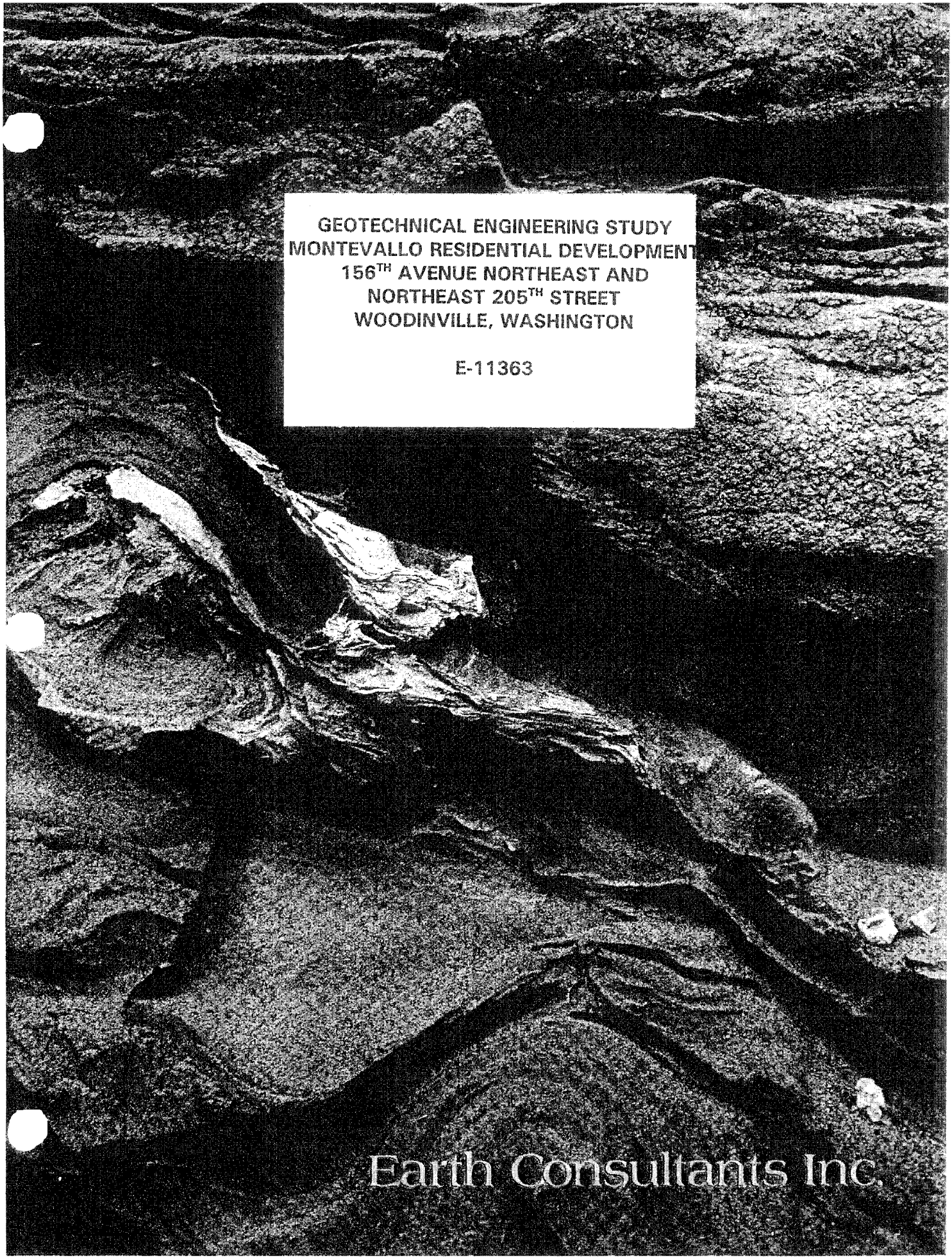
Appendix A:

Geotechnical Engineering Study, Montevallo, September 2004



GEOTECHNICAL ENGINEERING STUDY
MONTEVALLO RESIDENTIAL DEVELOPMENT
156TH AVENUE NORTHEAST AND NORTHEAST 205TH STREET
WOODINVILLE, WASHINGTON

E-11363

Earth Consultants Inc.

GEOTECHNICAL ENGINEERING STUDY
MONTEVALLO RESIDENTIAL DEVELOPMENT
156TH AVENUE NORTHEAST AND
NORTHEAST 205TH STREET
WOODINVILLE, WASHINGTON

E-11363

September 22, 2004

PREPARED FOR
PHOENIX DEVELOPMENT INC.

Eric L. Woods
Staff Geologist

RAYMOND A. COGLAS
STATE OF WASHINGTON
38018
REGISTERED
PROFESSIONAL ENGINEER

9/22/04

EXPIRES 7/24/2006

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IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used*:

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage*, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

Published by

ASFE THE ASSOCIATION OF ENGINEERING FIRMS PRACTICING IN THE GEOSCIENCES

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Earth Consultants, Inc.
Geotechnical Engineers, Geologists & Environmental Scientists
Construction Testing & ICBO / WABO Inspection Services
Established 1975

September 22, 2004

E-11363

Phoenix Development, Inc.
P.O. Box 3167
Lynnwood, Washington 98046

Attention: Ms. Loree Quade

Dear Ms. Quade:

Earth Consultants, Inc. (ECI) is pleased to submit our report titled "Geotechnical Engineering Study, Montevallo Residential Development, 156th Avenue Northeast and Northeast 205th Street, Woodinville, Washington". This report presents the results of our field exploration, selective laboratory tests, and engineering analyses. The purpose and scope of our study were outlined in our August 17, 2004 proposal.

We understand it is planned to develop the approximately 16.5-acre irregularly shaped site with a single-family residence development consisting of seventy (70) lots. We anticipate the building construction will consist of relatively lightly loaded wood-frame construction with crawl space and slab-on-grade floors. The proposed site improvements are to include two east-west trending access streets from 156th Avenue Northeast, with several interconnecting access streets on-site. A stormwater detention vault is planned for the northwest corner of the site. The site is currently occupied by five single-family residences and several outbuildings, which are to be removed to make way for the proposed development.

Based on the results of our study, development of the site is feasible from a geotechnical standpoint. The proposed buildings can be supported on conventional foundations bearing on competent native soil or on structural fill used to modify existing site grades. Slab-on-grade floors may be similarly supported.

1805 136th Place N.E., Suite 201, Bellevue, WA 98005
Bellevue (425) 643-3780 FAX (425) 746-0860 Toll Free (888) 739-6670
Other Locations
Fife

We appreciate this opportunity to be of service to you. If you have any questions or if we can be of further assistance, please call.

Sincerely,

EARTH CONSULTANTS, INC.

Raymond A. Coglas, P.E.
Manager of Geotechnical Services

ELW/RAC/ddw

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GEOTECHNICAL ENGINEERING STUDY
MONTEVALLO RESIDENTIAL DEVELOPMENT
156TH AVENUE NORTHEAST AND
NORTHEAST 205TH STREET
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E-11363

INTRODUCTION

General

This report presents the results of the geotechnical engineering study completed by Earth Consultants, Inc. (ECI) for the proposed Montevallo Residential Development located at the intersection of 156th Avenue Northeast and Northeast 205th Street in Woodinville, Washington. The general location of the site is shown on the Vicinity Map, Plate 1.

