FILE

Washington State Department of Transportation

MEMORANDUM

August 8, 2002

TO: M. Russell
Northwest Region NB82-55

FROM: T. M. Allen / W. S. Hegge
OSC Geotechnical Branch, 47365

SUBJECT: SR 543, MP 0.20 to 1.08
SR 5 to International Boundary Modifications
Final Geotechnical Report

Attached is the final geotechnical report for the SR 543, SR 5 to International Boundary Modifications project. This final report presents the results of our subsurface explorations and analyses as well as our geotechnical recommendations for the site. Previously, we prepared a memorandum for the retaining wall lateral pressure diagrams and P-Y curve soil parameters for the project on July 15, 2002. The information in that memorandum has been incorporated into this final report.

Please contact us if you have any questions or comments regarding the information presented herein.

TMA/DS:wh

Attachment: Geotechnical Report

cc: J. Kapur, Bridge and Structures, 47340
S. Bushnaq, Bridge and Structures, 47340
R. Lewis, OSC Construction, 47354
C. Johnson, NW Materials Engineer, NB82-29
T. Harrison, Area Regional Administrator, NB82-210

GEOTECHNICAL REPORT

SR 543, SR 5 to International Boundary Modifications

OL-3500, Milepost 0.20 to 1.08

8/7/02

Tony M. Allen, P.E.
State Geotechnical Engineer

TONY M. ALLEN
STATE OF WASHINGTON
25339
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES JULY 1, 2003

Prepared by:
William S. Hegge, P.E.
Geotechnical Engineer

Reviewed by:
David L. Sowers, P.E.
Senior Geotechnical Engineer

August 8, 2002

Washington State Department of Transportation
Doug McDonald
Secretary of Transportation

Environmental and Engineering Programs Division
Materials Laboratory
Geotechnical Branch
P.O. Box 47365
Olympia, WA 98504-7365

Table of Contents

1. INTRODUCTION 1

1.1. GENERAL 1
1.2. PROJECT DESCRIPTION 1
1.3. PREVIOUS STUDIES 2

2. PROJECT SUBSURFACE CONDITIONS 3

2.1. LOCAL GEOLOGY 3
2.2. SOIL CONDITIONS 4
2.3. GROUNDWATER 5

3. SEISMOLOGICAL CONSIDERATIONS 5

3.1. DESIGN EARTHQUAKE PARAMETERS 5
3.2. LIQUEFACTION POTENTIAL 6

4. GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS 7

4.1. RETAINING WALLS 7
4.1.1. Tangent Pile and Soldier Pile Walls 7
4.1.2. MSE Walls 8
4.1.3. Noise Walls and Cast-in-Place Retaining Walls 10
4.2. DRILLED SHAFT FOUNDATIONS 11
4.2.1. Axial Support 11
4.2.2. Lateral Analyses 12
4.3. DETENTION PONDS 12
4.4. SIGNAL POLE, CAMERA POLE AND LUMINAIRE FOUNDATIONS 13
4.4.1. Signal Poles 13
4.4.2. Luminaire and Camera Poles 14
4.5. BRIDGE APPROACH SLABS 14

5. CONSTRUCTION CONSIDERATIONS 14

APPENDIX A -FIGURES

APPENDIX B- FIELD EXPLORATIONS

APPENDIX C- LABORATORY TESTING

APPENDIX D- LUMINAIRE/CAMERA POLE FOUNDATION TYPES

APPENDIX E – AXIAL CAPACITY CHARTS FOR DRILLED SHAFTS

APPENDIX F – P-Y CURVE INPUT PARAMETERS

APPENDIX G – LATERAL PRESSURE DIAGRAMS

1. INTRODUCTION

1.1. GENERAL

This report presents the results of our geotechnical study for the SR 543, SR 5 to International Boundary Modifications project. The location of the project site is shown on the Vicinity Map (Figure 1). This report presents the results of our site reconnaissance, subsurface explorations, and engineering analyses. Specifically, geotechnical conclusions and recommendations are provided for bridge foundation support, retaining walls, detention ponds, signal poles, luminaires and related construction considerations.

The analyses, conclusions, and recommendations provided in this report are based on the project description, and site conditions existing at the time of our site visits. The exploratory borings are assumed to be representative of the subsurface conditions at the locations throughout the site. If during construction, subsurface conditions differ from those described in the explorations, we should be advised immediately so that we may reevaluate our recommendations and provide assistance.

1.2. PROJECT DESCRIPTION

The purpose of the project is to improve the traffic flow on SR 543 south of the International Boundary crossing. This will be done by creating a grade separated crossing at the intersection of SR 543 and D Street, widening the roadway and reducing the road grades through the project area. The SR 543, SR 5 to International Boundary Modifications project includes lowering the alignment of SR 543, new off-ramp structures at D Street, six detention ponds, and roadway widening. As shown on the Wall Layout (Figure 2), the focus of this project will be the off ramps, depressed roadways and two bridges at the intersection with D Street. This will allow SR 543 traffic to pass under this intersection without stopping, while creating a separate, elevated intersection between SR 543 and D Street. The bridges will be designed using LRFD (Load Reduction Factor Design). The retaining walls will be designed using LFD (Load Factor Design).

Ten new retaining walls are planned as part of the project to support the soils on each side of the alignment throughout the depressed roadway section and the soils forming the new off-ramp structures rising to the elevation of the two bridges over SR 543 at the original grade of the intersection with D Street. These retaining walls, designated Retaining Walls 1 through 10 are shown on the Wall Layout (Figure 2) and on the Site and Exploration Plans (Figures 3A through 3G).

Two new bridges are planned as part of this project. These bridges will be constructed over the depressed sections of SR 543 at D Street. No approach fills will be constructed since the new bridges will be located at the existing elevation of D Street. Both bridges will be two

lanes wide. The eastern bridge will cross the northbound lanes of SR 543 and the western bridge will cross the southbound lanes of SR 543.

Six new detention ponds will be constructed as part of this project as shown on the Site and Exploration Plans (Figures 3A through 3G). Two of the proposed detention ponds will be constructed on each side of the alignment of SR 543 immediately north of the intersection with Boblett Street. Two more of the proposed detention ponds will be constructed on each side of the alignment immediately north of the intersection with H Street. The remaining two proposed detention ponds will be constructed immediately south of the international border on each side of the alignment of the SR 543 Truck Crossing Spur.

Due to the complexity of the proposed alignment, ten separate centerlines were used for the project. The location and purpose for each centerline is shown in Table 1 below:

Table 1 – Project Centerlines

Centerline	Location
B Line	Centerline of Boblett Street
D Line	Centerline of D Street Crossing Main Alignment
F Line	Centerline of 14th Street (East of Main Alignment)
H Line	Centerline of H Street
L Line	Centerline of Main Alignment
LL Line	East Curb of Southbound Lanes (Main Alignment)
LR Line	West Curb of Northbound Lanes (Main Alignment)
T Line	Centerline of Truck Lane
TW Line	Centerline of 12th Street (West of Main Alignment)
Y Line	Centerline of Northbound Right Turn Lane at Boblett Street

The subsurface explorations and geotechnical analyses described in this report were limited to the proposed structures along the first five centerlines referenced above. The proposed B, F, H, TW and Y alignments do not contain any structures.

1.3. PREVIOUS STUDIES

Previous exploratory work in the project vicinity and associated geotechnical studies have been prepared by WSDOT and several geotechnical consultants. In September 1996, GeoEngineers Inc. completed a report entitled *"Report, Geotechnical Engineering Services, Proposed Port of Entry Redevelopment and Expansion, Pacific Highway, Blaine, Washington."* This project was located northwest of the proposed project. This report contained design recommendations for the site grading and foundations for the proposed Port structures. In addition, in August 1998, GeoEngineers Inc. completed a report entitled *"Report, Geotechnical Engineering Services, Proposed Sign Foundations, North Bound Truck Parking Facility, Pacific Highway Port of Entry, Blaine, Washington."* This project

was located along the alignment of the proposed project. This report contained design recommendations for proposed sign foundations at the truck parking facility.

2. PROJECT SUBSURFACE CONDITIONS

Subsurface conditions at the project site explored by WSDOT drill crews are included in Appendix B. This appendix also includes a detailed discussion of our exploration program. Boring logs presented herein should be made available to all prospective bidders and included in the contract documents. Appendix C provides a discussion of the laboratory testing program and applicable test results.

2.1. LOCAL GEOLOGY

The site is located within an area that has been occupied by glaciers several times in the last million years. The glaciers carved relatively deep north-south trending channels within the Puget Sound Basin that have been infilled with glacial outwash materials and subsequently eroded and/or infilled by alluvial/fluvial deposits.

The geologic map for the area (USGS map entitled "Western Whatcom County" by Don J. Easterbrook, 1976) shows that the surficial soils in the site vicinity are mapped as Outwash Sand and Gravel of the Sumas Stade. Underlying the outwash material is a geological unit know as Bellingham Glaciomarine Drift (GMD).

The Outwash Sands and Gravels and the GMD deposits resulted from recent glacial events and included the Vashon and Sumas Stades of the Fraser Glaciation and the intervening Everson Interstade. During the Vashon Stade of the Fraser Glaciation, which occurred approximately 15,000 to 13,500 years ago, the Puget Lobe of the ice sheet advanced as far south as Olympia, Washington. During the later Sumas Stade of the Fraser Glaciation, which occurred approximately 10,000 to 9,000 years ago, the lobe of the ice sheet extended 4 miles across the Canadian border south of Sumas. The Vashon and Sumas Stades were periods of glacial advancement, and the Everson Interstade was a period of glacial retreat. Sea level fluctuated significantly in response to the glacial advance and retreat (melting), relative to the land surface and present day sea level.

The sediment that forms the GMD was derived from the melting of floating glacial ice and was subsequently deposited on the sea floor. Glaciomarine drift was deposited during the Everson Interstade approximately 11,000 to 12,000 years ago. The relative sea level was as high as Elevation 183 meters (600 feet) MSL. The thickness is indicated as a maximum of 21 meters (70 feet), although greater thicknesses of this unit have been observed in Whatcom County. This soil unit typically consists of unsorted, unstratified silt and clay with varying amounts of sand, gravel, cobbles and occasional boulders. Localized sand stringers or "pods" can be encountered with the GMD deposit and are generally wet. The upper portion of this unit, sometimes to about 4.5 meters (15 feet) of depth, can be stiff as a result of desiccation or partial ice contact in upland areas and it typically grades to medium stiff/soft at depth.

The Outwash Sand and Gravel generally consists of cobble and boulder gravel near the Canadian border, grading to sand near Lynden. Former meltwater channels are partially filled with peat bogs and lakes. The thickness of this outwash deposit varies but appears to be on the order of 1 meter (3 feet) in the vicinity of the project site.

2.2. SOIL CONDITIONS

Based on our test borings, the I-5 to International Boundary Project appears to be mantled by Outwash Sand and Gravel overlying Bellingham Glaciomarine Drift (GMD), consistent with the geologic map. The general subsurface profile along the project alignment consists of medium dense to very dense sands and gravels overlying soft to very soft silt and clay (with sand layers) overlying dense to very dense sand and gravel. For the purposes of this report, the soils can be grouped into five units. These units vary in thickness and all units are not present everywhere on the project site. These soil units are described below in the order that they appear in the borings with increasing depth.

1. Unit 1 – This material consists of moist, medium dense to very dense silty sand and gravel which appears to be part of the Outwash Sand and Gravel geologic unit. This material varied in thickness across the project, from 9.1 meters (30 feet) in TH-3-99 to 1.2 meters (4 feet) in TH-9-01. This material was not encountered in TH-1-01 through TH-7-01 and TH-10-01 through TH-11-01. This material was generally thickest in the areas of higher elevation near the center of the project, tapering out and disappearing in the areas of lower elevation near the northern and southern ends of the project. The existing cut slopes along the project from D Street north to the international border are made in this Unit 1 soil.

2. Unit 2 – This material consists of wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand. This material appears to be a stiff crust of the Bellingham Glaciomarine Drift (GMD). This material was located beneath Unit 1 except in those areas where Unit 1 was not present. In those areas, this material was located at the ground surface. This material varied in thickness across the project, from 7.0 meters (23.0 feet) in TH-6-01 to 1.5 meters (5 feet) in TH-1-99, Th-3-99 and TH-8-01. This material was not encountered in TH-2-99, TH-4-99, and TH-8-99.

3. Unit 3 - This material consists of wet, very soft to soft clay and/or loose silt with varying amounts and interlayers of loose sand. This material appears to Bellingham Glaciomarine Drift (GMD). This material was located beneath soil units 1 and 2 except in those areas where no stiff crust was present. This material was encountered in all of the borings and varied in thickness across the project, from more than 38.1 meters (125 feet) in TH-3-01 to 4.6 meters (15 feet) in TH-8-01.

4. Unit 4 – This material consists of wet, loose to dense sand with varying amounts of silt and clay and layers of medium stiff to hard sandy silt. This material varied in thickness from 9.1 meters (30 feet) in TH-11-99 to 1.2 meters (4 feet) in TH-8-01. This material was not encountered in TH-2-99, TH-8-99, and TH-9-01. Borings TH-

1-01, TH-2-01, TH-3-01, TH-4-01, Th-10-02, TH-11-02, and TH-12-01 did not encounter this layer.

5. Unit 5 – This material consists of wet, very dense sand and gravel with varying amounts of silt and clay and layers of hard sandy silt. This material was not encountered south of Station 1+500 (L Line).

Profiles of the subsurface conditions along the LL line are shown on Figures 4A through 4C. Profiles of the subsurface conditions along the LR line are shown on Figures 5A through 5D. Profiles of the subsurface conditions along the T line are shown on Figures 6A through 6B. A Profile of the subsurface conditions along the D line is shown on Figure 7.

2.3. GROUNDWATER

Groundwater was observed in each of the test holes except TH-2-99, TH-3-99, TH-3-01, TH-7-01, TH-8-01 and TH-11-02 at the depths shown in Appendix B. The borings were drilled using wet rotary drilling methods. Consequently, groundwater levels are not always discernable with this drilling technique. Comparison of current groundwater levels with borings drilled in 1999 and 2001 indicates lower groundwater levels were encountered in the earlier borings. Our opinion is that the water introduced into the boreholes as part of the drilling process has not yet drained from the more recent borings. This slow stabilization time indicates that the soil permeability is low, consistent with its classification as silt and/or clay. It is anticipated that groundwater conditions will change in response to rainfall, time of year, and other factors. However, the low permeability of the soils may result in a lag time in the groundwater level adjustment.

The data also shows that there is a perched groundwater level in the near surface sands and gravels that is not connected to the groundwater level in the underlying silts and clays. This was clearly demonstrated in the nested piezometers installed in TH-12-99. The near surface piezometer measured a groundwater elevation that was consistently between 6.6 to 7.0 meters (21.8 to 23.1 feet) above the groundwater elevation in the piezometer installed in the deeper clays. Therefore our opinion is that it is not conservative to use the lower groundwater levels observed in some of the borings for design. After a review of the groundwater data, a groundwater depth of 1.5 meters (5 feet) below the surface was selected for the design of the project. The complete groundwater level data is shown on Table B-2 in Appendix B.

