as well as straining the subdrains behind walls.

From the above perspective, the soils outside building areas are either not affected, or provided with improved drainage.

Item 5 - Groundwater

Groundwater encountered during our geotechnical exploration effort in May, 1982, consisted of perched groundwater, whereby the water is usually found in a sand layer or lense which in turn is underlain by a relatively impervious layer of silt or clay. Where the sand layer intercepts the slope, an area of seepage can generally be observed. This is typical of most groundwater conditions in the Puget Sound area with the quantity of water varying seasonally.

Shored excavations will have wick drains installed at locations where groundwater will be encountered. If large quantities of groundwater are encountered, geotextile or burlap material may be used behind the lagging, in conjunction with the wick drains.

If large quantities of groundwater seep out of shored excavations, they should not pose a problem for the crushed rock, filter fabric and perforated drain systems installed behind retaining walls, since the permeability of the crushed rock drain is orders of magnitude larger than that of the water bearing sandy layers.

Item 6 - Impacts on Stability Due to Water

A) At the present time, based on the existing soils information, we have no evidence of any deleterious effect that water in the sand lenses has had on the clay and silt layers at the site. This is confirmed by the following:

1) High standard penetration blow counts in the silt and clay layers at the site, even below the perched groundwater table, indicate that no loss of strength has occurred in the silt and clay layers due to the perched water table.

2) The locations where groundwater will be channelled will be behind retaining walls and at interceptor trenches. The effect of drainage systems on the stability of walls will be to decrease the hydrostatic pressure behind walls and reduce stresses at the wall, therefore, improving the stability of the soil/wall system.

Interceptor trenches will only be needed at cut slopes, and present plans for site grading do not include cut slopes. Nevertheless, the inclusion of interceptor drains (filter fabric, gravel, slotted pipe) will only drain excess water, and should improve both the stability and erosion on the slopes where they are installed.

B) Impact on adjacent areas due to the interception of groundwater at the retaining wall or at the interceptor trench should be negligible. This conclusion stems from the following observations:

1) The flow of groundwater at the site is from north to south.

2) The proposed retaining walls and interceptor trenches will drain surficial and seepage water.

3) Areas east and west of the development are not affected by the proposed improvements since no water will be added or taken away by the improvements.

4) Areas north of the site are not affected by the development since they constitute the groundwater recharge areas, and whether this water seeps out of the ground or gets intercepted by drains further down, does not affect the upslope areas.

5) Areas south of the proposed development will greatly benefit from the proposed improvements, as soil erosion will be reduced and stability of the soil improved by the proposed development.

C) The origional geotechnical report of February 28, 1984, expressed concern about the removal of vegetation in slope areas as it would increase erosion. Based on our review of Bazemore Associates, Architects' plans dated October 13, 1984, it is our opinion that the plans for the site have taken into consideration the soil erosion aspect, and no regrading is shown for areas outside of the buildings and parking lots. Therefore, our original concern with respect to erosion has been fully addressed by the plans, and no adverse impacts are foreseen.

City of Kirkland
April 26, 1984

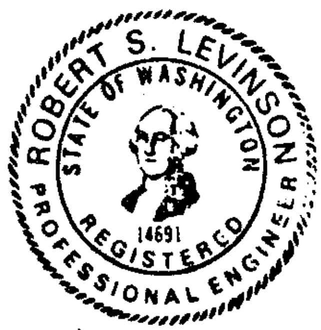
E-1802-1
Page Six

If you have any questions, please call.

Respectfully submitted,

EARTH CONSULTANTS, INC.