The purpose of this study was to explore the subsurface conditions at the site, and based on the conditions encountered, to develop geotechnical engineering recommendations for the proposed residential development. Specifically, our scope of services consisted of the following:

- Assessing subsurface soil and groundwater conditions and their influence on the proposed development;
- Providing site preparation, grading, and earthwork procedures, including stripping depth recommendations and details of structural fill placement and compaction;
- Assessing the suitability of existing on-site materials for use as structural fill and providing recommendations for imported fill materials;
- Providing recommendations for utility trench excavation and backfill;
- Providing geotechnical seismic design recommendations, including an evaluation of potential liquefaction hazard;
- Addressing short-term and long-term groundwater management and erosion control measures;
- Providing foundation design recommendations, including bearing capacity and lateral pressures for walls and structures;

- Providing estimates of potential total and differential settlement magnitudes; and
- Providing pavement design recommendations.

Project Description

We understand it is planned to develop the approximately 16.5-acre irregularly shaped property with a new single-family residence development. Based on preliminary design information provided by Triad Associates, the development will consist of seventy (70) lots. The site is to be accessed by two east-west trending streets from 156th Avenue Northeast, near the northeast and southeast corners of the site. Several additional on-site access streets are also planned. A storm water detention vault is planned for the northwest corner of the site. A wetland area occupies the western edge of the site. A fifty (50) foot buffer from the wetland area is included in the proposed site plans. The proposed development and our exploratory locations are approximately as shown on Plate 2, Test Pit Location Plan.

Five existing single-family residences and several outbuildings currently occupy the site. The existing structures are to be removed to make way for the planned development.

Based on our current understanding of the proposed development, we anticipate cuts and fills to accomplish the site grading will be five feet or less. Cuts within the detention tract will likely be on the order of ten to fifteen (15) feet.

We anticipate the building construction will consist of relatively lightly loaded wood-frame construction with crawl space and slab-on-grade floors. We estimate perimeter foundation loading will be on the order of 2 kips to 4 kips per lineal foot, and slab-on-grade loading of approximately 150 pounds per square foot (psf).

If the above project criteria are incorrect or change, we should be consulted to review the recommendations contained in this report. In any case, ECI should be retained to perform a general review of the final design.

SITE CONDITIONS

Surface

The subject site consists of an approximately 16.5-acre irregularly shaped property located at 156th Avenue Northeast and Northeast 205th Street in Woodinville, Washington (see Plate 1, Vicinity Map).

The site is bordered to the east by 156th Avenue Northeast, to the south by single-family residences, to the west by undeveloped wetland and single-family residences, and to the north by undeveloped forest and 244th Street Southeast, both located in neighboring Snohomish County. Four single-family residences with paved driveways from 156th Avenue Northeast occupy the east edge of the site. A gravel driveway extends from 156th Avenue Northeast along the northern site perimeter to a single-family residence in the northwest corner of the property.

The topography of the site slopes gently from east to west at gradients in the range of 5 to 10 percent. A wetland area occupies the western edge of the site. The site is vegetated primarily with grass, with a large portion of the western half of the site used for horse pasture. A stand of trees occupies part of the central portion of the site and portions of the northern perimeter. The wetland area is heavily forested.

Subsurface

Subsurface conditions at the site were evaluated by excavating twelve (12) test pits at the approximate locations shown on Plate 2. The test pits were excavated with a rubber-tired backhoe to a maximum depth of thirteen and one-half (13.5) feet below existing grade. Our test pit logs are included as Plates A2 through A13. Please refer to the test pit logs for a detailed description of the conditions encountered at each exploration location. A description of the field exploration methods is included in Appendix A. The following is a generalized description of the subsurface conditions encountered.

At our test pit locations, we encountered a two to twelve (12) inch thick layer of topsoil, with areas as thick as sixteen (16) inches. The topsoil is characterized by its dark brown color, loose consistency, and the presence of roots and organic debris. The soil and vegetative layer is not suitable for support of foundations, slab-on-grade floors, or pavements. In addition, it is not suitable for use as structural fill, nor should it be mixed with material to be used as structural fill.

Underlying the topsoil, we generally encountered a surficial layer of loose silty sand to silty sand with gravel (Unified Soil Classification SM). The surficial silty sand was characterized by its reddish brown to brown color and numerous roots, and typically ranged from two to three feet thick. Underlying the surficial silty sands, we encountered silty sand glacial till. The glacial till deposits were typically medium dense, becoming increasingly dense with depth. The glacial till deposits extended to the maximum depth explored at each test pit location.

The soils encountered at the time of our exploration in August of 2004, were generally in a moist to wet condition, with moisture contents typically in the range of 6 percent to 12 percent, with localized areas containing up to 24 percent moisture. The native soils are moisture sensitive, and will become disturbed if exposed to excessive moisture during construction.

At Test Pit TP-12, underlying the topsoil, we encountered a zone of fill consisting of silty sand. The fill was characterized by its disturbed appearance and trace amounts of wood debris. The fill was in a loose condition, and was approximately six inches thick.

The geologic map of the Bothell Quadrangle (Minard, 1985) indicates the site is underlain by till (Qvt) deposits. The native soils encountered at our test pit locations are generally consistent with glacial till deposits.

The King County Soil Survey (1973) indicates the site is underlain by Alderwood gravelly sandy loam, 6 to 15 percent slopes (AgC). Alderwood soils are characterized by slow to medium run-off potential, and moderate erosion hazard potential.

Groundwater

Groundwater seepage was not encountered during our subsurface exploration. However, iron oxide staining was observed at all of our test pit locations. The iron oxide staining was generally encountered above the glacial till at two to three feet below existing grade, and may be indicative of seasonal perched groundwater. The iron oxide staining at Test Pit TP-9 was encountered from two and one-half to eight feet below existing grade and may be indicative of seasonal groundwater within permeable lenses in the till.

Based on conditions observed at our test pit locations, in our opinion, light to moderate groundwater seepage could be encountered if grading is conducted during the wet season. The contractor should be made aware that groundwater seepage levels are not static. There will likely be fluctuations in the level depending on the season, amount of rainfall, surface water runoff, and other factors. Generally, the water level is higher and seepage rates are greater in the wetter winter months (typically October through May). The contractor should be prepared to control groundwater if seepage is encountered in site excavations.

Laboratory Testing

Laboratory tests were conducted on representative soil samples to verify or modify the field soil classifications and to evaluate the general physical properties and engineering characteristics of the soil encountered. Visual field classifications were supplemented by grain size analyses on representative soil samples. Moisture content tests were performed on all samples. The results of laboratory tests performed on specific samples are provided either at the appropriate sample depth on the individual test pit logs or on a separate data sheet contained in Appendix B. It is important to note that these test results may not accurately represent the overall in-situ soil conditions. Our geotechnical engineering recommendations are based on our interpretation of these test results. ECI cannot be responsible for the interpretation of these data by others.

In accordance with our Standard Fee Schedule and General Conditions, the soil samples for this project will be discarded after a period of fifteen (15) days following completion of this report unless we are otherwise directed in writing.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our study, in our opinion, the site can be developed generally as planned, provided the geotechnical recommendations contained in this report are followed. Building support can be provided using conventional spread and continuous footing foundation systems bearing on competent native soil or on structural fill used to modify existing site grades. Slab-on-grade floors may be similarly supported.

At our test pit locations, soils suitable for support of foundations were observed at a depth of approximately two to three feet below the existing ground surface elevation. If loose soil is encountered at construction subgrade elevation, it should either be compacted in-place to the requirements of structural fill or it should be overexcavated and replaced with structural fill.