3. SEISMOLOGICAL CONSIDERATIONS

3.1. DESIGN EARTHQUAKE PARAMETERS

The I-5 to International Boundary project alignment is situated in the northern portion of the Puget Lowland of western Washington. The Puget lowland is an elongated topographic and structural depression that extends southward from the Canadian Border to Oregon where it merges with the Willamette Valley. Seismic activity in this area is largely attributed to the

Cascadia subduction zone, where the Juan de Fuca oceanic plate is being thrust under the North America plate, and related shallow crustal faults. While the seismicity of Washington is not as well understood as other areas of western North America, seismologists believe that the local subduction zone has created great interplate earthquakes in the past (Modified Mercalli Intensities up to VIII), and is capable of future great earthquakes (Atwater, 1987).

For seismic design, a peak ground acceleration of 0.23 is recommended, as per the Bridge Design Manual (BDM). The recommended acceleration is based on an expected ground motion at the project site that has a 10 percent probability of exceedance in a 50-year period (475-year return period).

Design response spectra presented in the AASHTO guide specifications for seismic design of highway bridges are considered appropriate for seismic design of the retaining walls and bridges for the I-5 to International Boundary project. A Type IV Soil Profile response spectrum, with a Site Coefficient of 2.0 is recommended for seismic design.

3.2. LIQUEFACTION POTENTIAL

Soil liquefaction is a phenomenon whereby saturated soil deposits temporarily lose strength and behave as a viscous fluid in response to cyclic loading. Soil types considered at the highest risk of liquefaction during a seismic event are loose sandy soils. However, fine – grained soils such as those present at this site have been shown to lose significant strength due to elevated pore water pressures induced by seismic effects. Analyses of soils encountered in the test borings indicate areas that are subject to liquefaction as shown in Table 2 below:

Table 2 – Liquefiable Soils

Boring	Ground Elevation (m/ft)	Elevation of Liquefiable Zone (m)	Elevation of Liquefiable Zone (ft)	Elevation Of Proposed Retaining Wall (m)	Elevation Of Proposed Retaining Wall (ft)
TH-2-99	30.1/98.9	24.4-26.5	79.9-86.9	29.0-33.0	95.2-108.3
TH-3-99	31.2/102.5	24.2-24.5	79.5-80.5	29.0-31.6	95.2-103.7
TH-8-99	32.2/105.8	24.9-27.7	81.8-90.8	26.5-29.5	87.0-96.8
TH-9-99	36.8/120.9	24.7-26.2	80.9-85.9	29.0-33.0	95.2-108.3
TH-10-99	38.3/125.7	28.3-29.8	92.7-97.7	29.0-33.0	95.2-108.3
TH-8-01	28.6/93.8	22.5-25.5	73.8-83.8	25.5-27.6	83.7-90.4

None of these areas of liquefiable soils are located in the immediate vicinity of the proposed bridges. Therefore, the soil liquefaction effects do not need to be considered in the design of the bridges. However, these areas of liquefiable soils are located within the zone of soil being retained by the proposed retaining walls. If these soils liquefy during a seismic event, the lateral soil pressures on the retaining walls will rise, increasing the potential for wall

rotation. However, WSDOT policy does not include the effects of soil liquefaction in the design of retaining walls. Therefore, geotechnical parameters reflecting the effects of soil liquefaction were not provided for use in the design of the retaining walls

4. GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

4.1. RETAINING WALLS

The presence of deep soft soils on the site makes the use of conventional retaining walls impractical for much of the site. As a result, a variety of wall types are proposed for this project. For walls less than 1.5 meters (5 feet) high, the proposed wall types are limited to conventional cast-in-place walls, soldier pile walls, or tangent pile walls. For walls between 1.5 and 3 meters (5 and 10 feet) high, the proposed wall types are limited to soldier pile walls or tangent pile walls. For walls greater than 3 meters (10 feet) high, the proposed wall type is limited to tangent pile walls. Because noise walls are co-located with the retaining walls, Mechanically Stabilized Earth (MSE) walls were not considered along most of the alignment. However, MSE walls are recommended around the perimeter of some of the proposed detention ponds where noise walls are not planned.

4.1.1. Tangent Pile and Soldier Pile Walls

Tangent pile walls (sometimes called cylinder pile walls) consist of rows of adjacent drilled shafts. At this site, the proposed tangent pile walls will be used as retaining walls and bridge abutments. Pile caps will be constructed to transfer the bridge loads to the tangent pile walls. Loads transferred from the bridge deck into the proposed tangent pile walls would be resisted by both skin friction and tip bearing capacity acting against the shafts.

The tangent pile walls will consist of rows of drilled-in-place concrete shafts. Every other concrete shaft is constructed as a reinforced structural concrete pile. The intervening piles are constructed as low-strength "lean" concrete piles. The piles are drilled adjacent to each other such that they touch each other and provide a continuous wall. The "lean" concrete piles are offset behind the structural piles and the spacing of the structural piles is reduced slightly to contain the "lean" concrete piles. Tangent piles are installed using conventional drilled shaft methods. The construction sequence first involves installing a row of alternating piles comprised of low-strength "lean" concrete. After allowing the lean concrete to cure (minimum of one day), the remaining piles are drilled and backfilled with reinforced structural concrete. Following curing, the soil is excavated from in front of the wall and a wall facing is constructed in front of the tangent piles. The new bridge deck could be placed to span between the two rows of tangent piles before or after the excavation operation in front of the walls is begun. However, if the bridge deck is placed before excavating begins, the abutment support details should be designed to permit lateral movement of the walls as the excavation is completed. Otherwise, the bridge may act as a horizontal strut, preventing the lateral movement necessary to reduce lateral pressures to the active state, which could overstress the retaining walls.

Lateral earth pressure diagrams to be used in the design of the tangent pile and soldier pile walls are presented in Appendix G. Lateral support is presented in accordance with the design methodology presented in the *Bridge Design Manual*. For the purposes of our design, we have presented data for both braced and unbraced walls. For the unbraced situation, we have assumed that both tangent pile and soldier pile walls will be allowed to deform up to 1 percent of their unsupported heights. By allowing these walls to deflect, they may be designed to resist active earth pressures. For the braced situation, we have assumed that the bracing installed to help support the wall will limit the allowable deflection of the wall, making it necessary to design the wall for higher lateral earth pressures (i.e. closer to the "at-rest" conditions).

As shown on the lateral earth pressure diagrams, and per the *Bridge Design Manual*, the lateral earth pressure due to traffic surcharge loading is calculated using a uniformly distributed load at the ground surface of 12 kPa (250 psf), multiplied by K_a, or an equivalent fluid weight of 3.3 kPa (68 psf) (See Appendix G).

For the tangent pile walls, the active lateral earth pressures should be taken to act across two pile diameters both above and below the base of the excavation for the tangent pile walls. For the soldier pile walls, the active lateral earth pressures should be taken to act across two pile diameters below the base of the excavation. However, above the base of the excavation, the active lateral earth pressures should be taken to act across the pile spacing to reflect the load transferred from the lagging to the piles.

As shown on the lateral earth pressure diagrams, we recommend disregarding passive resistance contribution from soils less than 1.2 meters (4 feet) below the base of the excavation. For the tangent pile walls the resistance contribution from lean concrete piles should not be used in the design and passive resistance should be taken to act over two tangent pile diameters (structural concrete piles only). For the soldier piles walls the passive resistance should be taken to act over three soldier pile diameters. A factor of safety of 1.5 should be applied to the passive earth pressure.

The lateral capacities of the tangent piles should be computed using the LPILE computer program and the P-Y curve input parameters presented in Appendix F.

4.1.2. MSE Walls

Retaining walls approximately 1.9 meters (6.2 feet) high are planned for the side slopes of the two northernmost detention ponds on the project site as well as the pond located northeast of the intersection of H Street and SR 543. Preapproved proprietary MSE wall systems are considered feasible for these locations. This includes both structural earth and welded wire wall types.

Preapproved proprietary MSE wall systems are considered feasible on this project site. This includes both structural earth and welded wire wall types. Wall proprietors should be contacted prior to the ad date to be included in the PS&E. Design parameters shown below

should be included in the General Special Provisions for both structural earth walls and welded wire walls:

Soil Parameters	Wall Backfill	Retained Soil	Foundation Soil
Unit Weight kg/m3 (pcf)	2080 (130)	2000 (125)	1920 (120)
Friction Angle (deg)	38	36	0
Cohesion kPa (psf)	0 (0)	0 (0)	2450 (500)

Foundation Soil	AASHTO Load Group 1	AASHTO Load Group VII
Allowable Bearing Capacity kPa (psf)	53 (1100)	88 (1830)
Acceleration Coefficient (g)	N/A	0.20

Design Notes

(Not to be included in the General Special Provisions)

1. A traffic surcharge load of 12 kPa (250 psf) should be added when designing the wall.

2. Internal and external stability are critical to the long-term performance of the proposed wall. All MSE wall systems should meet the following requirements to maintain adequate stability.

    a. The wall should be placed on a level (horizontal) and firm foundation.

    b. The base width of the wall (minimum length of reinforcement) should be greater than or equal to 200 percent of the wall height.

    c. The top-reinforcing layer should be placed no lower than 0.6 meters (2 feet) below the top of the wall.

    d. Wall embedment should be at least 0.6 meters (2 feet).

    e. A minimum horizontal bench 1.2 meters (4 feet) wide should be provided in front of walls.

    f. Drainage structures should be located outside the reinforced zone where possible. If drainage structures are planned within the reinforced zone, they

must be shown on the plan and profile sheets provided to the wall proprietor so that they can account for the structures in their design.

The proposed MSE walls will be founded in medium stiff clay that extends approximately 3.3 meters (7 feet) below the base of the walls. Underlying this is soft clay extending to the base of our subsurface explorations in this portion of the project site. Based upon our experience with similar walls founded in cohesive clay, our opinion is that global stability is not an issue for MSE retaining walls 1.8 meters (6 feet) high with these subsurface conditions.

We performed a settlement analysis for an allowable bearing pressure of 52.7 kPa (1100 psf) acting on the subgrade beneath a 3.7 m (12 foot) wide footing. Based on the results of that analysis, this additional load should result in approximately 50 to 100 mm (2 to 4 inches) of settlement. Most of the settlement of the native clay deposit is expected to occur slowly, taking many years to complete.

4.1.3. Noise Walls and Cast-in-Place Retaining Walls

Noise walls that do not retain soil will be constructed along the western side of the proposed project between Stations 1+282 and 1+500 as referenced to the L-Line. In addition, cast-in-place retaining walls may be considered for use where the retaining walls are less than 1.5 meters (5 feet) high and subsurface conditions make such a design feasible. Due to the loose/soft nature of the soils, a special foundation design is required. We recommend that both spread footing and drilled shaft foundation options be evaluated for feasibility in these wall sections. We do not recommend the use of trench footings due to the difficult trenching conditions expected in this portion of the project site.

Due to the loose/soft nature of the soils at the project site, a special foundation design is required for drilled shaft foundations. The lateral capacities of the drilled shafts should be computed using the P-Y iterative method. The P-Y curve input parameters and lateral earth pressures to use when evaluating the use of drilled shafts are presented in Appendices F and G. We anticipate that some strain softening will occur during cyclic loading and have provided both static and cyclic P-Y curve input parameters. Cyclic loads are those imposed by repeated forces such as wind.

Due to the loose/soft nature of the soils at the project site, a special foundation design is required for spread footings. These walls should be designed using an allowable bearing capacity of 52.7 kPa (1100 psf).

The base of the footings for the proposed noise walls and cast-in-place retaining walls should be embedded approximately 0.6 m (2 feet) below the final site grade. We performed a settlement analysis for an allowable bearing pressure of 52.7 kPa (1100 psf) acting on the subgrade beneath a 3.1 m (10 foot) wide footing. Based on the results of this analysis, this additional load should result in approximately 50 to 100 mm (2 to 4 inches) of settlement. Most of the settlement of the native clay deposit is expected to occur slowly, taking many years to complete.

Footing subgrades should be prepared in accordance with Sections 2-06.3(1) and 2-09.3(3)C of the *Standard Specifications*. We recommend this office be contacted during footing excavation/subgrade preparation and/or drilled shaft construction to verify subsurface conditions.

4.2. DRILLED SHAFT FOUNDATIONS

4.2.1. Axial Support

Tangent pile walls will be used to support the proposed roadway cuts and bridges at the D Street intersection. At this intersection, the tangent piles should be designed as drilled shafts. We understand design of the proposed bridges at the intersection of SR 543 and D Street will be performed using AASHTO Load and Resistance Factor Design (LRFD) methodology. In accordance with this methodology, we have provided axial capacities for nominal strength (ultimate), service and extreme limit states on the charts in Appendix E. Foundation support should only be considered for "structural" piles and not "lean concrete" piles. For these attached charts, we assume friction and bearing support only occur below the elevation of the roadway crossing under the proposed bridges, and not from the top of the wall. These charts include nominal capacities for end bearing and skin friction resistance for 1.2-meter (4-foot) diameter shafts. Shaft uplift capacity for the strength and extreme event limit cases can also be taken directly from the capacity charts, where the unit uplift resistance is taken as equal to the unit skin friction. Note that the capacity charts do not account for the net weight of the shafts, which should be added as a separate load when sizing the shafts (for both compression and uplift).

Resistance factors for bearing capacity and uplift for service, strength, and extreme event limit states are shown in Table 3 below:

Table 3 - Drilled Shaft Resistance Factors

Limit State	Resistance Factor ϕ		
	Skin Friction	End Bearing	Uplift
Strength	0.65	0.50	0.55
Service	1.00	1.00	1.00
Extreme	1.00	1.00	1.00

After appropriate factoring (see Table 3 above) of the service and extreme event limit states charts shown in Appendix E, 25 and 150 mm (1 inch and 6 inches) of settlement, respectively, are required to mobilize these ultimate nominal capacities. Minimum tip elevations should be determined using theses capacity charts and the required loading for the appropriate design limit state.

4.2.2. Lateral Analyses

We understand lateral analyses of drilled shafts will be evaluated using the LPILE computer program (Reese and Wang, 1989). P-Y curve soil parameters for the static loading case that are to be used for LPILE input are presented in Appendix F.

Group reduction factors for lateral load analysis should be used where drilled piers are spaced closer than 5D, where D is the pier diameter and spacing is center to center. These reduction factors should be applied to the cohesion and modulus of subgrade reaction values shown on the P-Y curve input parameter tables. Figure 4.4.3-1 from the *Bridge Design Manual* should be used to adjust the friction angle for group effects.

Table 4 - Reduction Factors for Group Effects

Pile Spacing	Reduction Factor (Longitudinal Direction)	Reduction Factor (Transverse Direction)
6D	0.9	1.0
5D	0.8	1.0
4D	0.65	0.9
3D	0.5	0.8
2D	0.4	0.6

For the purposes here, the "longitudinal direction" applies to piers that are configured in the direction of the applied lateral load (in a row parallel to the direction of load). The "transverse direction" applies to piles configured in a direction perpendicular to the applied load.