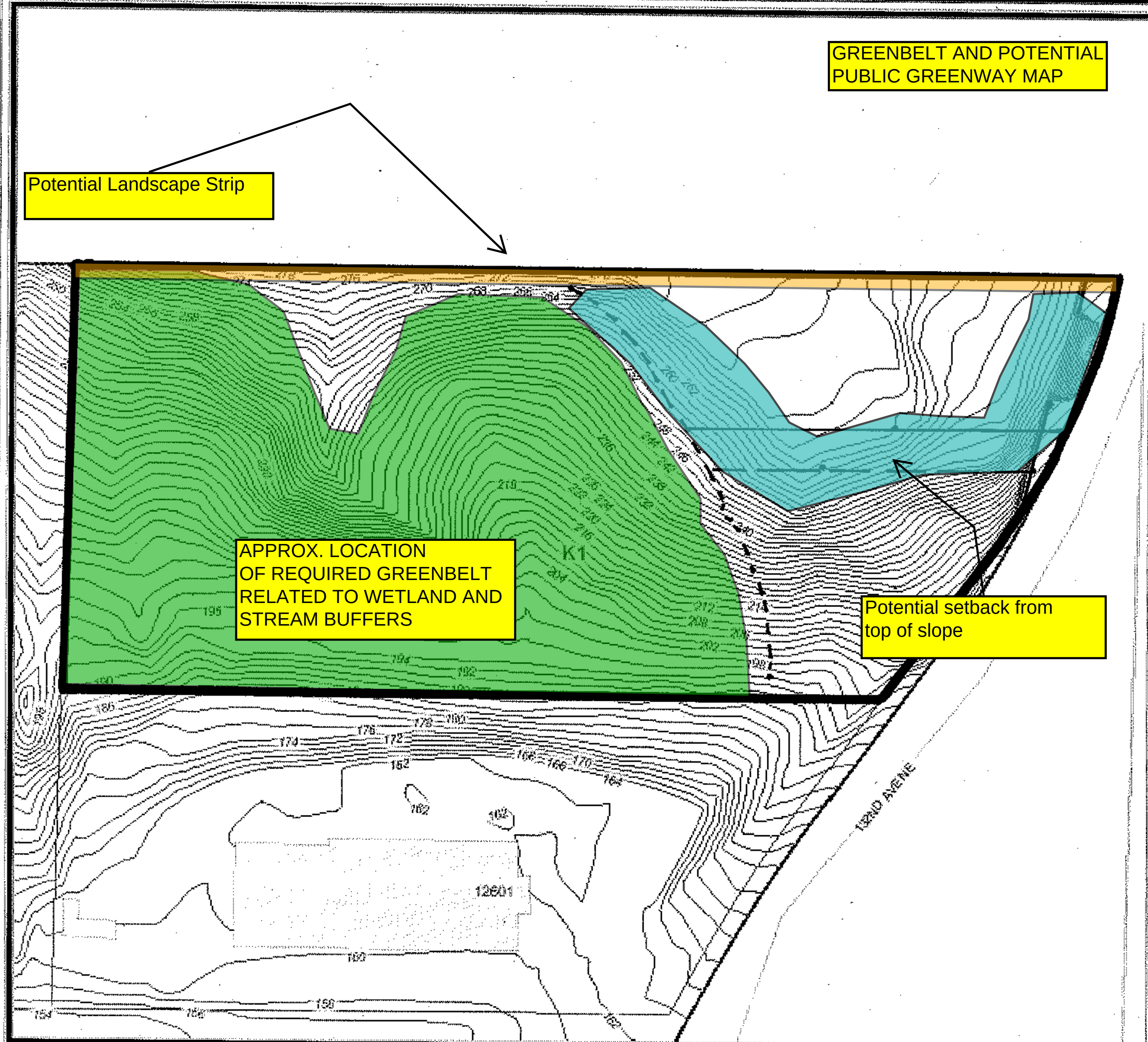
William Chang, P. E.
Project Manager



Robert S. Levinson, P. E.
President

WC/RSL/bs

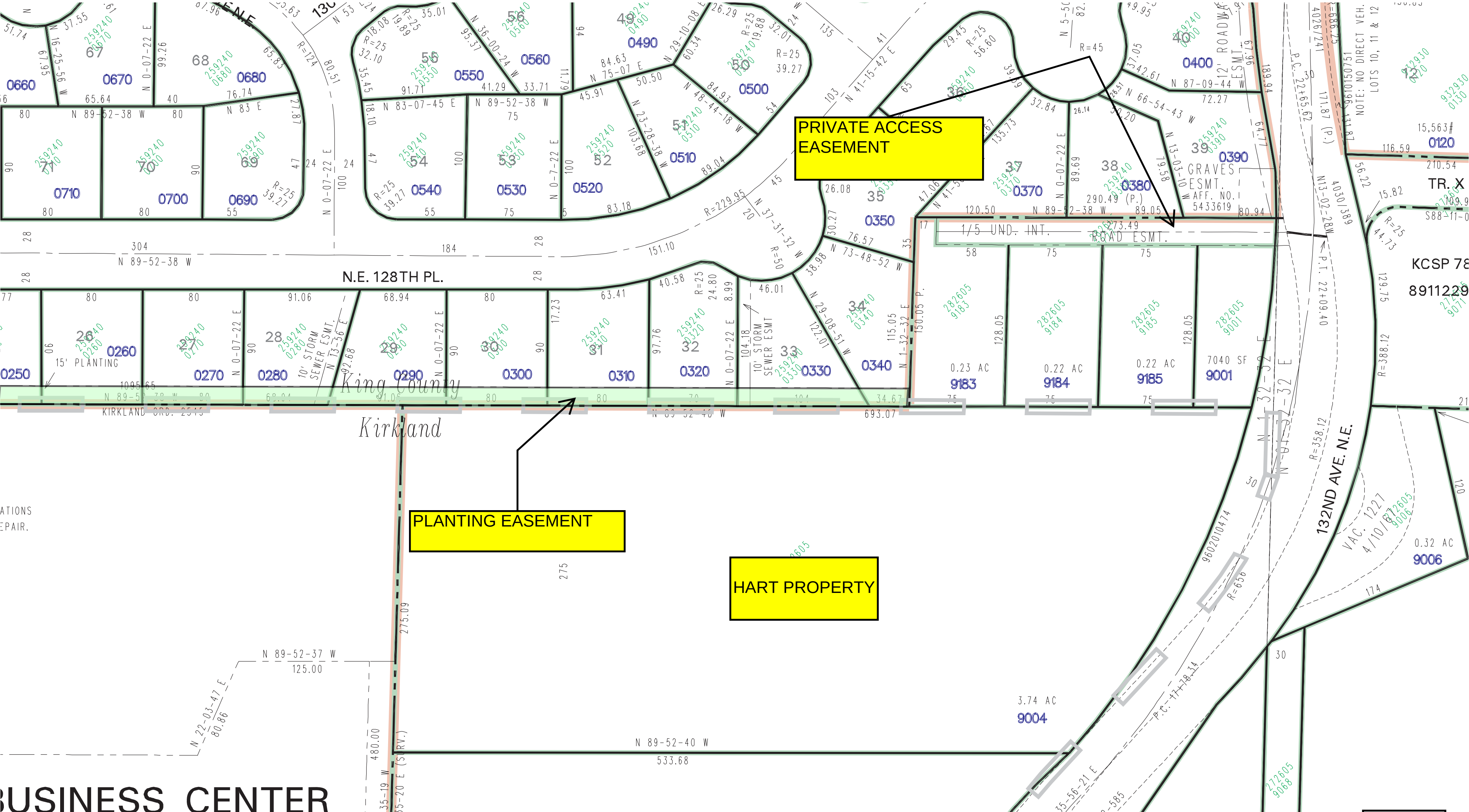
cc: Bazemore Associates



Legend

Approximate
Scale 1:1,200
1 in = 100 ft

ATTACHMENT 18
ZON06-00019



ATTACHMENT 19
ZON06-00019

Residential Capacity 2003

(estimate of future residential development)

TAZ	Neighborhood	MF Existing	Net Added Redev Units	New MF Units	MF Capacity Units	SF Existing	Net Added Redev Units	New SF Units	SF Capacity Units	Existing Total	Capacity Total	Difference
247-249	Bridle Trails	135	0	0	135	723	178	37	899	858	1,034	176
250-259	Central (Moss Bay)	2,236	1,009	17	3,096	233	12	3	245	2,469	3,342	873
243-246	Central Houghton	374	10	33	412	1,009	201	110	1,267	1,383	1,678	295
260-261.5	Everest	404	1	48	447	231	21	5	252	635	700	65
274	Highlands	122	48	1	163	852	123	33	980	974	1,143	169
236-242	Lakeview	1,264	63	4	1,320	353	12	14	375	1,617	1,695	78
268	Market	204	0	0	204	731	53	7	780	935	984	49
269-273	Norkirk	299	60	4	353	1,213	130	37	1,350	1,512	1,703	191
287-289	North Juanita	915	23	0	935	897	72	19	972	1,812	1,906	94
265-267, 275-280	North Rose Hill	1,566	510	208	2,177	1,588	651	140	2,237	3,154	4,414	1,260
281-286	South Juanita	2,441	611	79	3,023	1,336	298	107	1,670	3,777	4,693	916
262-264	South Rose Hill	110	282	17	361	996	434	65	1,404	1,106	1,766	660
290-302	Totem Lake	1,855	2,110	33	3,652	33	10	0	41	1,888	3,693	1,805
Total Existing		**11,925**	4,727	444	16,278	**10,195**	2,195	577	12,472	22,120	28,751	6,631
	Total Existing MF & SF	**22,120**										
	Total Capacity MF & SF	**28,750**			**16,278**				**12,472**			

Based on January 2003 King County Assessor Data

7/15/2005

ATTACHMENT 20
ZON06-00019