Cuts for the proposed detention vault in the northwest corner of the site will likely be on the order of ten to fifteen (15) feet. At Test Pit TP-4, we encountered dense to very dense soil conditions at a depth of four feet below existing grade. Based on our subsurface exploration, in our opinion, cuts necessary to reach foundation elevations for the proposed detention vault will be feasible.

This report has been prepared for specific application to this project only and in a manner consistent with that level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area for the exclusive use of Phoenix Development, Inc. and their representatives. No warranty, expressed or implied, is made. This report, in its entirety, should be included in the project contract documents for the information of the contractor.

Site Preparation and General Earthwork

Based on preliminary plans provided, the site work will include utility installation and minimal grading with cuts and fills of five feet or less. Cuts needed to reach foundation subgrade for the detention vault will likely be on the order of ten to fifteen (15) feet.

The building and roadway areas should be stripped and cleared of surface vegetation, organic matter, and other deleterious material. Based on the thickness of the topsoil and vegetative cover encountered in our test pits, a stripping depth of approximately two to twelve inches for most of the site with localized areas as deep as sixteen (16) inches should be anticipated. The actual stripping depth should be based on field observation at the time of construction.

Stripped materials should not be mixed with materials to be used as structural fill. The stripped soil materials may be "wasted" on site in non-structural landscaping areas or they may be exported off site.

Following the stripping operation and excavations necessary to achieve construction subgrade elevations, an ECI representative should observe the ground surface where structural fill, foundations, or slabs are to be placed. Soil in loose or soft areas, if recompacted and still excessively yielding, should be overexcavated and replaced with structural fill to a depth that will provide a stable base beneath the general structural fill. The optional use of a geotextile fabric placed directly on the overexcavated surface may help to bridge unstable areas. ECI can provide recommendations for geotextiles, if necessary.

Structural fill is defined as compacted fill placed under buildings, roadways, slabs, pavements, or other load-bearing areas. Structural fill under floor slabs and footings should be placed in horizontal lifts not exceeding twelve (12) inches in loose thickness and compacted to a minimum of 90 percent of its laboratory maximum dry density determined in accordance with ASTM Test Designation D-1557 (Modified Proctor). The fill materials should be placed at or near their optimum moisture content.

During dry weather, granular soils that are compactable and non-organic can be used as structural fill. Based on the results of our laboratory tests, the on-site soils at the time of our exploration appear to be in a moist to wet condition. Laboratory testing indicates the site soils have between 40 and 45 percent fines passing the No. 200 sieve. Soil with fines in excess of around 5 percent will degrade if exposed to excessive moisture, and compaction and grading will be difficult if the soil moisture increases significantly above its optimum level. Aeration and moisture conditioning of the on-site soils may be necessary prior to use as structural fill.

If the site soils are exposed to excessive moisture and cannot be adequately compacted, then it may be necessary to import a soil that can be compacted. During dry weather, non-organic, compactable granular soil with a maximum grain size of four inches can be used. Fill for use during wet weather should consist of a fairly well graded granular material having a maximum grain size of four inches and no more than 5 percent fines passing the No. 200 sieve based on the minus 3/4-inch fraction. A contingency in the earthwork budget should be included for the possibility of importing a material meeting this specification.

Foundations

Based on the results of our study, the proposed building structures can be supported on conventional spread and continuous footing foundation systems bearing on competent native soil or on structural fill used to modify existing site grades. In general, native soils suitable for support of foundations were observed at a depth of approximately two to three feet below existing grades.

Exterior foundation elements should be placed at a minimum depth of eighteen (18) inches below final exterior grade. Interior spread foundations can be placed at a minimum depth of twelve (12) inches below the top of slab, except in unheated areas, where interior foundation elements should be founded at a minimum depth of eighteen (18) inches. Continuous and individual spread footings should have minimum widths of sixteen (16) and eighteen (18) inches, respectively.

With foundation support obtained as described, for design, an allowable soil bearing capacity of two thousand five hundred (2,500) psf should be used for competent native soils, native soil compacted to the requirements of structural fill, or for newly placed structural fill used to modify site grades. Loading of this magnitude would be provided with a theoretical factor-of-safety in excess of 3.0 against shear failure. For short-term dynamic loading conditions, a one-third increase in the above allowable bearing capacity can be used.

With structural loading as expected, total settlement of less than one inch is anticipated with differential movement of less than one-half inch. Most of the anticipated settlement should occur during construction as dead loads are applied.

Horizontal loads can be resisted by friction between the base of the foundation and the supporting soil and by passive soil pressure acting on the face of the buried portion of the foundation. For the latter, the foundation must be poured "neat" against the competent native soils or backfilled with structural fill. For frictional capacity, a coefficient of 0.35 should be used. For passive earth pressure, the available resistance should be computed using an equivalent fluid pressure of three hundred fifty (350) pounds per cubic foot (pcf). These lateral resistance values are allowable values; a factor-of-safety of 1.5 has been included. As movement of the foundation element is required to mobilize full passive resistance, the passive resistance should be neglected if such movement is not acceptable.

Footing excavations should be observed by a representative of ECI, prior to placing forms or rebar, to verify that conditions are as anticipated in this report.

Detention Vault

Preliminary plans indicate a detention vault is planned for the northwest corner of the site. We anticipate cuts on the order of ten to fifteen (15) feet may be needed to reach foundation subgrade. At Test Pit TP-4, located in the northern portion of the proposed vault, we encountered four feet of loose to medium dense granular soils, underlain by dense to very dense glacial till. Cuts within the loose to medium dense soils underlying the vault area should be sloped at an inclination of 1.5H:1V (Horizontal:Vertical). Cuts within the dense to very dense glacial till can be sloped at an inclination of 0.75H:1V. Due to the very dense condition of the glacial till soils, we do not anticipate seepage encountered within the excavation will adversely impact the excavation stability.

With regard to foundation support for the proposed vault, for design, an allowable soil bearing capacity of six thousand (6,000) psf should be used for the competent native soils anticipated to be encountered along the vault bottom.

The walls of the detention vault should be designed to resist the lateral loads imposed by the retained soils. Walls that are designed to yield can be designed to resist the lateral earth pressures imposed by an equivalent fluid with a unit weight of thirty-five (35) pcf. If walls are to be restrained at the top from free movement, the equivalent fluid weight should be increased to fifty (50) pcf. These values are based on horizontal backfill and that surcharges due to backfill slopes, hydrostatic pressures, traffic, structural loads or other surcharge loads will not act on the wall. If such surcharges are to apply, they should be added to the above design lateral pressure. The passive pressure and friction coefficient previously provided in the *Foundations* section of this study are applicable to the detention vault wall design.

To reduce the potential for hydrostatic forces building up behind the vault walls, the use of free-draining backfill or a sheet drain combined with a perforated drain pipe can be considered. The free-draining backfill should consist of pea gravel or washed rock with a fines content of less than 5 percent, based on the minus 3/4-inch fraction. The free-draining material should extend at least eighteen (18) inches behind the wall. A rigid, four-inch diameter, schedule 40, perforated PVC or SDR 35 drainpipe should be placed at the base of the wall, and should be surrounded by a minimum of one cubic foot per lineal foot with 3/8-inch pea gravel. The pipe should be placed with the perforations in the down position. The remainder of the backfill should consist of structural fill. Where drainage behind the walls cannot be achieved, the walls should be designed for hydrostatic pressures.

Slab-on-Grade Floors

Slab-on-grade floors should be supported on competent native soil, native soil compacted in-place to the requirements of structural fill, or on structural fill used to modify site grades. Subgrade soils that are loose or disturbed during construction should either be compacted in-place to the requirements of structural fill or overexcavated and replaced with structural fill.