4.3. DETENTION PONDS

The pond base elevations and the soil types observed at those elevations in the closest subsurface explorations are presented in Table 5 below:

Table 5 – Pond Bottom Elevations and Conditions

Pond Location	Base of Pond Elevation (m/ft)	Closest Boring	Anticipated Soil Type at Base of Pond Elevation
NW of Boblett Street Intersection	20.2/66.3	TH-1-01	Fat CLAY, stiff, dark grayish brown, moist, homogeneous
NE of Boblett Street Intersection	20.3/66.6	TH-2-01	Elastic SILT, loose, olive brown, moist, homogeneous
NW of H Street Intersection	21.4/70.2	TH-3-01	Fat CLAY, medium stiff, gray brown, moist, homogeneous
NE of H Street Intersection	21.9/71.9	TH-4-01	Fat CLAY, medium stiff, grayish brown, moist, stratified
W of T-Line at the Border (WSDOT Pond)	20.5/67.3	TH-10-02	Lean CLAY with Sand, medium stiff, dark olive, moist, homogeneous
E of T-Line at the Border (City Pond)	21.0/68.9	TH-11-02	Sandy lean CLAY, soft, olive brown, moist, homogeneous

Based upon this information, the soils at the proposed pond bottoms will consist of clay with varying amounts of sand and gravel. These soils are nearly impermeable and will provide no infiltration or reservoir capacity. Based on these soil conditions, we recommend against accounting for any infiltration capability at the proposed pond site. Pond side slopes without retaining walls should be sloped no steeper than 4H:1V.

4.4. Signal Pole, Camera Pole and Luminaire Foundations

4.4.1. Signal Poles

We recommend that the proposed signal poles be supported on drilled shaft foundations because of the loose/soft nature of the soils at the pole locations. The lateral capacities of the drilled shafts should be computed using the P-Y curve input parameters contained in Appendix F. We anticipate that some strain softening will occur during cyclic loading and have provided both static and cyclic soil parameters. Cyclic loads are those imposed by repeated forces such as wind. We do not anticipate any significant amount of soil liquefaction

in the vicinity of the proposed signal poles during the design seismic event. Consequently, no reduced seismic P-Y curve input parameters are provided in Appendix F.

4.4.2. Luminaire and Camera Poles

Where possible, we recommend proposed luminaire and camera poles be structurally attached to the retaining walls. The axial load imposed by these poles is small enough that it may be neglected in the design of the retaining walls. However, the lateral load should be added to the lateral pressure diagrams as a point load during the design of the retaining walls.

The table in Appendix D contains information regarding the locations of the proposed luminaire and camera poles, where retaining walls and/or standard foundations may support these poles. Where non-standard foundations are necessary (as indicated in Appendix D), P-Y curve input parameters for drilled shaft foundations are presented in Appendix F. We anticipate that some strain softening will occur during cyclic loading and have provided both static and cyclic and P-Y curve input parameters. Cyclic loads are those imposed by repeated forced such as wind. We do not anticipate any significant amount of soil liquefaction in the vicinity of the proposed luminaries and camera poles during the design seismic event. Consequently, no reduced seismic P-Y parameters are provided in Appendix F.

4.5. BRIDGE APPROACH SLABS

The Design Manual Section 1120.03(6) requires all bridges to have approach slabs unless approval for their deletion has been given. Based on the soil conditions at each approach and the use of deep foundations to support the end piers, we recommend the use of bridge approach slabs for this project.

5. CONSTRUCTION CONSIDERATIONS

The proposed excavations for the roadways and detention ponds are expected to extend down into the soft to very soft soils observed in the borings. These soils are wet and difficult to excavate. Significant excavation and equipment mobility issues will be encountered during earthwork operations. Soft wet subgrade conditions may prevent the use of wheeled equipment as well as tracked equipment with standard tracks. Low ground pressure equipment may be necessary to move and work on the exposed subgrade. Groundwater flow from sandy zones in the excavations may be initially heavy. However, experience has shown that these sandy zones are generally isolated from each other so the initial groundwater flow generally decreases rapidly as the sandy zone drains. Long term flows from these sandy zones are expected to be small. Much of the exposed subgrade will be located below the existing groundwater table and the subgrade materials are expected to be highly moisture sensitive. To minimize the potential for subgrade disturbance and constructability problems, we recommend the final excavation and subgrade preparation be conducted during the drier summer months.

To minimize settlement potential and constructability problems, we recommend the proposed noise walls and MSE walls be built during the drier summer months. This is particularly important when preparing subgrade, which is located at/below the groundwater table and is considered highly moisture sensitive. Unless excavation proceeds in the drier summer months, dewatering and overexcavation will likely be necessary to prepare the foundation pad. If this is the case, we recommend the footing subgrades be overexcavated 0.6 meters (2.0 feet) below the base of the footing. Wall footing overexcavation, if necessary, should be performed as described in Section 2-03 of the *Standard Specifications*. Overexcavations should be backfilled with compacted Crushed Surfacing Base Course per Section 9-03.9(3) of the *Standard Specifications*. We recommend this office be contacted during footing excavation and subgrade preparation to verify subsurface conditions. Footing subgrade should be prepared in accordance with Sections 2-06.3(1) and 2-09.3(3)C of the *Standard Specifications*.

On site soils encountered during excavating are anticipated to have very high moisture and will be difficult to reuse without sufficient reconditioning/aeration. Consequently, we recommend against using on site soils as structural embankment fill or wall backfill. On site soils should be disposed of off-site or used only in non-settlement sensitive areas, such as for landscaping.

Drilled shafts at the project site will require the use of temporary casing at all of the drilled shaft locations because of the presence of very soft to soft/loose silts, clays and sands that are susceptible to severe caving and displacement. We suggest that temporary casing extend at least 3 meters (9.8 feet) into the dense sand layer (unit 4) underlying the soft/loose silts, clays and sands observed in the subsurface explorations unless the drilled shaft is terminated above that elevation. In that case, temporary casing should be used for the entire depth of the drilled shaft. The minimum depth of temporary casing below the proposed roadway along the project alignment is shown in Table 6 below:

Table 6 - Minimum Depth of Temporary Casing Below the Proposed Roadway

Retaining Wall	Starting Station (m)	Ending Station (m)	Minimum Depth of Temporary Casing Below the Proposed Roadway m (ft)*	Reference Boring
1	1+612 (LL Line)	1+645 (LL Line)	16.5 (54.2)	TH-3-99
"	1+645 (LL Line)	1+703 (LL Line)	15.4 (50.6)	TH-4-99
2	1+728 (LL Line)	1+786 (LL Line)	12.8 (42.3)	TH-6-01
"	1+786 (LL Line)	1+808 (LL Line)	16.5 (54.4)	TH-2-99
3	1+651 (LR Line)	1+663 (LR Line)	14.3 (47.2)	TH-12-99
"	1+663 (LR Line)	1+703 (LR Line)	9.4 (31.0)	TH-11-99
4	1+723 (L Line)	1+785 (LR Line)	14.0 (46.0)	TH-1-99

Retaining Wall	Starting Station (m)	Ending Station (m)	Minimum Depth of Temporary Casing Below the Proposed Roadway m (ft)*	Reference Boring
4	1+785 (LR Line)	1+793 (LR Line)	21.3 (70.1)	TH-10-99
5	1+500 (L Line)	1+645 (L Line)	16.5 (54.2)	TH-3-99
"	1+645 (L Line)	1+708 (L Line)	15.4 (50.6)	TH-4-99
6	1+724 (LL Line)	1+786 (LL Line)	12.8 (42.3)	TH-6-01
"	1+786 (LL Line)	1+882 (LL Line)	16.5 (54.4)	TH-2-99
"	1+882 (LL Line)	1+947 (LL Line)	10.5 (34.6)	TH-8-99
"	1+947 (LL Line)	1+982 (LL Line)	12.6 (41.5)	TH-8-01
7	1+501 (LR Line)	1+563 (LR Line)	21.6 (71.1)	TH-5-01
"	1+563 (LR Line)	1+663 (LR Line)	14.3 (47.2)	TH-12-99
"	1+663 (LR Line)	1+707 (LR Line)	9.4 (31.0)	TH-11-99
8	1+723 (L Line)	1+785 (LR Line)	14.0 (46.0)	TH-1-99
"	1+785 (LR Line)	1+831 (T Line)	121.3 (70.1)	TH-10-99
9	1+831 (T line)	1+900 (T Line)	21.3 (70.1)	TH-10-99
"	1+900 (T Line)	1+949 (T Line)	14.5 (47.8)	TH-7-01
10	1+949 (T Line)	1+991 (T Line)	14.5 (47.8)	TH-7-01
"	1+991 (T Line)	2+040 (T Line)	16.9 (55.5)	TH-9-01

Because of the potential for seepage, soil disturbance, bottom heave, and caving, all shaft excavations will need to be constructed using slurry, even those shafts with full depth temporary casing. Water slurry may be used for those shafts with full depth temporary casing. Mineral or polymer slurries should be used for those shaft excavations that extend below the temporary casings. Caving is possible even in the dense to very dense soils (units 4 and 5) underlying the soft silts and clays. Therefore, the contractor may need to take steps to prevent caving in the dense to very dense soils (units 4 and 5).

The stability of temporary excavations is the responsibility of the contractor. We do not anticipate shoring will be necessary at this site because of the location of the proposed bridge and retaining walls in relation to the existing structures.

While cobbles and boulders were not encountered in the borings, based on the geologic nature of the soil units, cobbles and boulders may still be encountered in all soil units at this site.

APPENDIX A - FIGURES

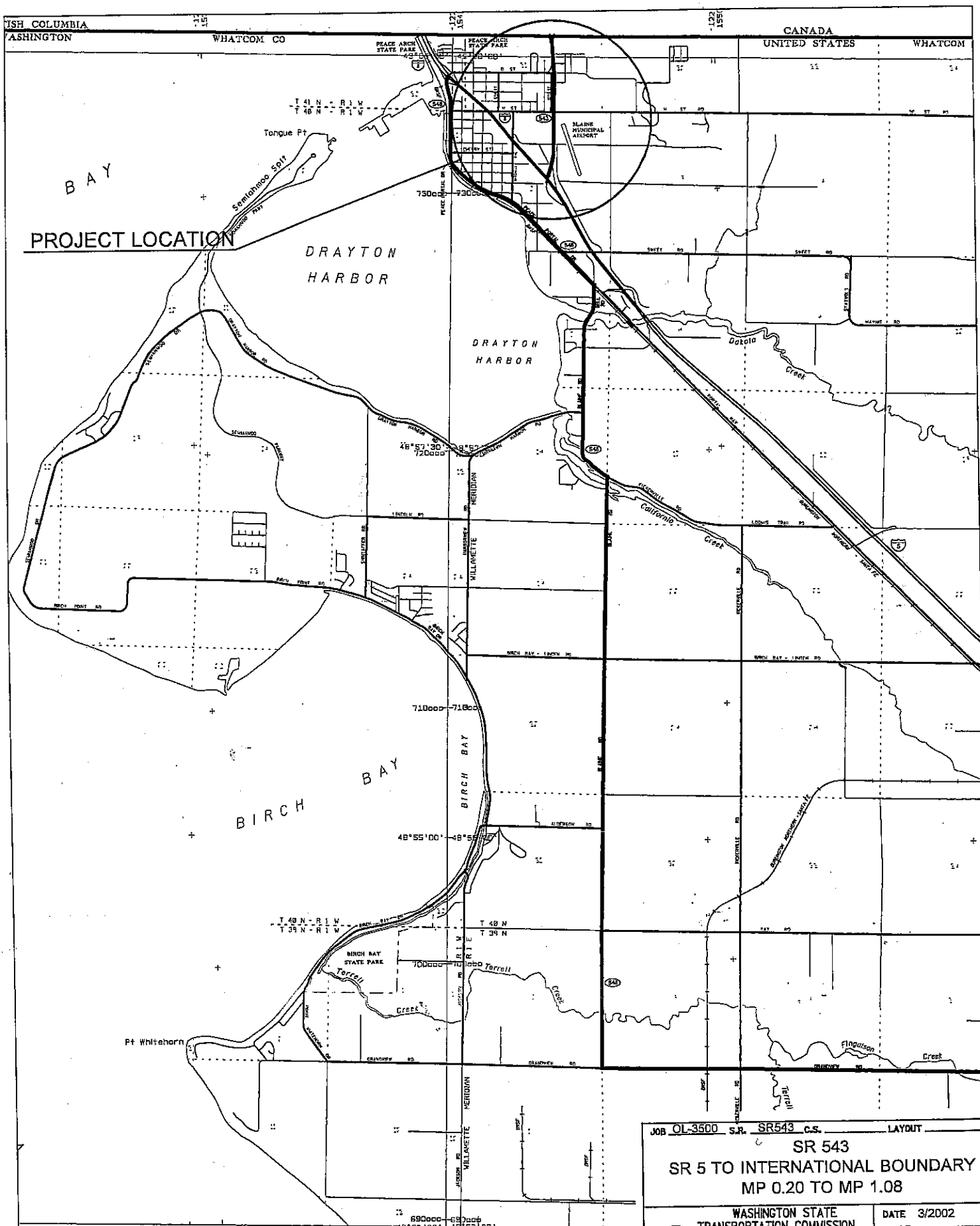


FIGURE 1: VICINITY MAP

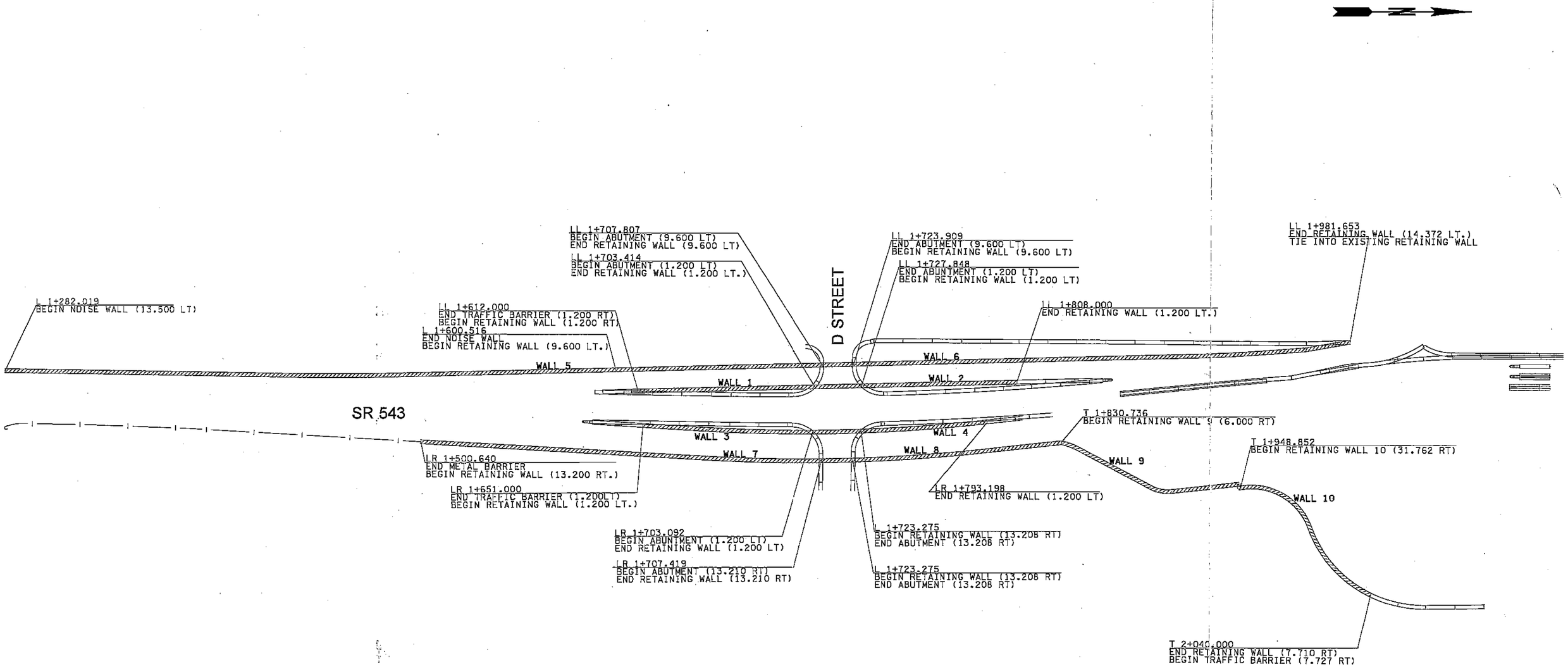


FIGURE 2: WALL LAYOUT

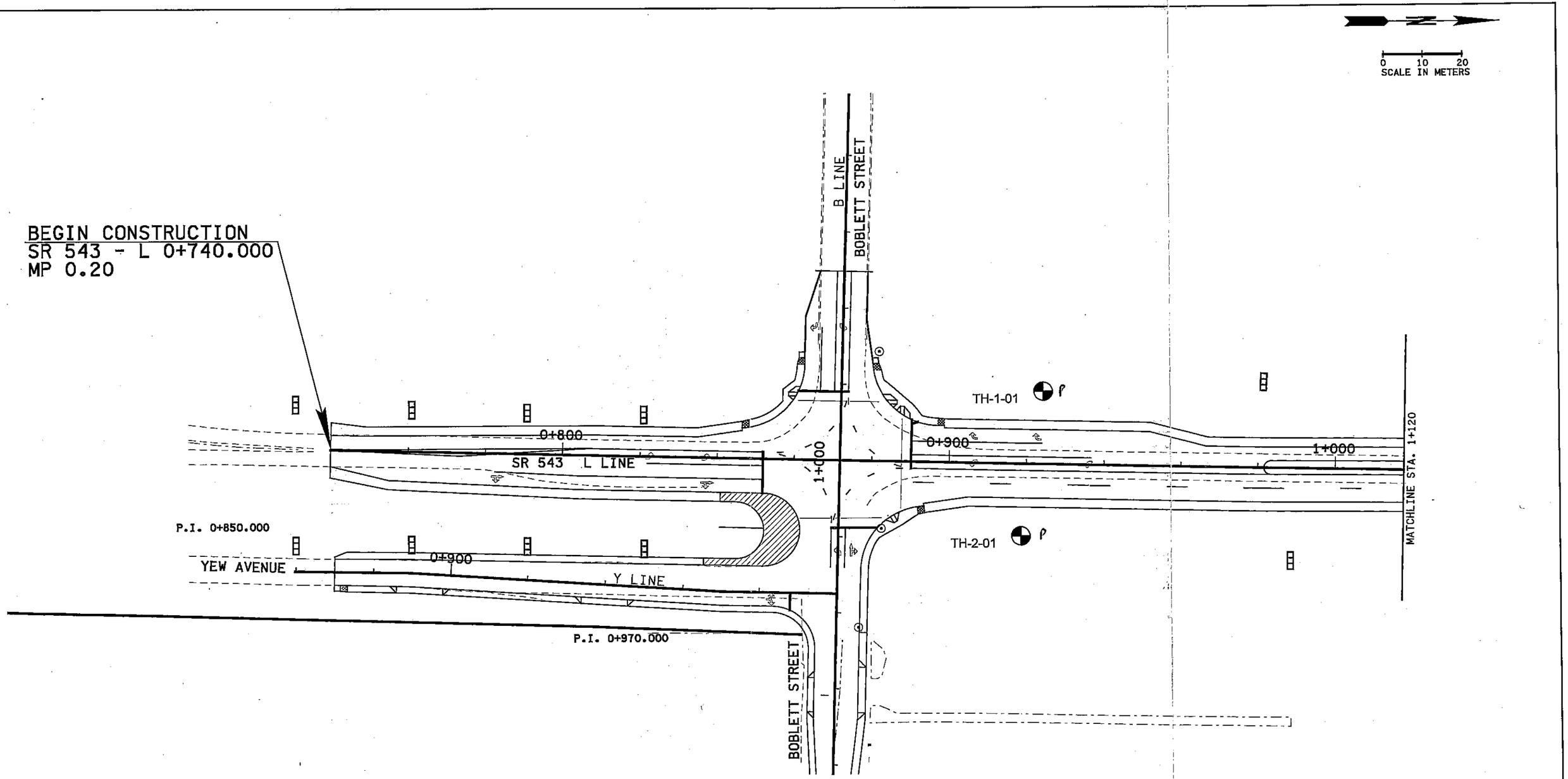
JOB OL-3500 S.R. SR543 C.S. _____

SR 543
SR 5 TO INTERNATIONAL BOUNDARY
MP 0.20 TO MP 1.08

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=200 VERT.
1=200 HORIZ.
SHEET ____ OF ____
DRAWN BY W.M.

..\4-10-02\WALLSHEETS.dgn 06/20/2002 08:26:27 AM



TH-1-01 TEST HOLE DESIGNATION AND APPROXIMATE LOCATION

JOB OL-3500 S.R. SR 543 C.S.

SR 543

SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION

MATERIALS BRANCH

T. E. BAKER MATERIALS ENGINEER

DATE 3/2002

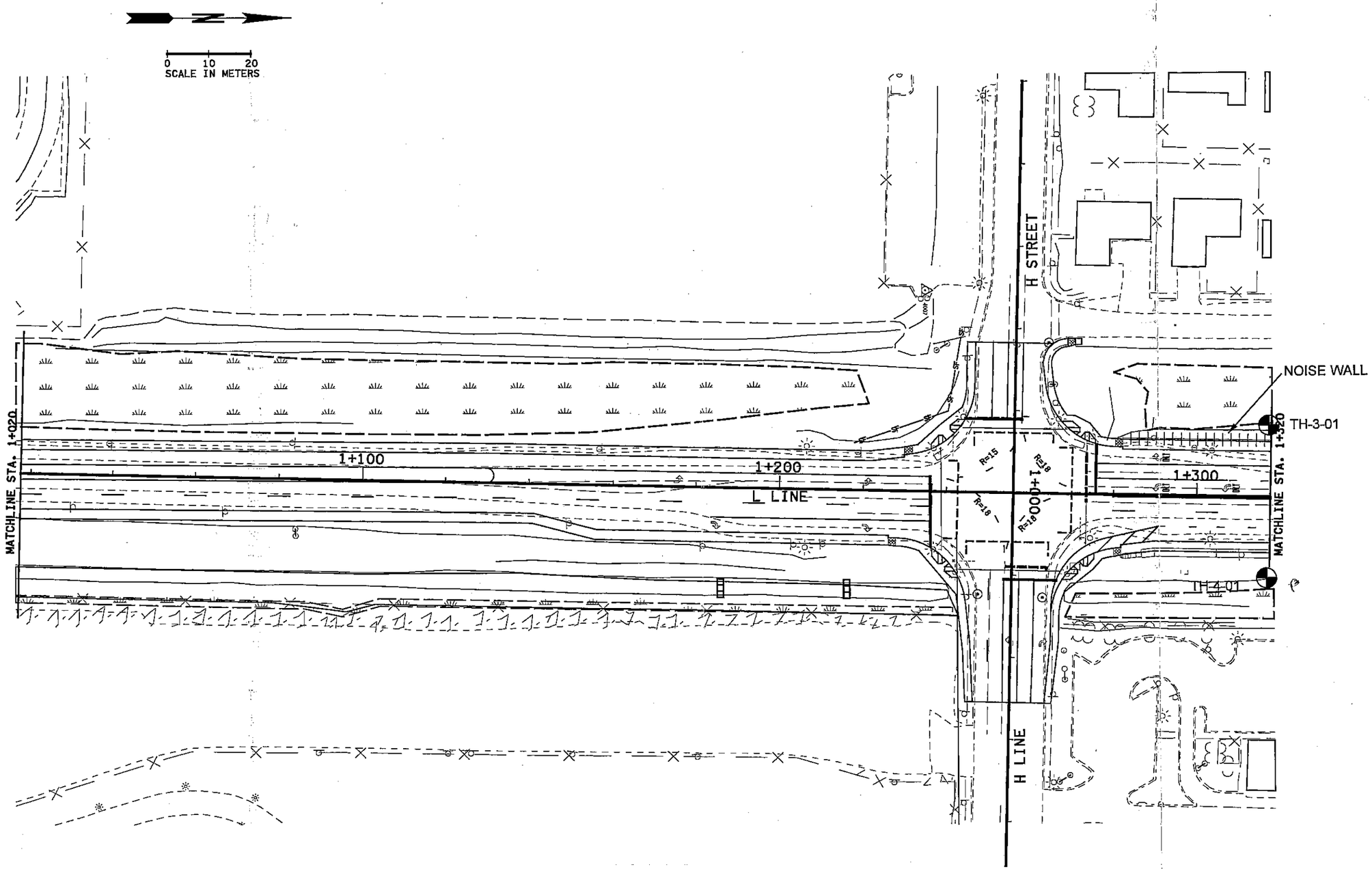
SCALE 1=100 VERT. HORIZ.

SHEET ___ OF ___

DRAWN BY W.M.

FIGURE 3A: SITE AND EXPLORATION PLAN

..\4-10-02\543shts.dgn 06/20/2002 08:23:49 AM



TH-1-01 TEST HOLE DESIGNATION AND APPROXIMATE LOCATION

NOISE WALL

FIGURE 3B: SITE AND EXPLORATION PLAN

JOB OL-3500 S.R. SR 543 C.S.

SR 543

SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION

MATERIALS BRANCH

T. E. BAKER MATERIALS ENGINEER

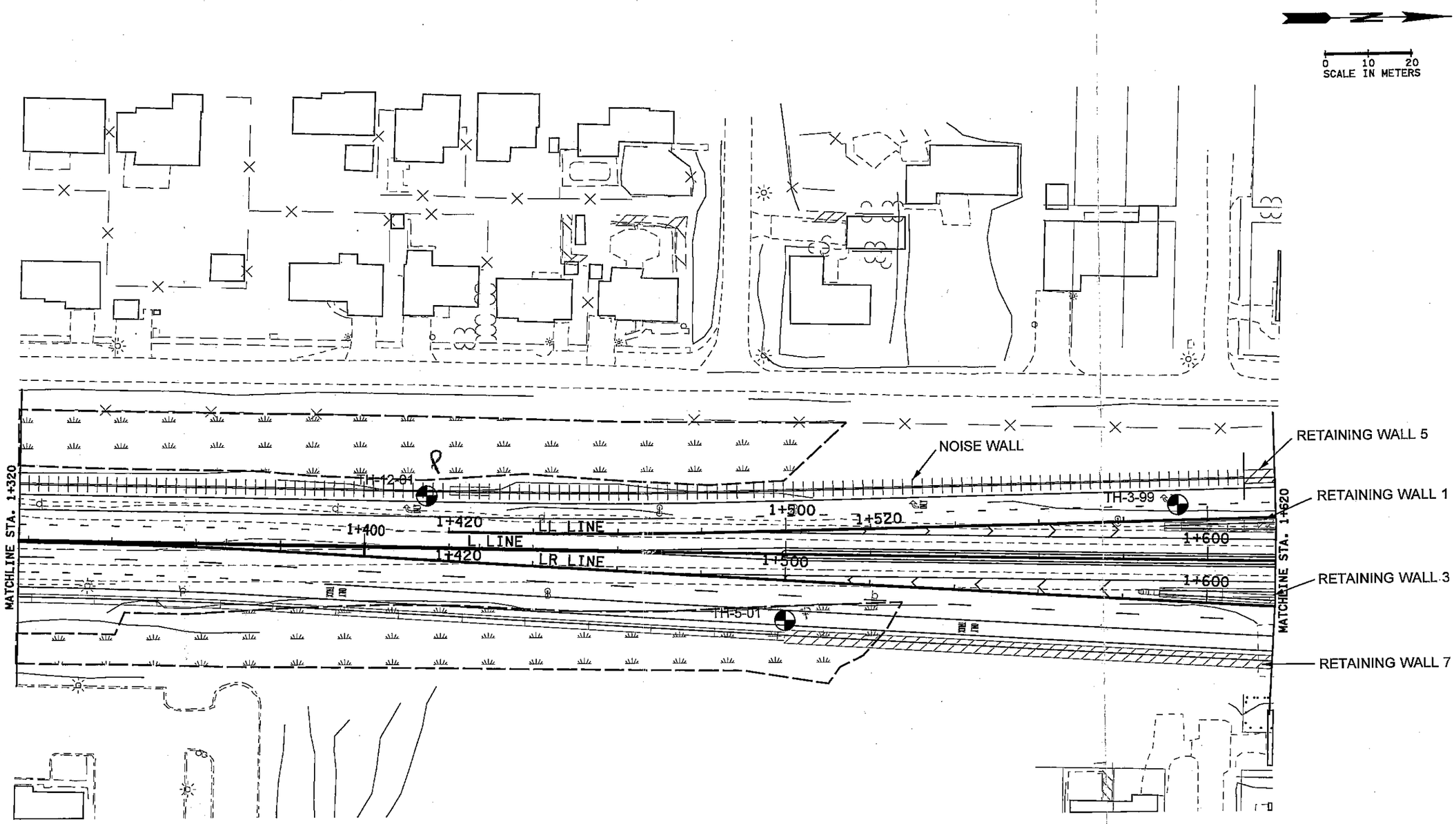
DATE 3/2002

SCALE 1=100 VERT. HORIZ.

SHEET ___ OF ___

DRAWN BY W.M.

..\4-10-02\543shts.dgn 06/20/2002 08:23:39 AM



TH-1-01 TEST HOLE DESIGNATION AND APPROXIMATE LOCATION

RETAINING WALL

NOISE WALL

FIGURE 3C: SITE AND EXPLORATION PLAN

JOB OL-3500 S.R. SR 543 C.S.