Slabs should be provided with a capillary break consisting of a minimum four inches of free-draining sand or gravel. In areas where slab moisture is undesirable, a vapor barrier such as a 6-mil plastic membrane should be placed beneath the slab. Two inches of damp sand may be placed over the membrane for protection during construction and to aid in curing of the concrete.

Seismic Design Considerations

The Puget Lowland is classified as a Seismic Zone 3 in the 1997 Uniform Building Code (UBC). Earthquakes occur in the Puget Lowland with regularity, however, the majority of these events are of such low magnitude they are not felt without instruments. Large earthquakes do occur, as indicated by the 1949, 7.2 magnitude earthquake in the Olympia area, the 1965, 6.5 magnitude earthquake in the Midway area, and the 2001, 6.8 magnitude Nisqually earthquake.

There are three potential geologic hazards associated with a strong motion seismic event at this site: ground rupture, liquefaction, and ground motion response.

Ground Rupture

The strongest earthquakes in the Puget Lowland are widespread, subcrustal events, ranging in depth from thirty (30) to fifty-five (55) miles. Surface faulting from these deep events has not been documented to date. Therefore, it is our opinion, that the risk of ground rupture at this site during a strong motion seismic event is negligible.

Liquefaction

Liquefaction is a phenomenon in which soils lose all shear strength for short periods of time during an earthquake. Groundshaking of sufficient duration results in the loss of grain-to-grain contact and rapid increase in pore water pressure, causing the soil to behave as a fluid. To have a potential for liquefaction, a soil must be cohesionless with a grain size distribution of a specified range (generally sand and silt); it must be loose; it must be below the groundwater table; and it must be subject to sufficient magnitude and duration of groundshaking. The effects of liquefaction may be large total and/or differential settlement for structures founded in the liquefying soils.

In our opinion, the potential for liquefaction-induced settlement of the soils encountered at this site should be negligible. This conclusion is based on the absence of a shallow groundwater table in the immediate vicinity of the proposed development and the generally increasing soil density with depth.

Ground Motion Response

The 1997 UBC seismic design section provides a series of soil types that are used as a basis for seismic design of structures. Based on the encountered soil conditions, it is our opinion that soil type S_C, from Table 16-J should be used for design. For International Building Code (IBC) based design, Site Class C from Table 1615.1.1 from the 2003 IBC should be used.

Excavations and Slopes

The following information is provided solely as a service to our client. Under no circumstances should this information be interpreted to mean that ECI is assuming responsibility for construction site safety or the contractor's activities, such responsibility is not being implied and should not be inferred.

In no case should excavation slopes be greater than the limits specified in local, state (WISHA), and Federal (OSHA) safety regulations. Based on the information obtained from the subsurface exploration, the loose to medium dense soils encountered in the upper portion of the test pit locations would be classified as Type C by OSHA/WISHA. Temporary cuts greater than four feet in height in Type C soils should be sloped at an inclination of 1.5H:1V. The underlying dense to very dense glacial till encountered at our test pit locations would be classified as Type A by OSHA/WISHA. Temporary cuts greater than four feet in height in Type A soils should be sloped at an inclination of 0.75H:1V. Where groundwater seepage is encountered the saturated soils should be treated as a Type C soil and should be cut no steeper than 1.5H:1V.

If slopes of this inclination, or flatter, cannot be constructed, temporary shoring may be necessary. Shoring will help protect against slope or excavation collapse, and will provide protection to workers in the excavation. If temporary shoring is required, we will be available to provide shoring design criteria.

Permanent cut and fill slopes should be inclined no steeper than 2H:1V. Cut slopes should be observed by ECI during excavation to verify that conditions are as anticipated. Supplementary recommendations can then be developed, if needed, to improve stability, including flattening of slopes or installation of surface or subsurface drains.

Permanently exposed slopes should be seeded with an appropriate species of vegetation to reduce erosion and to improve stability of the surficial layer of soil.

Site Drainage

Iron oxide staining was encountered at all of our test pit locations. The iron oxide staining is likely indicative of either seasonal perched groundwater or seasonal groundwater within permeable lenses in the glacial till.

If seepage is encountered during construction, the bottom of the excavation should be sloped to one or more shallow sump pits. The collected water can then be pumped from these pits to a positive and permanent discharge. Depending on the magnitude of such seepage, it may also be necessary to interconnect the sump pits by a system of connector trenches.

The appropriate locations of subsurface drains, if needed, should be established during grading operations by ECI's representative at which time the seepage areas, if present, may be more clearly defined.

During construction, the site must be graded such that surface water is directed away from construction areas. Water must not be allowed to stand in areas where foundations, slabs, or pavements are to be constructed. Loose surfaces should be sealed by compacting the surface to reduce the potential for moisture infiltration into the soils. Final site grades must allow for drainage away from the future retail buildings. The ground should be sloped at a gradient of 3 percent for a distance of at least ten feet away from the structures.

Footing drains should be installed around the perimeter of the buildings just below the invert of the footing, with a gradient sufficient to initiate flow. A typical detail is provided on Plate 3. Under no circumstances should roof downspout drain lines be connected to the footing drain system. Roof downspouts must be separately tightlined to discharge. Cleanouts should be installed at strategic locations to allow for periodic maintenance of the footing drain and downspout tightline systems.

Utility Support and Backfill

The site soils should generally provide adequate support for utilities. Where loose soils or unstable conditions are encountered, remedial measures such as overexcavating soft soils or compacting subgrade soils exposed in the trench bottom may be required.

Utility trench backfill is a primary concern in reducing the potential for settlement along utility alignments, particularly in pavement areas. It is important that each section of utility line is adequately supported in the bedding material. The material should be hand tamped to provide support around the pipe haunches. Fill should be carefully placed and hand tamped to about 12 inches above the crown of the pipe before heavy compaction equipment is brought into use. The remainder of the trench backfill should be placed in lifts having a loose thickness of less than twelve (12) inches. Trench backfill should be compacted to the requirements of structural fill. A typical utility trench fill detail is provided on Plate 4. The City of Woodinville Development Standards for trench backfill may supersede the compaction recommendations in this report.

Existing utility pipes to be abandoned should be plugged or removed so that they do not provide a conduit for water and cause soil saturation and stability problems.

Pavement Areas

The adequacy of site pavements is related in part to the condition of the underlying subgrade. To provide a properly prepared subgrade for pavements, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Structural fill in pavement areas should be prepared as described in the *Site Preparation and General Earthwork* section of this report. This means the pavement subgrade should be compacted to at least 95 percent of the maximum dry density. It is possible that some localized areas of soft, wet or unstable subgrade may exist after the pavement subgrade is prepared. Overexcavation and a greater thickness of structural fill or crushed rock may be needed to stabilize these localized areas.

Assuming a properly prepared subgrade that is in a firm and unyielding condition when subjected to proofrolling, the following pavement section for lightly loaded areas can be considered:

- Two inches of asphalt concrete (AC) over four inches of crushed rock base (CRB) material, or
- Two inches of AC over three inches of asphalt treated base (ATB) material.

Heavier truck-traffic areas will require thicker pavement sections depending upon site usage, pavement life, and site traffic. As a general rule, the following sections can be considered for truck-trafficked areas:

- Three inches of AC over six inches of CRB, or
- Three inches of AC over four and one-half inches of ATB.

These pavement thicknesses may be modified based on anticipated traffic loads and frequency.

AC, ATB, and CRB materials should conform to WSDOT specifications. All rock bases should be compacted to at least 95 percent of the maximum dry density.

The above pavement recommendations are preliminary, and may need to be modified based on anticipated traffic loading, subgrade conditions, or other factors that could affect the performance of the pavement.

LIMITATIONS

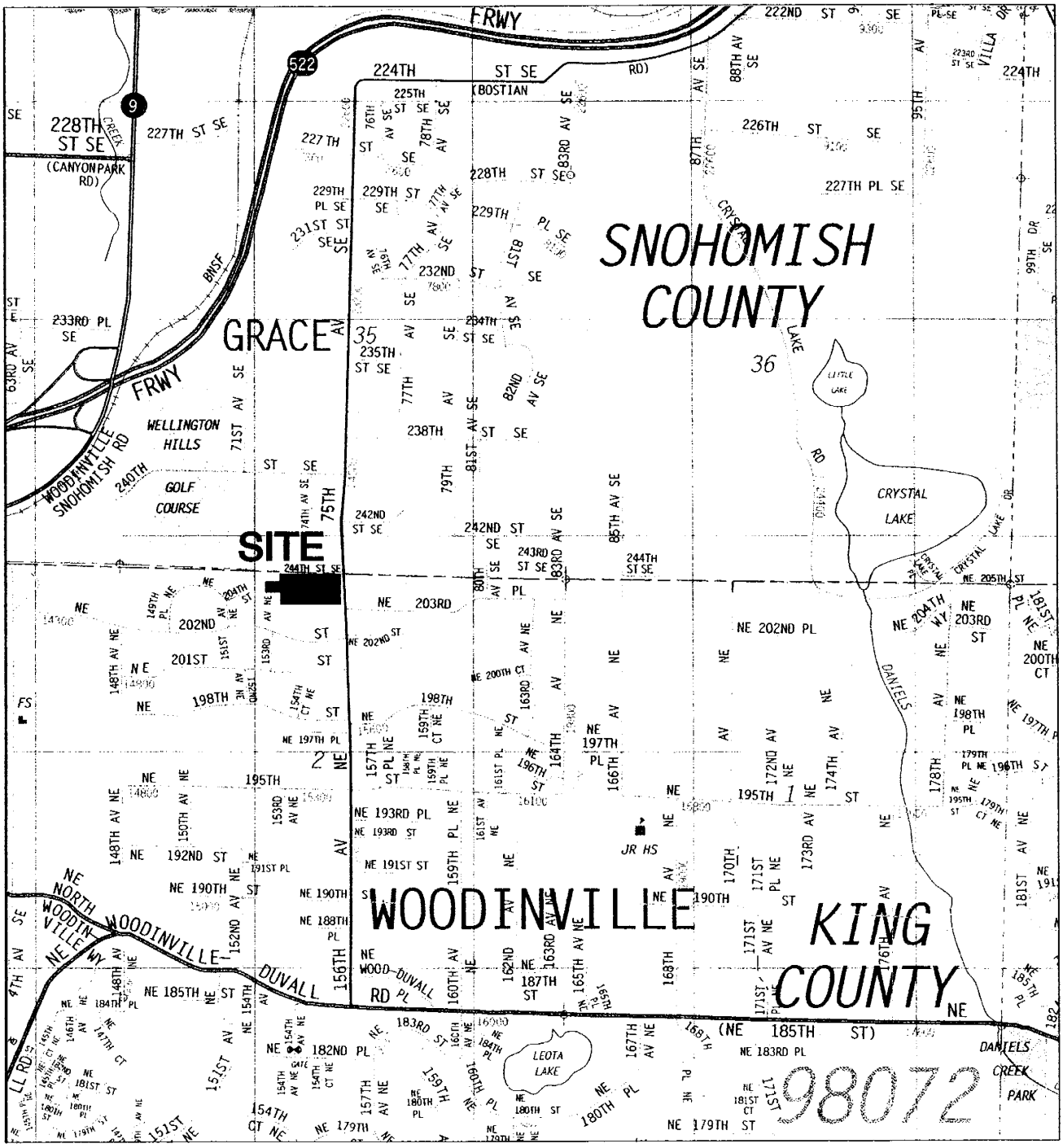
Our recommendations and conclusions are based on the observed site materials, selective laboratory testing, engineering analyses, the design information provided us, and our experience and engineering judgment. The conclusions and recommendations are professional opinions derived in a manner consistent with that level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area. No warranty is expressed or implied.

The recommendations submitted in this report are based on the data obtained from the test pits. Soil and groundwater conditions between test pits may vary from those encountered. The nature and extent of variations between our exploratory locations may not become evident until construction. If variations do appear, ECI should be requested to reevaluate the recommendations of this report and to modify or verify them in writing prior to proceeding with the construction.

Additional Services

As the geotechnical engineer of record, ECI should be retained to perform a general review of the final design and specifications to verify the earthwork and foundation recommendations have been properly interpreted and implemented in the design and in the construction specifications.

ECI should also be retained to provide geotechnical engineering services during construction. This is to observe compliance with the design concepts, specifications or recommendations and to facilitate design changes in the event subsurface conditions differ from those anticipated prior to the start of construction.



Reference:
King County
Map 477
By Thomas Brothers Maps
Dated 2005

NOTE: This plate may contain areas of color. ECI cannot be responsible for any subsequent misinterpretation of the information resulting from black & white Reproductions of this plate.

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Vicinity Map
Montevallo
Woodinville, Washington

Drwn. GLS	Date Sept. 2004	Proj. No. 11363
Checked ELW	Date 9/22/04	Plate 1

LEGEND

TP-1 — Approximate Location of ECI Test Pit, Proj. No. E-11363, Sep. 2004

Subject Site

6 — Proposed Lot Number

Existing Buildings

Limits of Wetland area (Delineated by Others)

Approximate Scale

0 25 50 100

NOTE: This plate may contain areas of color. ECI cannot be responsible for any subsequent misinterpretation of the information resulting from black & whit reproductions of this plate.