SR 543

SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION

MATERIALS BRANCH

T. E. BAKER MATERIALS ENGINEER

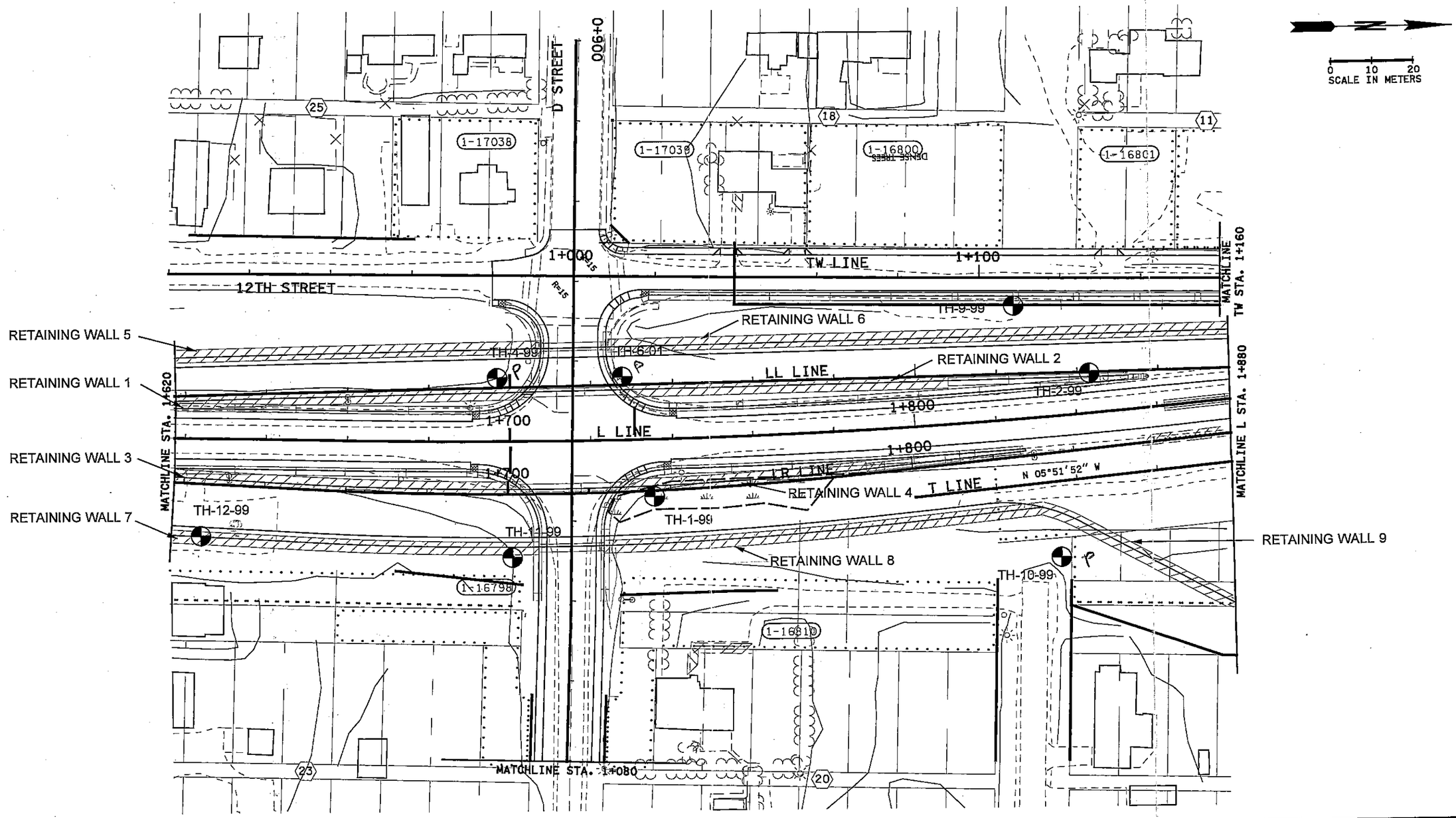
DATE 3/2002

SCALE 1=100 VERT. HORIZ.

SHEET ___ OF ___

DRAWN BY W.M.

...\4-10-02\543shts.dgn 06/20/2002 08:23:33 AM



TH-1-01 TEST HOLE DESIGNATION AND APPROXIMATE LOCATION

RETAINING WALL

FIGURE 3D: SITE AND EXPLORATION PLAN

JOB OL-3500 S.R. SR 543 C.S.

SR 543

SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION

MATERIALS BRANCH

T. E. BAKER MATERIALS ENGINEER

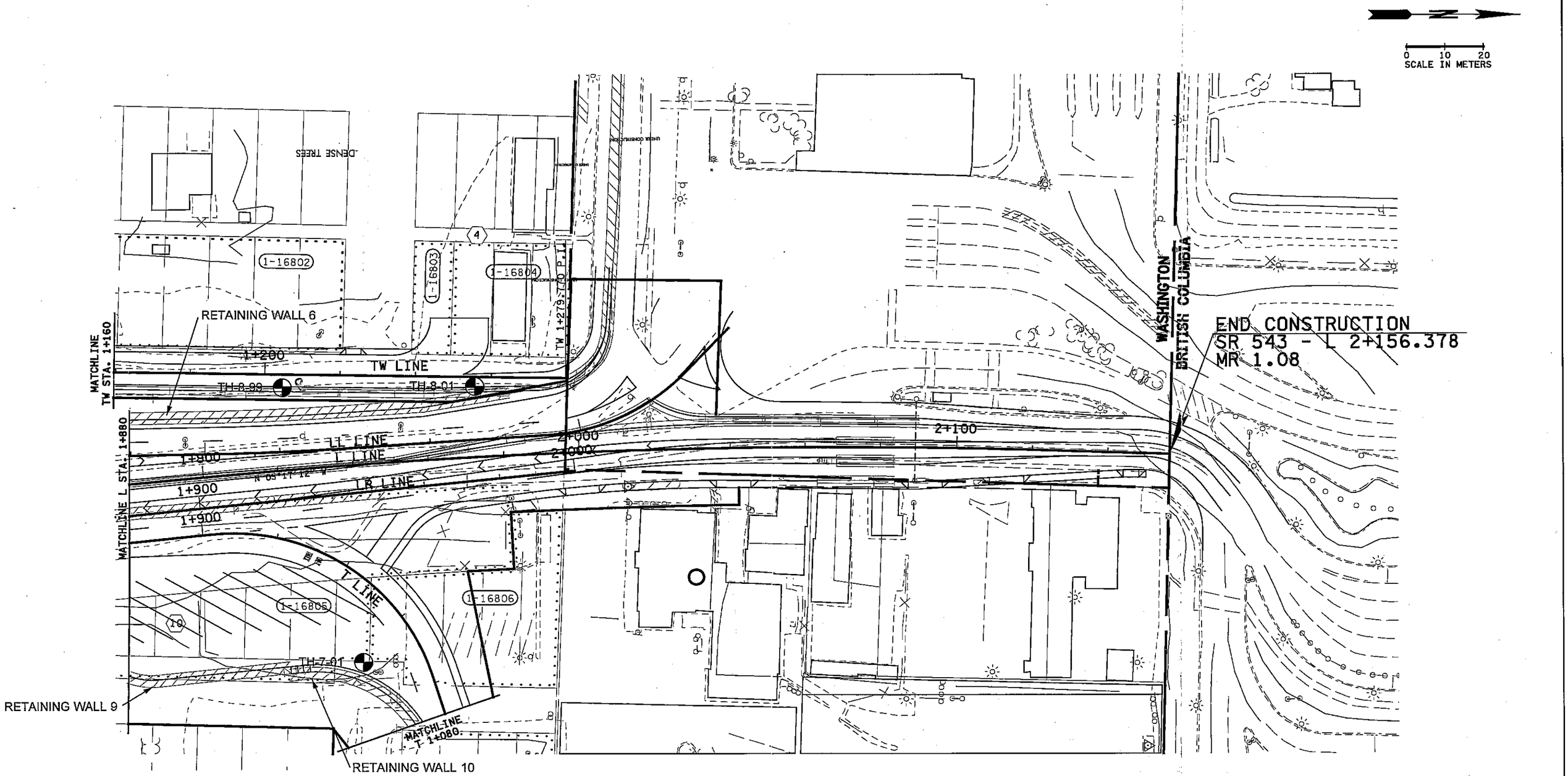
DATE 3/2002

SCALE 1=100 VERT. HORIZ.

SHEET ___ OF ___

DRAWN BY W.M.

...\4-10-02\543shts.dgn 06/20/2002 08:23:27 AM



TH-1-01 TEST HOLE DESIGNATION AND APPROXIMATE LOCATION

RETAINING WALL

FIGURE 3E: SITE AND EXPLORATION PLAN

JOB OL-3500 S.R. SR 543 C.S. _____

SR 543

SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION

MATERIALS BRANCH

T. E. BAKER MATERIALS ENGINEER

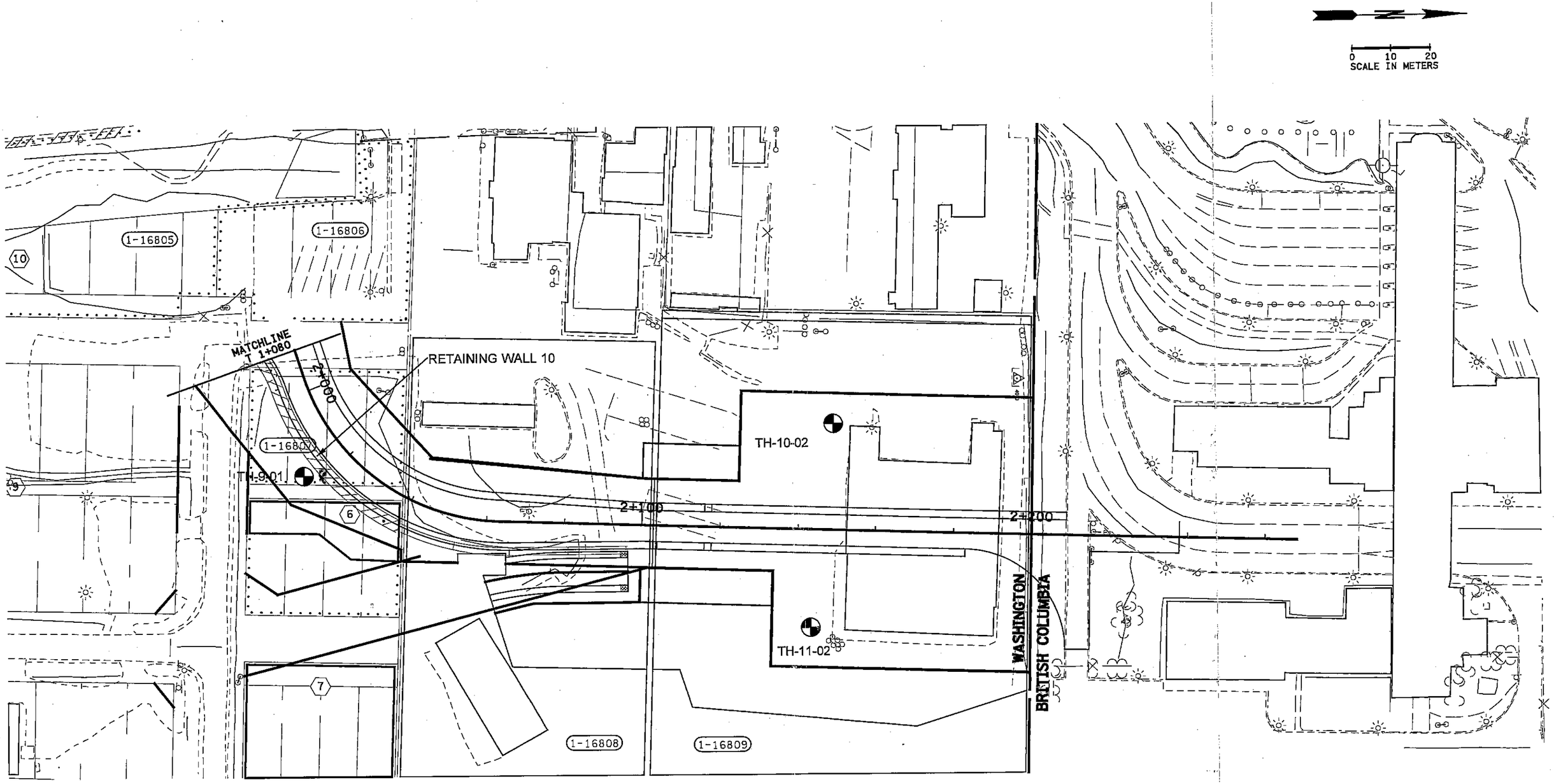
DATE 3/2002

SCALE 1=100 VERT. HORIZ.

SHEET ____ OF ____

DRAWN BY W.M.

..\4-10-02\543shts.dgn 06/20/2002 08:23:15 AM



TH-1-01 TEST HOLE DESIGNATION AND APPROXIMATE LOCATION

RETAINING WALL

FIGURE 3F: SITE AND EXPLORATION PLAN

JOB 01-3500 S.R. SR 543 C.S.

SR 543

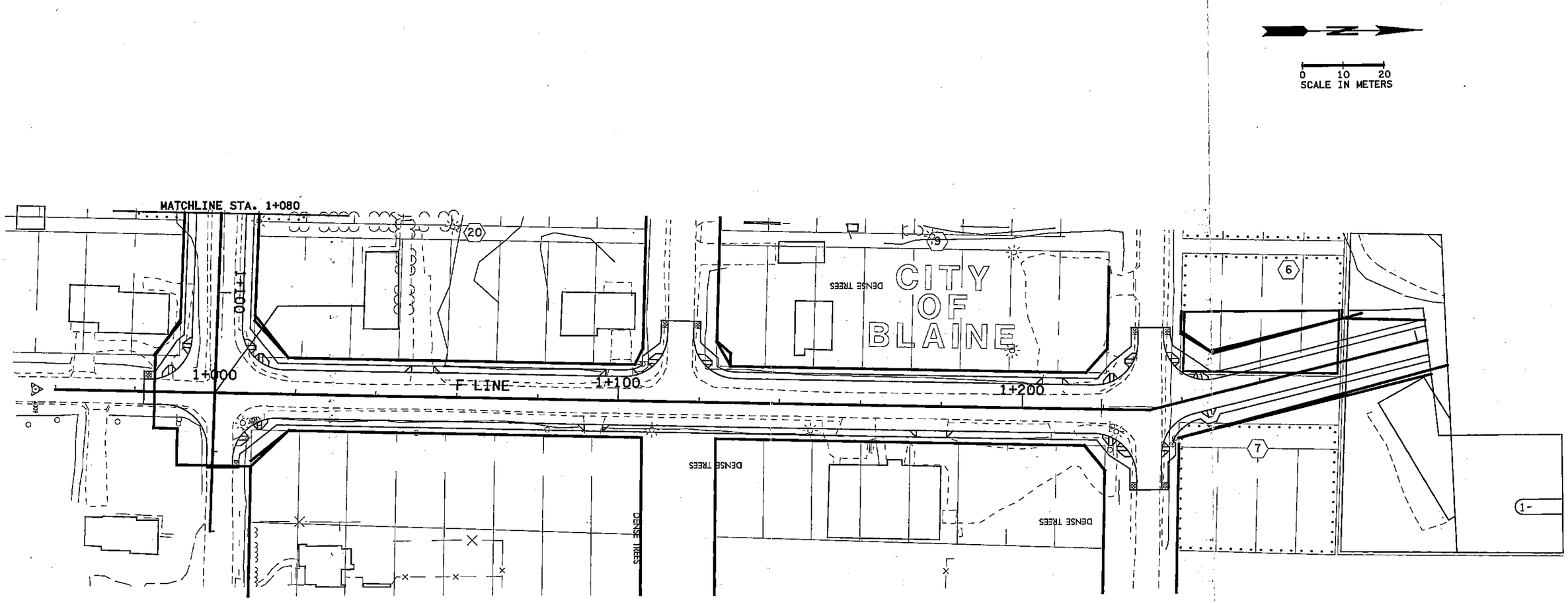
SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=100 VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

..\4-10-02\543shts.dgn 06/20/2002 08:23:10 AM



JOB OL-3500 S.R. SR 543 C.S.