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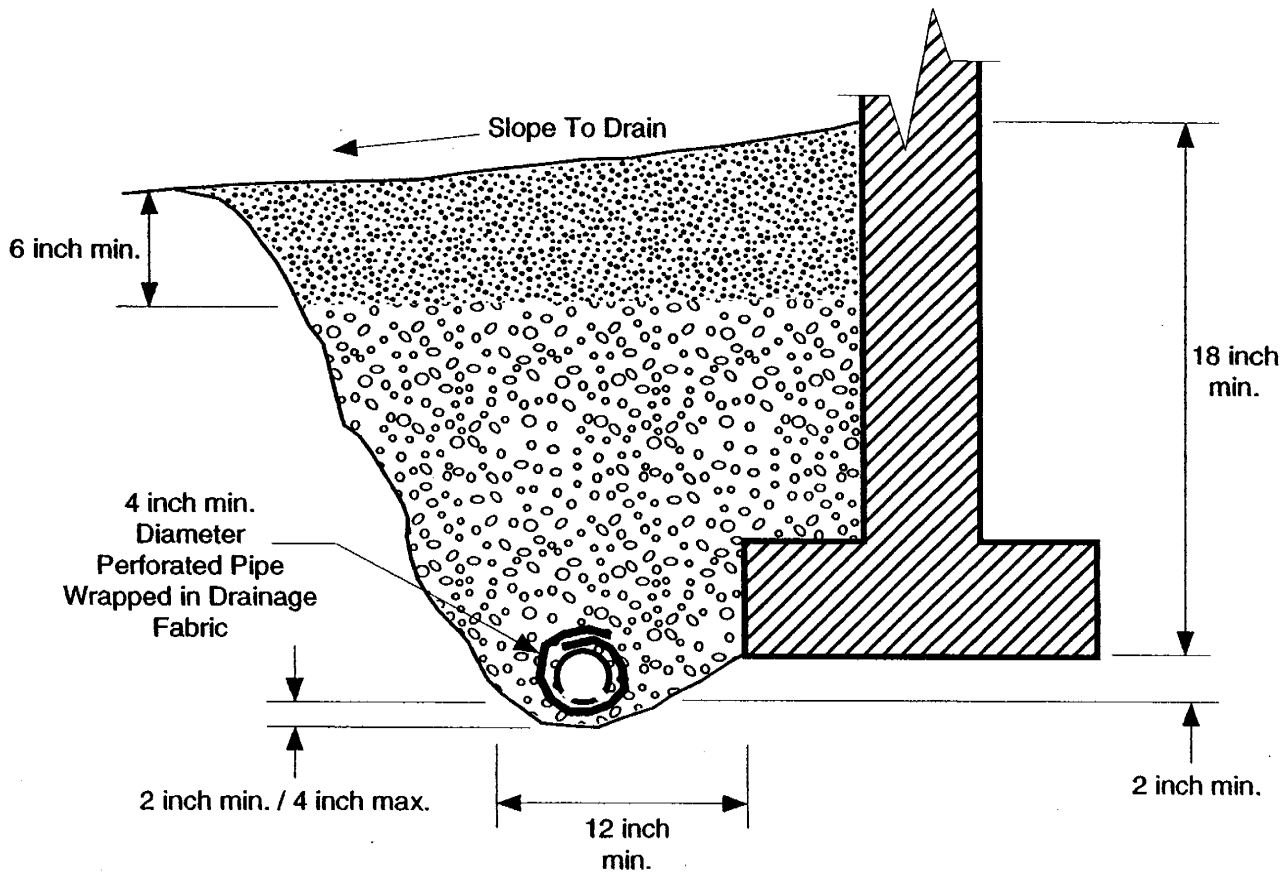
Test Pit Location Plan
Montevallo
Woodinville, Washington

Drwn. GAP	Date Sep. 2004	Proj. No. 11363
Checked ELW	Date 9/22/04	Plate 2



LEGEND

Surface seal; native soil or other low permeability material.

1" Drain Rock

Drain pipe; perforated or slotted rigid PVC pipe laid with perforations or slots facing down; tight jointed; with a positive gradient. Do not use flexible corrugated plastic pipe. Do not tie building downspout drains into footing lines. Wrap with Mirafi 140 Filter Fabric or equivalent.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

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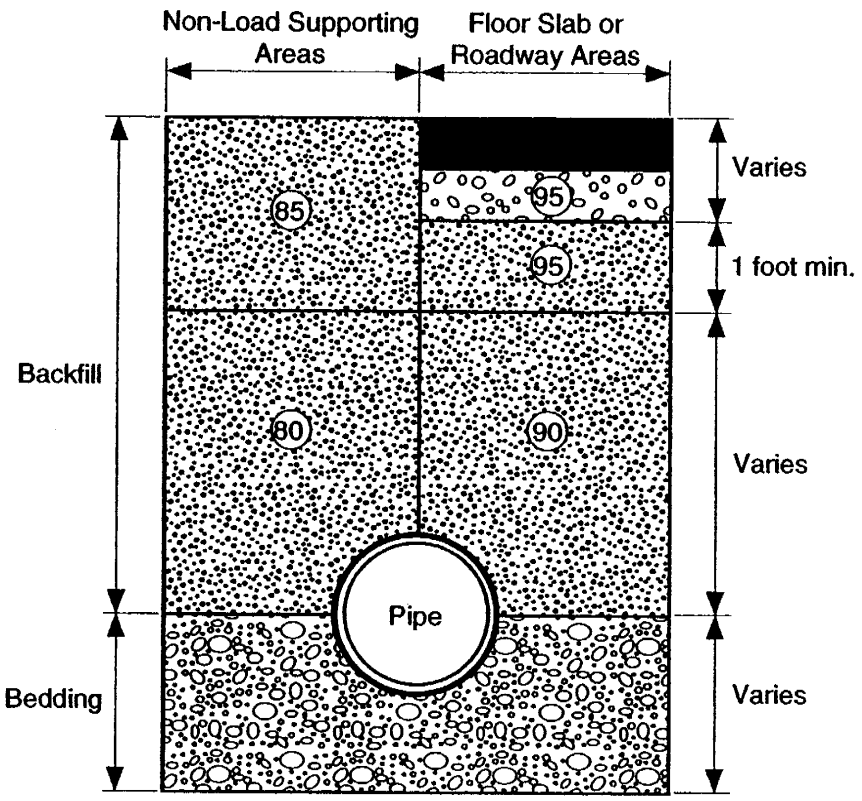
TYPICAL FOOTING SUBDRAIN DETAIL
Montevallo
Woodinville, Washington

Drwn. GAP	Date Sep. 2004	Proj. No. 11363
Checked ELW	Date 9/22/04	Plate 3



LEGEND

Asphalt or Concrete Pavement or Concrete Floor Slab

Base Rock or Capillary Break, as Appropriate

Backfill; Compacted On-Site Soil or Suitable Imported Fill Material

(90) Minimum Percentage of Maximum Laboratory Dry Density as determined by ASTM Test Method D 1557-91 (Modified Proctor), unless otherwise specified in the attached report text.

Bedding Material; material type depends on type of pipe and laying conditions. Bedding should conform to the manufacturers recommendations for the type of pipe selected.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

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TYPICAL UTILITY TRENCH FILL
Montevallo
woodinville, Washington

Drwn. GAP	Date Sep. 2004	Proj. No. 11363
Checked ELW	Date 9/22/04	Plate 4

APPENDIX A

FIELD EXPLORATION

E-11363

Earth Consultants, Inc. (ECI) performed test pit exploration on August 26, 2004. The subsurface conditions at the site were explored by excavating twelve (12) test pits to a maximum depth of thirteen and one-half (13.5) feet below existing grade. The test pits were excavated by Northwest Excavating, subcontracted to ECI, using a rubber-tired backhoe.

The approximate test pit locations were determined by pacing from site features depicted on a site plan provided by Triad Associates. The elevations were estimated from the topographic lines depicted on the site plan. The locations and elevations of the test pits should be considered accurate only to the degree implied by the method used. Exploration was limited in many areas due to existing residences and outbuildings, septic drain fields, fences, gardens, and landscaping. The approximate locations are shown on the Test Pit Location Plan, Plate 2.

The field exploration was continuously monitored by a geologist from our firm, who classified the soils encountered, maintained a log of each test pit, obtained representative samples and observed pertinent site features. All samples were visually classified in accordance with the Unified Soil Classification System that is presented on Plate A1, Legend. Logs of the test pits are presented on Plates A2 through A13. The final logs represent our interpretations of the field logs and the results of the laboratory tests on field samples. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual. Representative soil samples were collected and returned to our laboratory for further examination and testing.

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTION
Coarse Grained Soils	Gravel And Gravelly Soils	Clean Gravels (little or no fines)		GW gw	Well-Graded Gravels, Gravel-Sand Mixtures, Little Or No Fines
				GP gp	Poorly-Graded Gravels, Gravel-Sand Mixtures, Little Or No Fines
	More Than 50% Coarse Fraction Retained On No. 4 Sieve	Gravels With Fines (appreciable amount of fines)		GM gm	Silty Gravels, Gravel-Sand-Silt Mixtures
				GC gc	Clayey Gravels, Gravel-Sand-Clay Mixtures
More Than 50% Material Larger Than No. 200 Sieve Size	Sand And Sandy Soils	Clean Sand (little or no fines)		SW sw	Well-Graded Sands, Gravelly Sands, Little Or No Fines
				SP sp	Poorly-Graded Sands, Gravelly Sands, Little Or No Fines
	More Than 50% Coarse Fraction Passing No. 4 Sieve	Sands With Fines (appreciable amount of fines)		SM sm	Silty Sands, Sand-Silt Mixtures
				SC sc	Clayey Sands, Sand-Clay Mixtures
Fine Grained Soils	Silts And Clays	Liquid Limit Less Than 50		ML ml	Inorganic Silts & Very Fine Sands, Rock Flour, Silty-Clayey Fine Sands; Clayey Silts w/ Slight Plasticity
				CL cl	Inorganic Clays Of Low To Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean
				OL ol	Organic Silts And Organic Silty Clays Of Low Plasticity
More Than 50% Material Smaller Than No. 200 Sieve Size	Silts And Clays	Liquid Limit Greater Than 50		MH mh	Inorganic Silts, Micaceous Or Diatomaceous Fine Sand Or Silty Soils
				CH ch	Inorganic Clays Of High Plasticity, Fat Clays.
				OH oh	Organic Clays Of Medium To High Plasticity, Organic Silts
Highly Organic Soils				PT pt	Peat, Humus, Swamp Soils With High Organic Contents

Topsoil		Humus And Duff Layer
Fill		Highly Variable Constituents

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.

DUAL SYMBOLS are used to indicate borderline soil classification.

C	TORVANE READING, tsf
qu	PENETROMETER READING, tsf
W	MOISTURE, % dry weight
P	SAMPLER PUSHED
*	SAMPLE NOT RECOVERED
pcf	DRY DENSITY, lbs. per cubic ft.
LL	LIQUID LIMIT, %
PI	PLASTIC INDEX

I 2" O.D. SPLIT SPOON SAMPLER

II 24" I.D. RING OR SHELBY TUBE SAMPLER

WATER OBSERVATION WELL

▽ DEPTH OF ENCOUNTERED GROUNDWATER DURING EXCAVATION

▼ SUBSEQUENT GROUNDWATER LEVEL W/ DATE

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LEGEND

Proj. No. 11363	Date Sept. 2004	Plate A1

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-1
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 478'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 10" grass
					TPSL	Brown topsoil
			1		SM	Light brown silty SAND, loose, moist -trace gravel
	8.1		2		SM	Tan silty fine SAND with gravel, medium dense, moist -iron oxide staining -becomes gray, dense
	8.5		3			
			4			
			5			-increase moisture
	10.1		6		SM	Gray silty fine SAND, dense, moist -trace gravel -becomes very dense
			7			Test pit terminated at 7 feet below existing grade. No groundwater encountered during excavation. NOTE: Test pit excavated by Northwest Excavating with Rubber-Tired Backhoe. Elevations estimated from topo map by Triad Associates.

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Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A2

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-2
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 465'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 10" grass
					TPSL	Brown topsoil
			1		SM	Reddish brown silty fine SAND, loose, moist
			2			-trace gravel
	15.1					
			3			-becomes gray, medium dense
						-iron oxide staining
	11.5		4			-becomes dense
			5			
			6			-increase moisture
					SM	Gray silty fine SAND with gravel, dense, moist
			7			
	9.0					-becomes very dense
			8			
						Test pit terminated at 8.5 feet below existing grade. No groundwater encountered during excavation

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Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A3

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-3
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 457'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 10" grass
					TPSL	Brown topsoil
			1		SM	Reddish brown silty fine SAND, loose, moist
	22.6		2			-contains gravel - 42.8% fines -becomes gray, medium dense
	13.3		3			-iron oxide staining, becomes moist to wet -trace gravel
			4			-becomes dense
			5			
			6			
	11.3		7			-contains sand lenses -contains gravel
			8			
			9			-becomes very dense
						Test pit terminated at 9.5 feet below existing grade. No groundwater encountered during excavation

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Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A4

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-4
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 434'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 16" grass
			1		TPSL	Brown topsoil
	12.3		2		SM	Reddish brown silty fine SAND, loose, moist -contains gravel
			3		SM	Gray silty fine SAND with gravel, medium dense, moist -iron oxide staining -becomes dense
	9.3		4 5			
			6			-becomes very dense
	8.0		7 8			
						Test pit terminated at 8.5 feet below existing grade. No groundwater encountered during excavation

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Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A5

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-5
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 445'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 16" grass
			1		TPSL	Brown topsoil
	11.2		2		SM	Reddish brown silty fine SAND, loose, moist
			3			-becomes gray, dense, iron oxide staining
	12.1		4			-contains gravel
			5			-decrease fine, becomes moist to wet -iron oxide staining
	17.7		6			-increase in fines, becomes moist
			7			
			8			
	10.7		9			-becomes very dense -contains gravel
			10			Test pit terminated at 10 feet below existing grade. No groundwater encountered during excavation

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Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A6

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-6
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 455'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 5" grass
					TPSL	Brown topsoil
					SM	Reddish brown silty fine SAND, loose, moist
			1			-trace gravel
	16.2					-becomes tan
			2			-becomes gray, medium dense
						-iron oxide staining to 4'
			3			
			4			
	9.7					-becomes dense, trace gravel
						-reduced fines, increase moisture
			5			
			6			
			7			-increase fines
			8			-trace gravel
	10.9					Test pit terminated at 8.5 feet below existing grade. No groundwater encountered during excavation

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Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A7

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

TEST PIT LOG 11363.GPJ ECI.GDT 9/27/04

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-7
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 438'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 12" grass
					TPSL	Brown topsoil
			1		SM	Reddish brown silty fine SAND, loose, moist to wet
	24.5		2			-contains gravel
			3			-becomes gray, medium dense, moist -iron oxide staining
	11.8		4			-fine to medium grained sand - contains gravel
			5			-becomes dense
			6			-increase fines
			7			-becomes very dense -trace gravel
	11.0		8			Test pit terminated at 8 feet below existing grade. No groundwater encountered during excavation

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Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A8

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-8
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 453'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 12" grass
					TPSL	Brown topsoil
			1		SM	Tan silty SAND with gravel, loose, moist
	7.7		2			
			3			-becomes gray medium dense, iron oxide staining
	6.8		4			-becomes dense
			5		SM	Gray silty fine SAND, dense, moist -trace gravel
			6			
			7			
			8			
			9			-becomes very dense
	11.1					Test pit terminated at 9.5 feet below existing grade. No groundwater encountered during excavation

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Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/34/04	Plate A9

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

TEST PIT LOG 11363.GPJ ECI.GDT 9/24/04

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-9
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 449'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 2" grass
			1		SM	Tan silty fine SAND, loose, moist -contains roots -becomes reddish brown -contains gravel
	22.5		2			
			3		SM	Gray silty fine SAND with gravel, medium dense, moist -iron oxide staining to 8'
	9.6		4			
			5			-becomes dense
			6			
			7			
			8		SM	Gray silty fine to medium SAND, medium dense, wet -contains gravel - 40.4% fines
	14.4		9			
			10			
			11			-becomes medium dense to dense
			12			-contains sand lens
			13		SM	Gray silty fine to medium SAND with gravel, dense, wet
	12.3					Test pit terminated at 13.5 feet below existing grade. No groundwater encountered during excavation