SR 543

SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE
TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION

MATERIALS BRANCH

T. E. BAKER MATERIALS ENGINEER

DATE 3/2002

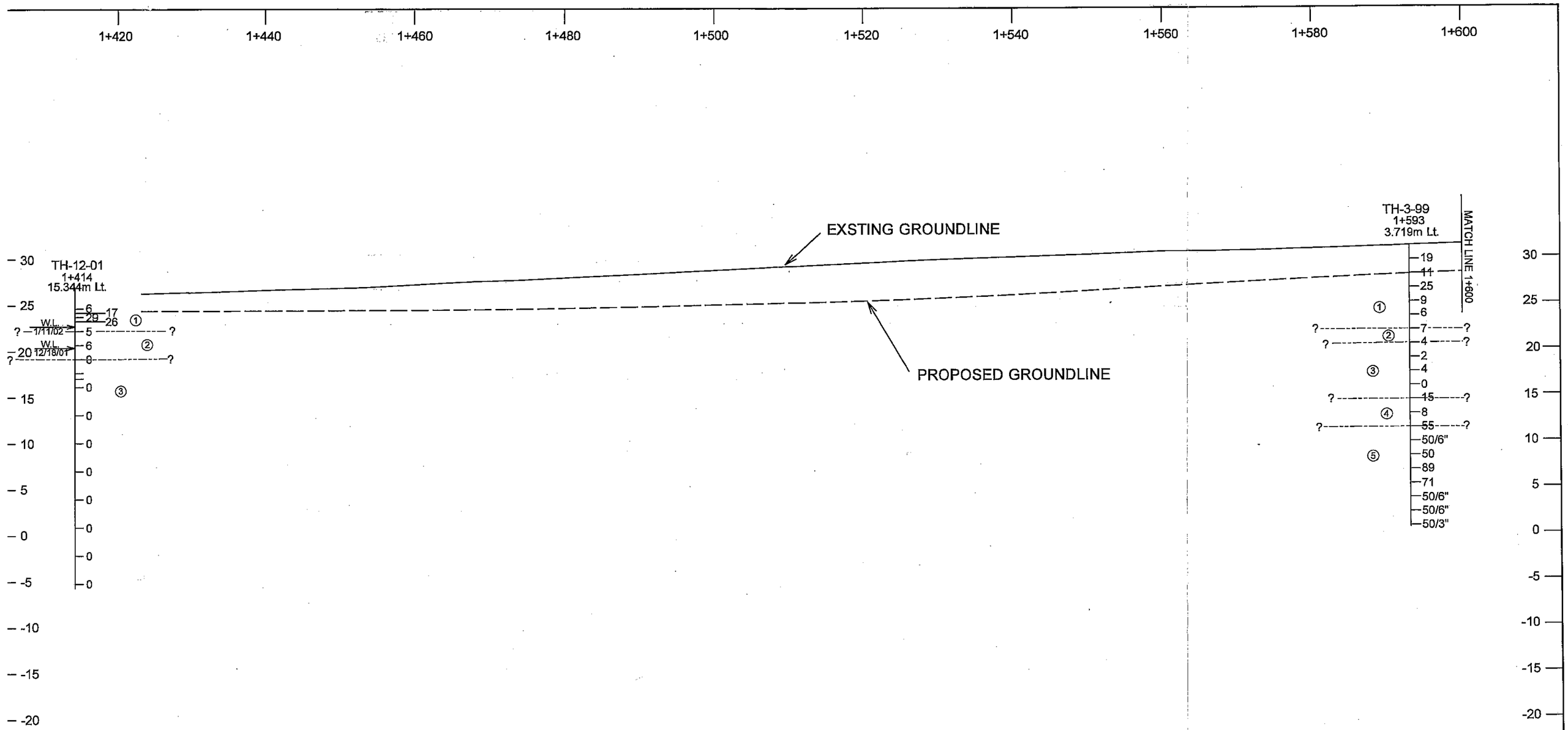
SCALE 1=100 VERT. HORIZ.

SHEET ___ OF ___

DRAWN BY W.M.

FIGURE 3G: SITE AND EXPLORATION PLAN

..\4-10-02\543shts.dgn 06/20/2002 08:23:04 AM



TEST HOLE LEGEND

H-1-98 TEST HOLE NUMBER
0+265 TEST HOLE STATION
3.5 m Rt. TEST HOLE OFFSET
23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)
UNDISTURBED SAMPLE
W.L. 8-6-86 WATER LEVEL & DATE
? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS
INDICATES INTACT ROCK
86% INDICATES CORE SAMPLE TAKEN
ROCK QUALITY DESIGNATION

SOIL UNITS

1. Moist, medium dense to very dense silty sand and gravel.
2. Wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand.
3. Wet, very soft to soft clay and/or loose silt with varying amounts of sand and layers of loose sand.
4. Wet, loose to dense sand with varying amounts of silt and clay and layers of medium stiff to hard sandy silt.
5. Wet, very dense sand with gravel and varying amounts of silt and clay and layers of hard sandy silt.

FIGURE 4A: PROFILE-LL LINE

JOB OL-3500 S.R. 543 C.S.

SR 543

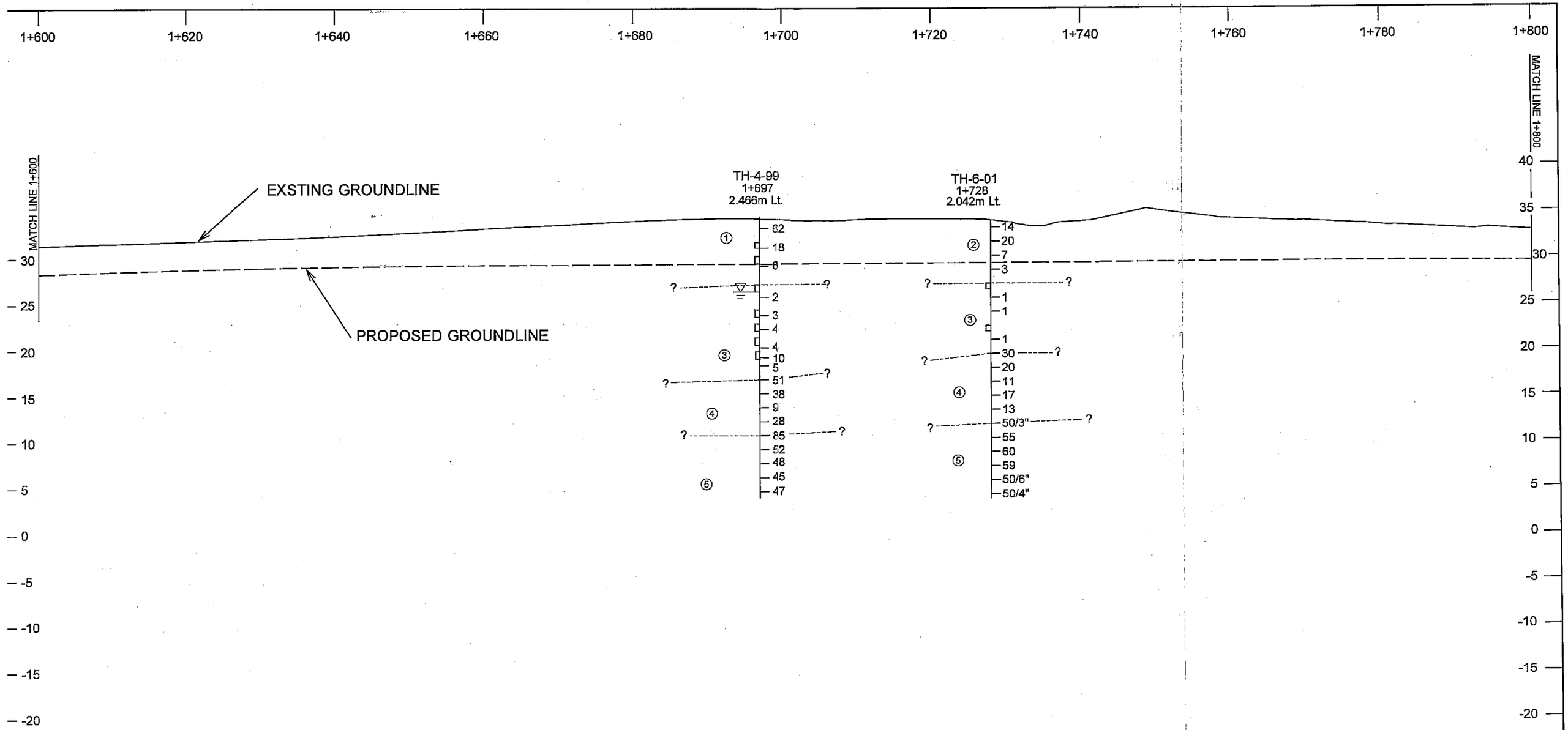
SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=400 VERT.
1=500 HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

..\4-10-02\PRLL1.DGN 06/20/2002 09:02:51 AM



TEST HOLE LEGEND

H-1-98 TEST HOLE NUMBER
0+265 TEST HOLE STATION
3.5 m Rt. TEST HOLE OFFSET

23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)
UNDISTURBED SAMPLE
W.L. 8-6-86 WATER LEVEL & DATE
? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS
INDICATES INTACT ROCK
86% INDICATES CORE SAMPLE TAKEN
ROCK QUALITY DESIGNATION

SOIL UNITS

1. Moist, medium dense to very dense silty sand and gravel.
2. Wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand.
3. Wet, very soft to soft clay and/or loose silt with varying amounts of sand and layers of loose sand.
4. Wet, loose to dense sand with varying amounts of silt and clay and layers of medium stiff to hard sandy silt.
5. Wet, very dense sand with gravel and varying amounts of silt and clay and layers of hard sandy silt.

FIGURE 4B: PROFILE-LL LINE

JOB OL-3500 S.R. 543 C.S.

SR 543

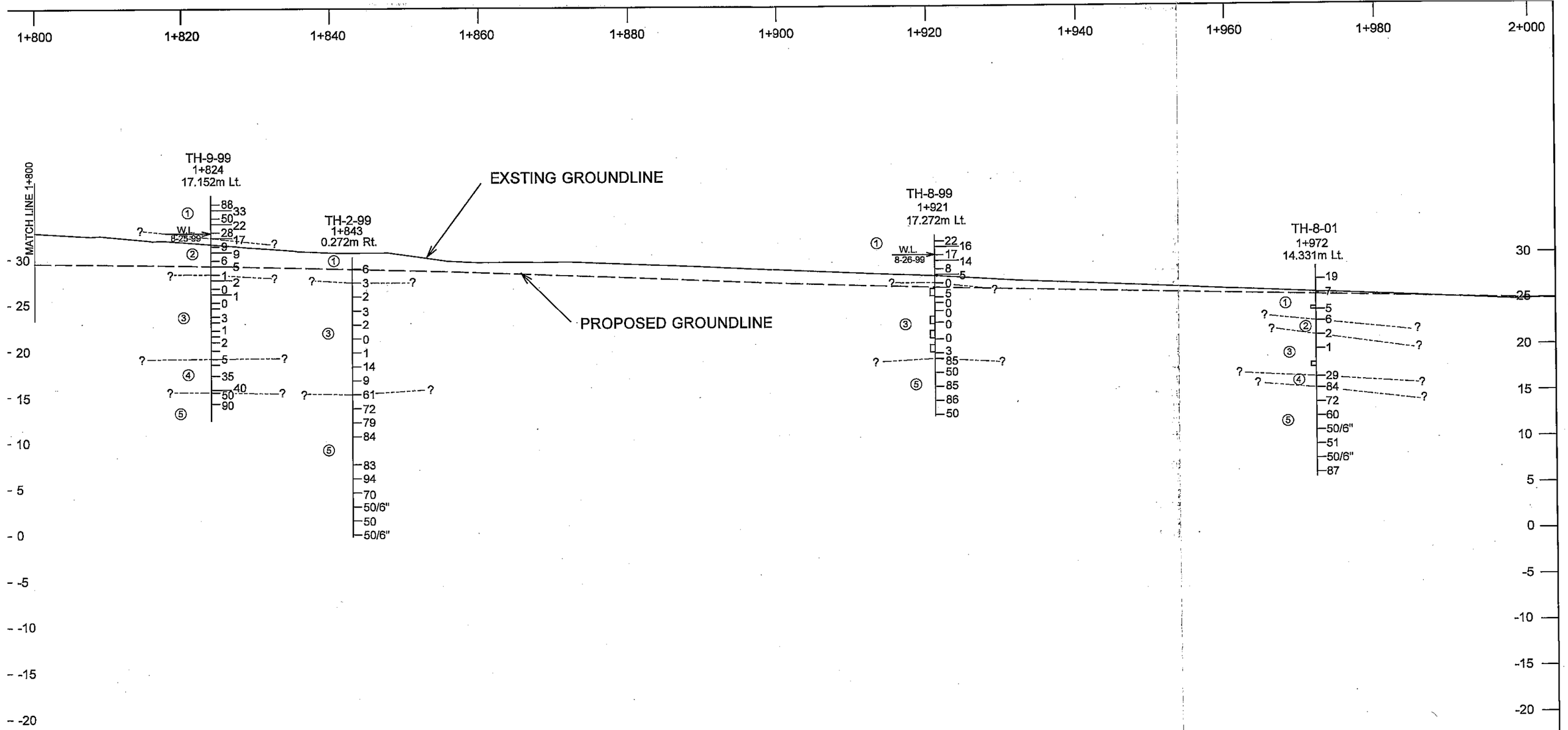
SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=400 VERT.
1=500 HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

..\4-10-02\PRLL1.DGN 06/20/2002 09:02:46 AM



TEST HOLE LEGEND

H-1-98 TEST HOLE NUMBER
0+265 TEST HOLE STATION
3.5 m Rt. TEST HOLE OFFSET

23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)
UNDISTURBED SAMPLE
W.L. 8-6-86 WATER LEVEL & DATE
? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS
INDICATES INTACT ROCK
86% INDICATES CORE SAMPLE TAKEN
ROCK QUALITY DESIGNATION

SOIL UNITS

1. Moist, medium dense to very dense silty sand and gravel.
2. Wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand.
3. Wet, very soft to soft clay and/or loose silt with varying amounts of sand and layers of loose sand.
4. Wet, loose to dense sand with varying amounts of silt and clay and layers of medium stiff to hard sandy silt.
5. Wet, very dense sand with gravel and varying amounts of silt and clay and layers of hard sandy silt.

FIGURE 4C: PROFILE-LL LINE

JOB OL-3500 S.R. 543 C.S.