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Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A10

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-10
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 463'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 8" grass
					TPSL	Brown topsoil
			1		SM	Reddish brown silty fine SAND, loose, moist -becomes tan, medium dense -contains gravel
	7.6		2			
			3		SM	Gray silty fine SAND with gravel, medium dense, moist -iron oxide staining
	8.9		4			-becomes dense
			5		SM	Gray silty fine SAND, dense, moist -trace gravel
			6			
			7			
	10.5		8			Test pit Terminated at 8 feet below existing grade. No groundwater encountered during excavation

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Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A11

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/26/04	Test Pit No.: TP-11
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 459'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 14" grass
					TPSL	Brown topsoil
			1		SM	Reddish brown silty fine SAND, loose, moist
						-contains gravel
	15.9		2			-becomes gray, medium dense
						-Iron oxide staining
			3			
						-becomes dense
	12.3		4			
						-decrease in fines, becomes moist to wet
			5			
			6			
			7			
			8			-iron oxide staining
						-becomes wet - sand lens
			9			
						-becomes moist to wet
			10			-trace gravel
			11			
	11.0					Test pit terminated at 11 feet below existing grade. No groundwater encountered during excavation

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A12

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Montevallo			Sheet 1 of 1
Job No. 11363	Logged by: ELW	Date: 8/24/04	Test Pit No.: TP-12
Excavation Contactor: Northwest Excavating			Ground Surface Elevation: 465'
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Topsoil & sod 6" grass
					TPSL	Brown topsoil
					SM	Brown silty fine SAND with gravel, loose, moist (Fill)
			1		SM	Reddish brown silty fine SAND, loose, moist
			2			
	9.2		3			-becomes gray medium dense -iron oxide staining
	9.1		4			-becomes dense -trace gravel - 45.3% fines
			5			
			6			
			7			-trace gravel
	10.7					Test pit terminated at 7.5 feet below existing grade. No groundwater encountered during excavation

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Test Pit Log
Montevallo
Woodinville, Washington

Proj. No. 11363	Dwn. GAP	Date 9/24/04	Checked ELW	Date 9/24/04	Plate A13

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

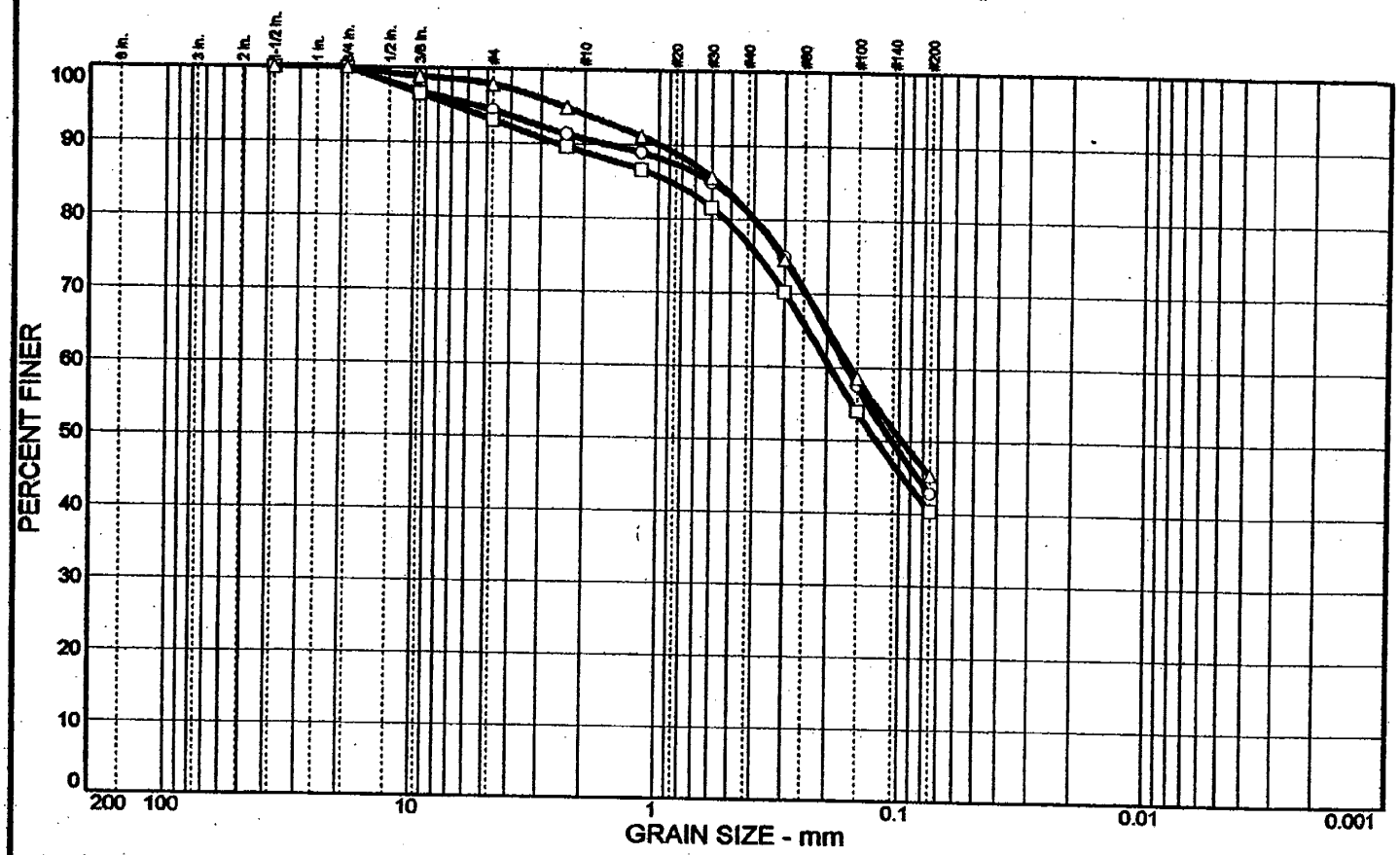
TEST PIT LOG 11363.GPJ ECI.GDT 9/24/04

APPENDIX B

LABORATORY TEST RESULTS

E-11363

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		5.6	51.6	42.8		SM			
□		6.9	52.7	40.4		SM			
△		2.1	52.6	45.3		SM			

SIEVE inches size	PERCENT FINER ○	□	△
1.5	100.0	100.0	100.0
3/4	100.0	100.0	100.0
3/8	96.9	96.6	98.9
	GRAIN SIZE		
D_{60}	0.166	0.194	0.160
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	94.4	93.1	97.9
#8	91.3	89.6	94.9
#16	88.9	86.6	91.1
#30	85.0	81.6	85.7
#50	74.9	70.2	74.6
#100	57.5	54.0	58.6
#200	42.8	40.4	45.3

SOIL DESCRIPTION

○ TP-3: 1.5' - SM
Reddish Brown silty Sand; 22.6% moisture

□ TP-9: 8.5' - SM
Gray silty Sand; 14.4% moisture

△ TP-12: 4.0' - SM
Gray silty Sand; 9.1% moisture

REMARKS:

○ SEP

□ SEP

△ SEP

○ Source: Sample No.: TP-3 Elev./Depth: 1.5'
□ Source: Sample No.: TP-9 Elev./Depth: 8.5'
△ Source: Sample No.: TP-12 Elev./Depth: 4.0'

EARTH CONSULTANTS, INC.

Client:
Project: Monte Vallo
Project No.: E-11363

Plate B1

DISTRIBUTION

E-11363

4 Copies

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