SR 543

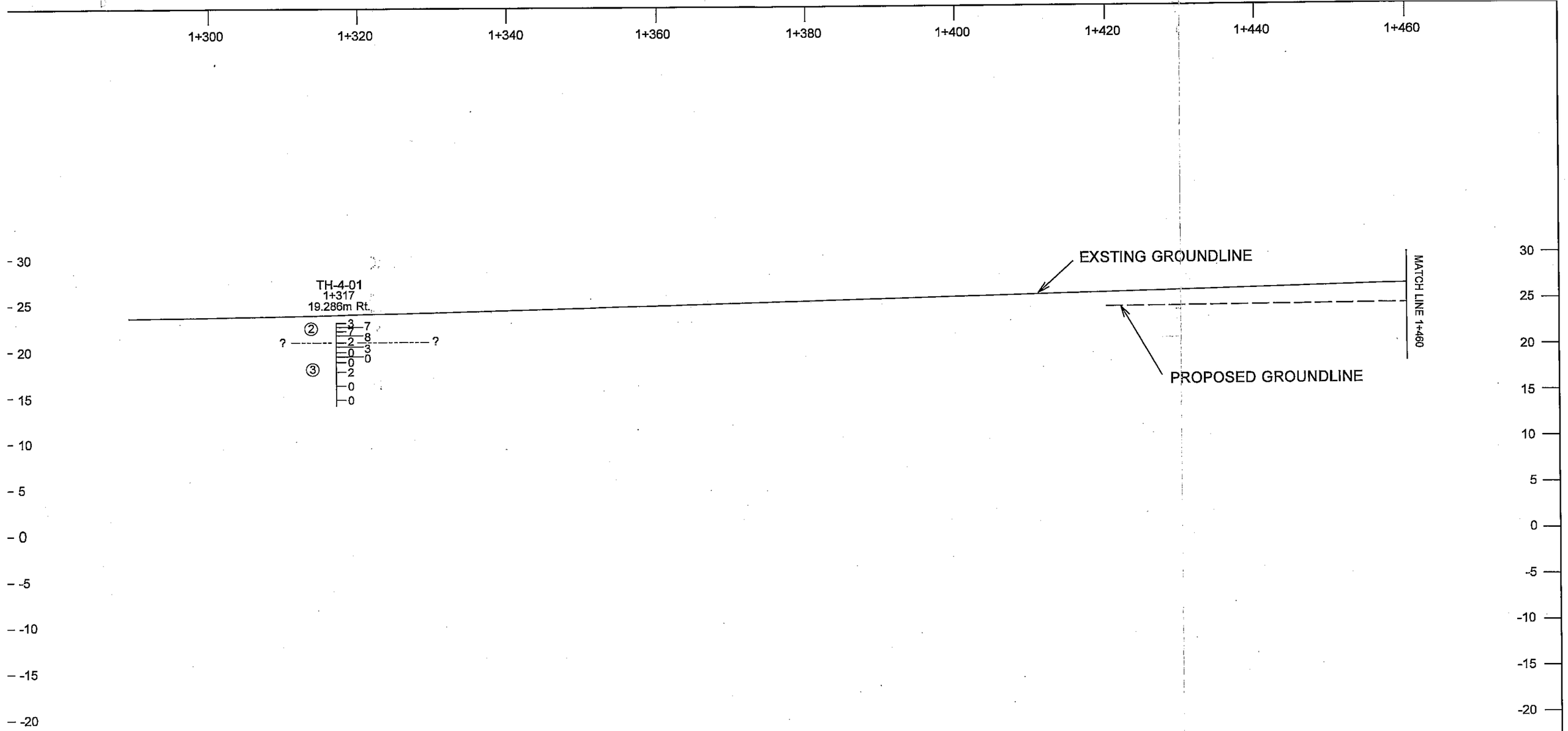
SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=400 VERT.
1=500 HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

..\4-10-02\PRLL1.DGN 06/20/2002 09:02:36 AM



TEST HOLE LEGEND

H-I-98 TEST HOLE NUMBER
0+265 TEST HOLE STATION
3.5 m Rt. TEST HOLE OFFSET

23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)

UNDISTURBED SAMPLE

W.L. 8-6-86 WATER LEVEL & DATE

? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS

INDICATES INTACT ROCK

86% INDICATES CORE SAMPLE TAKEN

ROCK QUALITY DESIGNATION

SOIL UNITS

② Wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand.

③ Wet, very soft to soft clay and/or loose silt with varying amounts of sand and layers of loose sand.

FIGURE 5A: PROFILE-LR LINE

JOB OL-3500 S.R. 543 C.S.

SR 543

SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

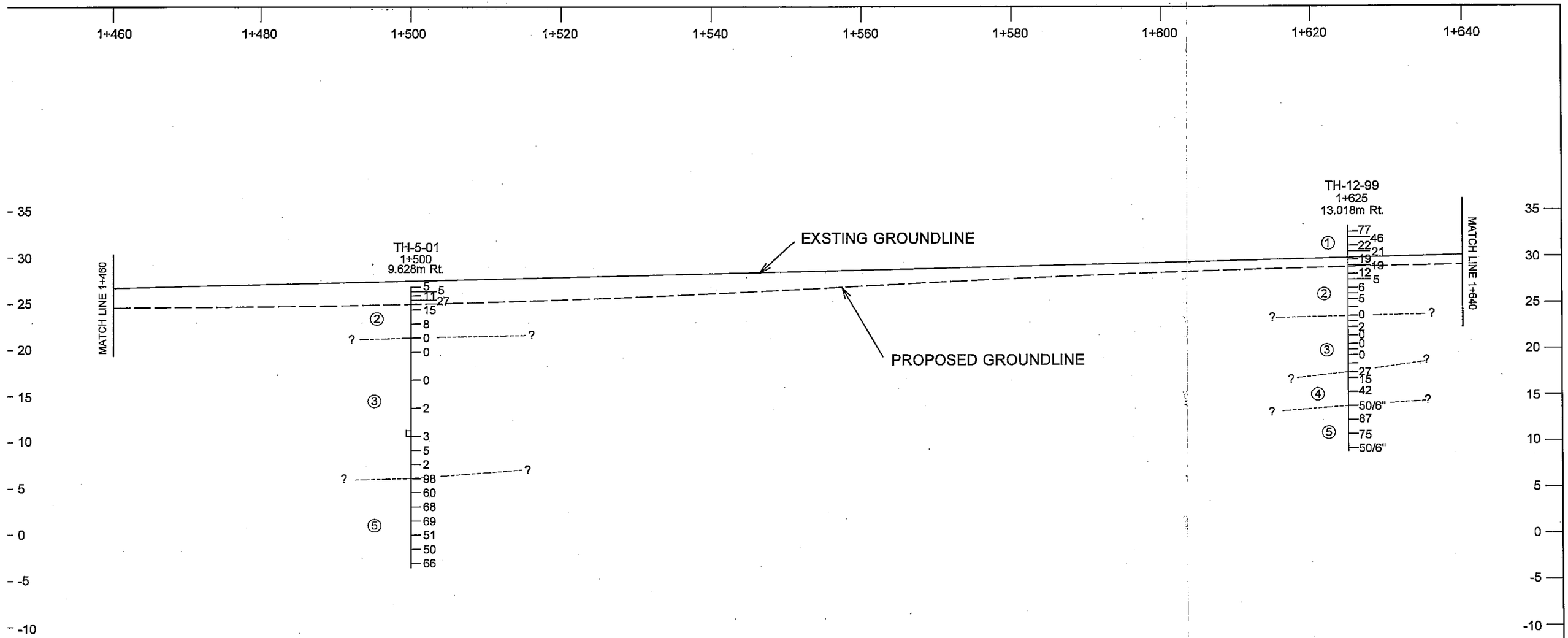
WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION

MATERIALS BRANCH

T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=400 VERT.
1=500 HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

..\4-10-02\PRLR1.dgn 06/20/2002 09:25:33 AM



TEST HOLE LEGEND

H-I-98 TEST HOLE NUMBER
0+265 TEST HOLE STATION
3.5 m Rt. TEST HOLE OFFSET
23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)
UNDISTURBED SAMPLE
W.L. 8-6-86 WATER LEVEL & DATE
? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS
INDICATES INTACT ROCK
86% INDICATES CORE SAMPLE TAKEN
ROCK QUALITY DESIGNATION

SOIL UNITS

1. Moist, medium dense to very dense silty sand and gravel.
2. Wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand.
3. Wet, very soft to soft clay and/or loose silt with varying amounts of sand and layers of loose sand.
4. Wet, loose to dense sand with varying amounts of silt and clay and layers of medium stiff to hard sandy silt.
5. Wet, very dense sand with gravel and varying amounts of silt and clay and layers of hard sandy silt.

FIGURE 5B: PROFILE-LR LINE

JOB OL-3500 S.R. 543 C.S.

SR 543

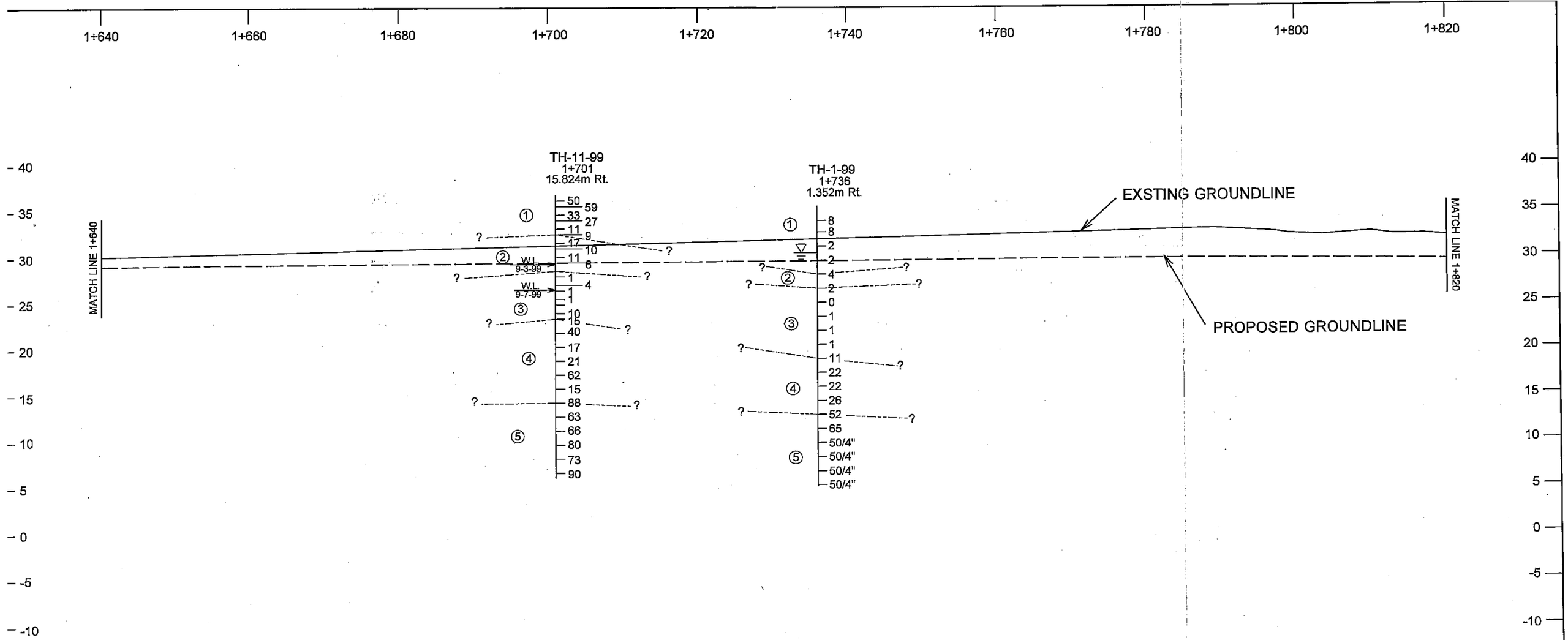
SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=400 VERT. 1=500 HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

.\4-10-02\PRLR1.dgn 06/20/2002 09:25:27 AM



TEST HOLE LEGEND

H-1-98 TEST HOLE NUMBER
0+265 TEST HOLE STATION
3.5 m Rt. TEST HOLE OFFSET

23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)

UNDISTURBED SAMPLE

W.L. 8-6-86 WATER LEVEL & DATE

? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS

INDICATES INTACT ROCK

86% INDICATES CORE SAMPLE TAKEN

ROCK QUALITY DESIGNATION

SOIL UNITS

1. Moist, medium dense to very dense silty sand and gravel.
2. Wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand.
3. Wet, very soft to soft clay and/or loose silt with varying amounts of sand and layers of loose sand.
4. Wet, loose to dense sand with varying amounts of silt and clay and layers of medium stiff to hard sandy silt.
5. Wet, very dense sand with gravel and varying amounts of silt and clay and layers of hard sandy silt.

FIGURE 5C: PROFILE-LR LINE

JOB OL-3500 S.R. 543 C.S.

SR 543

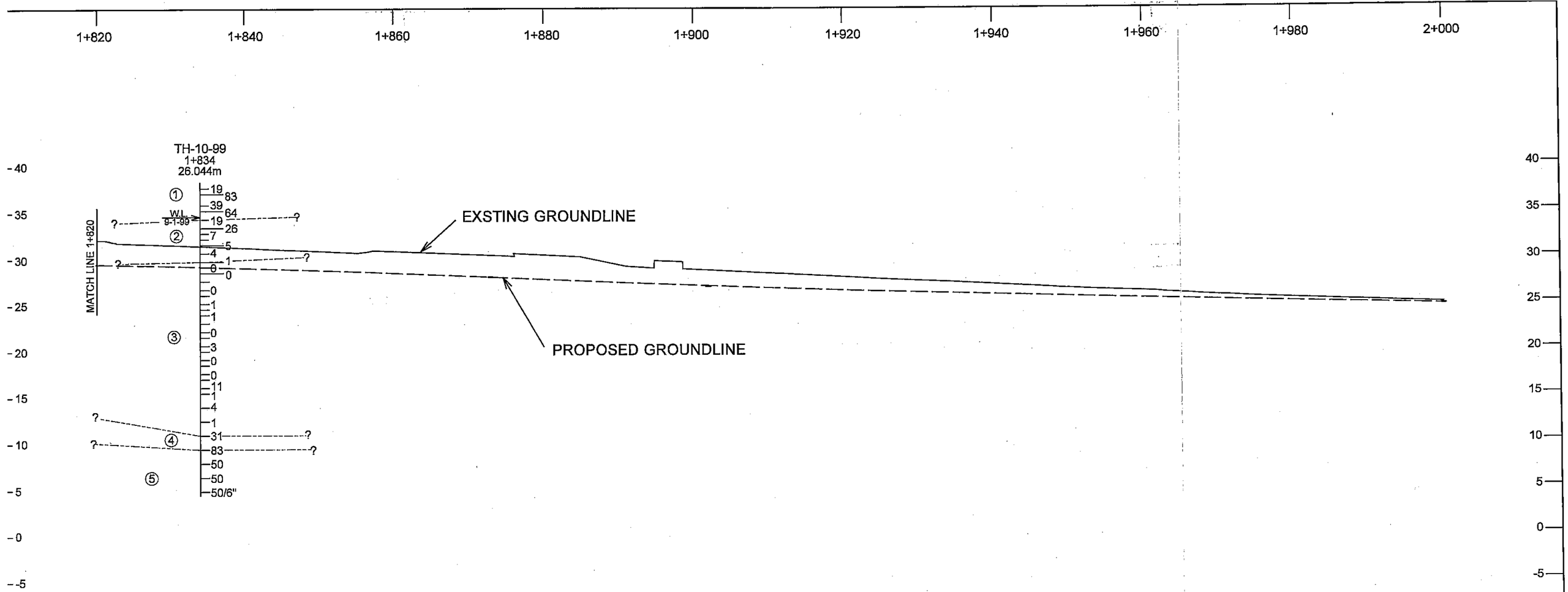
SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=400 VERT. 1=500 HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

..\4-10-02\PRLR1.dgn 06/20/2002 09:25:21 AM



TEST HOLE LEGEND

H-1-98 TEST HOLE NUMBER
0+265 TEST HOLE STATION
3.5 m Rt. TEST HOLE OFFSET

23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)

UNDISTURBED SAMPLE

W.L. 8-6-86 WATER LEVEL & DATE

? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS

INDICATES INTACT ROCK

86% INDICATES CORE SAMPLE TAKEN

ROCK QUALITY DESIGNATION

SOIL UNITS

1. Moist, medium dense to very dense silty sand and gravel.
2. Wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand.
3. Wet, very soft to soft clay and/or loose silt with varying amounts of sand and layers of loose sand.
4. Wet, loose to dense sand with varying amounts of silt and clay and layers of medium stiff to hard sandy silt.
5. Wet, very dense sand with gravel and varying amounts of silt and clay and layers of hard sandy silt.

FIGURE 5D: PROFILE-LR LINE

JOB OL-3500 S.R. 543 C.S.

SR 543

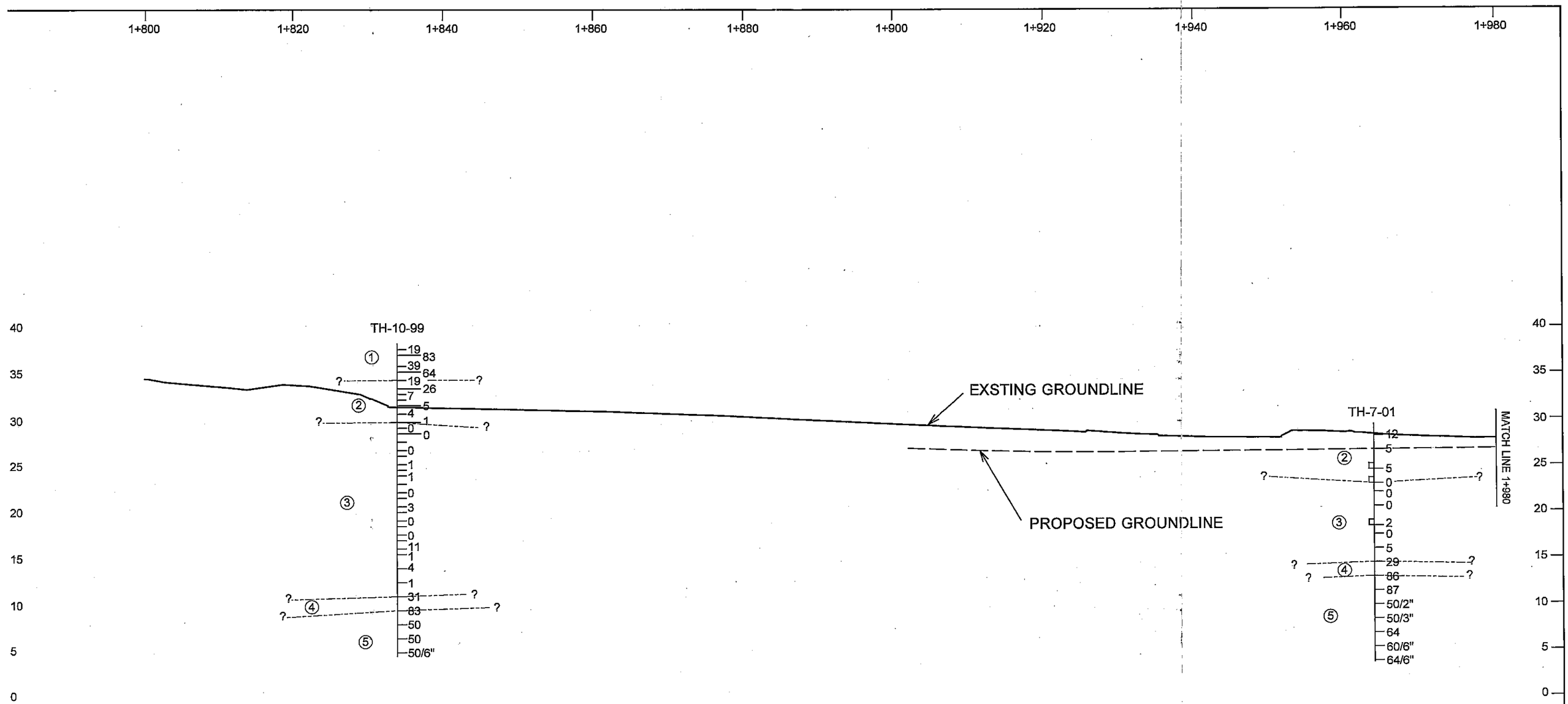
SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=400 VERT. 1=500 HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

..\4-10-02\PRLR1.dgn 06/20/2002 09:25:15 AM



TEST HOLE LEGEND

H-I-98 TEST HOLE NUMBER
0+265 TEST HOLE STATION
3.5 m Rt. TEST HOLE OFFSET

23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)
UNDISTURBED SAMPLE
WL 8-6-86 WATER LEVEL & DATE
? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS
INDICATES INTACT ROCK
86% INDICATES CORE SAMPLE TAKEN
ROCK QUALITY DESIGNATION

SOIL UNITS

1. Moist, medium dense to very dense silty sand and gravel.
2. Wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand.
3. Wet, very soft to soft clay and/or loose silt with varying amounts of sand and layers of loose sand.
4. Wet, loose to dense sand with varying amounts of silt and clay and layers of medium stiff to hard sandy silt.
5. Wet, very dense sand with gravel and varying amounts of silt and clay and layers of hard sandy silt.

FIGURE 6A: PROFILE-T LINE

JOB OL-3500 S.R. 543 C.S.

SR 543

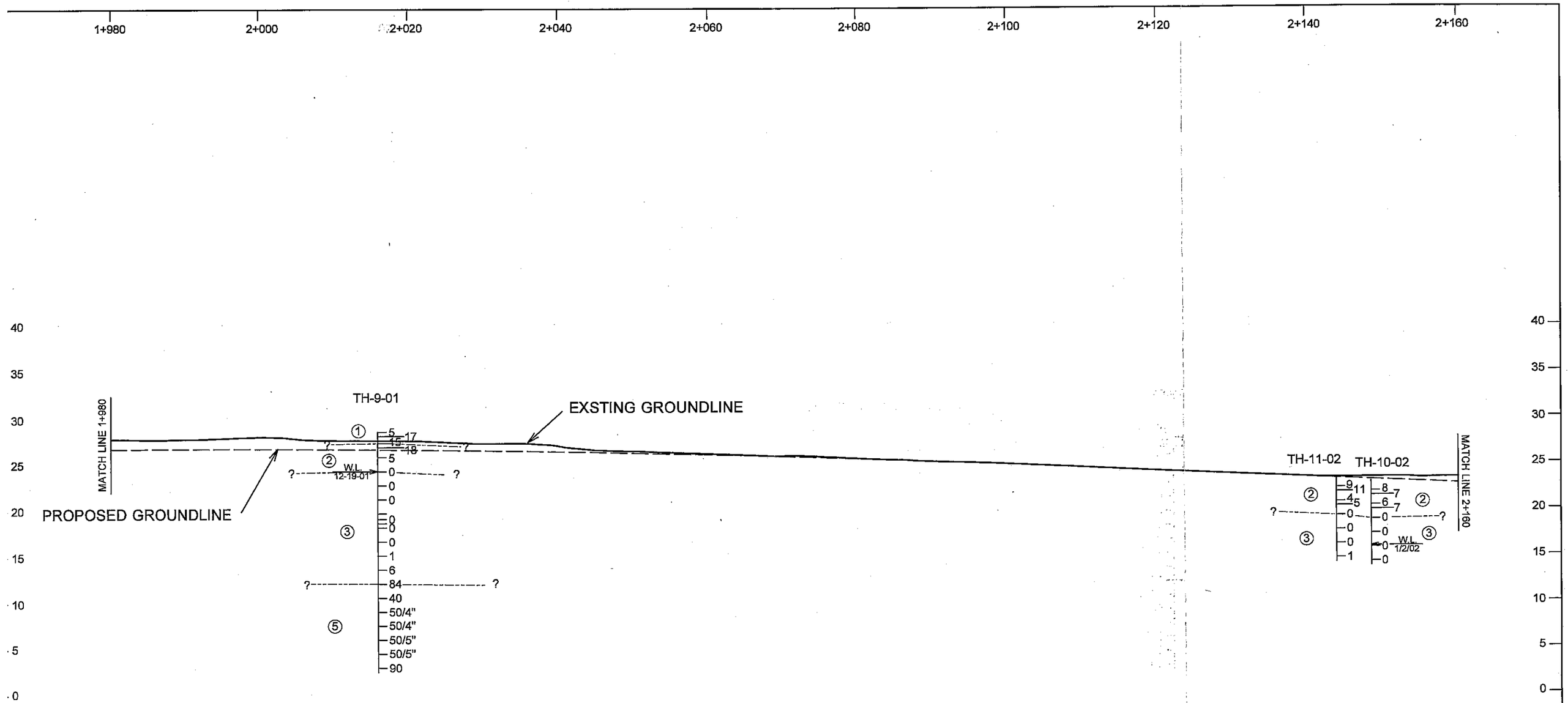
SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=400 VERT.
1=500 HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

.\Profile & Bridges\PRXTL1.DGN 06/20/2002 09:36:34 AM



SOIL UNITS

1. Moist, medium dense to very dense silty sand and gravel.
2. Wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand.
3. Wet, very soft to soft clay and/or loose silt with varying amounts of sand and layers of loose sand.
5. Wet, very dense sand with gravel and varying amounts of silt and clay and layers of hard sandy silt.

TEST HOLE LEGEND

H-1-98 TEST HOLE NUMBER
0+265 TEST HOLE STATION
3.5 m Rt. TEST HOLE OFFSET

23 STANDARD PENETROMETER TEST (BLOWS PER FOOT)

UNDISTURBED SAMPLE

W.L. 8-6-86 WATER LEVEL & DATE

? INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS

INDICATES INTACT ROCK

86% INDICATES CORE SAMPLE TAKEN

ROCK QUALITY DESIGNATION

FIGURE 6B: PROFILE-T LINE

JOB OL-3500 S.R. 543 C.S. _____

SR 543

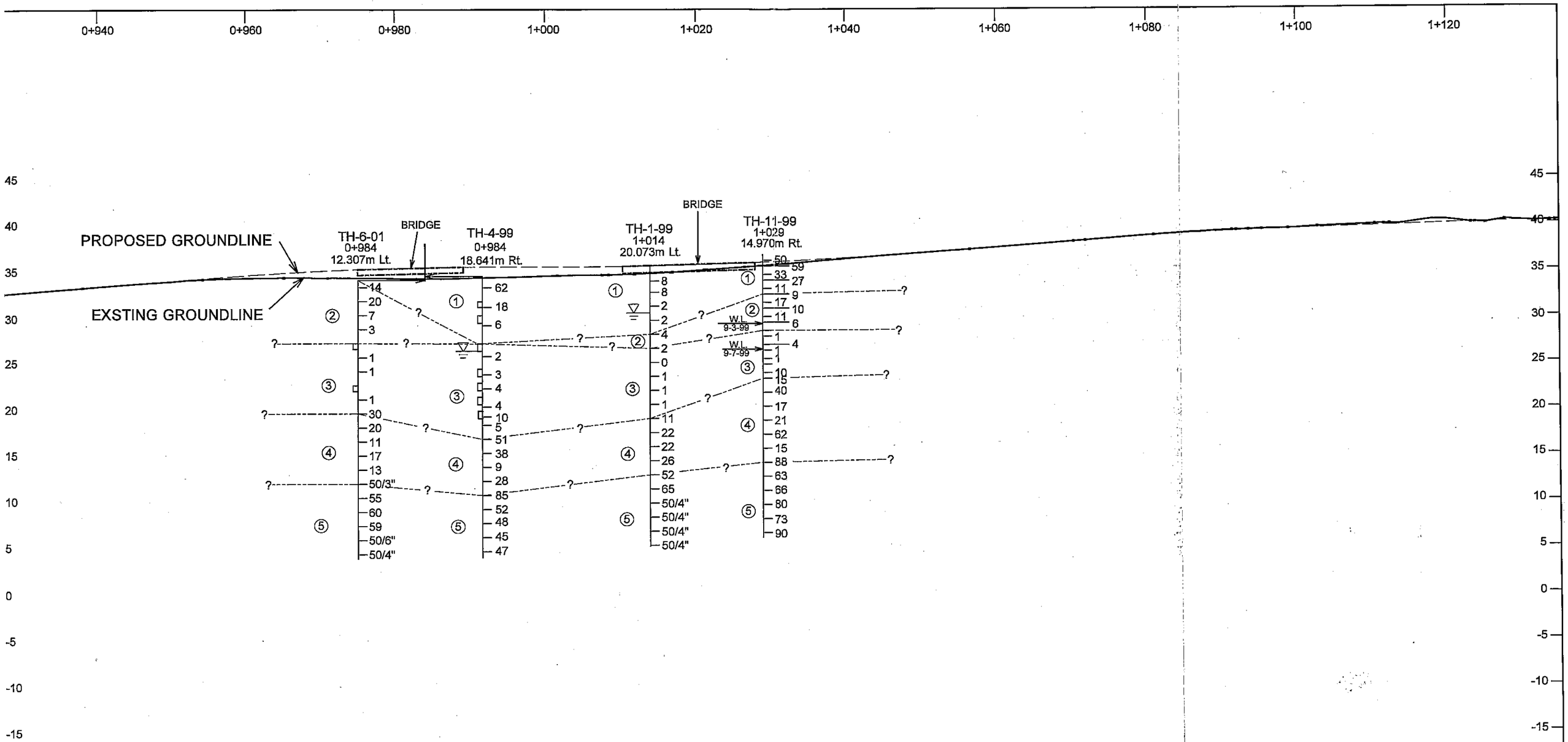
SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=400 VERT.
1=500 HORIZ.
SHEET ____ OF ____
DRAWN BY W.M.

..\Profile & Bridges\PRXTL1.DGN 06/20/2002 09:36:30 AM



SOIL UNITS

1. Moist, medium dense to very dense silty sand and gravel.
2. Wet, medium stiff to very stiff clay and/or medium dense silt with varying amounts of sand.
3. Wet, very soft to soft clay and/or loose silt with varying amounts of sand and layers of loose sand.
4. Wet, loose to dense sand with varying amounts of silt and clay and layers of medium stiff to hard sandy silt.
5. Wet, very dense sand with gravel and varying amounts of silt and clay and layers of hard sandy silt.

TEST HOLE LEGEND

- H-I-98 — TEST HOLE NUMBER
- 0+265 — TEST HOLE STATION
- 3.5 m Rt. — TEST HOLE OFFSET
- 23 — STANDARD PENETROMETER TEST (BLOWS PER FOOT)
- UNDISTURBED SAMPLE
- W.L. 8-6-86 — WATER LEVEL & DATE
- ? — INDICATES SOIL/ROCK STRATA BETWEEN TEST HOLES MAY NOT BE CONTINUOUS
- INDICATES INTACT ROCK
- 86% — INDICATES CORE SAMPLE TAKEN
- ROCK QUALITY DESIGNATION

FIGURE 7: PROFILE-D LINE

JOB OL-3500 S.R. 543 C.S.

SR 543

SR 5 TO INTERNATIONAL BOUNDARY

MP 0.20 TO MP 1.08

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 3/2002
SCALE 1=400 VERT. 1=500 HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

.\Bridges_PADL1.dgn 06/20/2002 10:01:32 AM

APPENDIX B - FIELD EXPLORATIONS

FIELD EXPLORATIONS

The field exploration program for the project consisted of 21 exploratory borings. The first phase of the site explorations (consisting of borings TH-1-99 through TH-4-99 and TH-8-99 through TH-12-99) was conducted between February 26, 1999 and September 9, 1999. The second phase of the site explorations (consisting of TH-1-01 through TH-9-01, TH-10-02, TH-11-02 and TH-12-01) was conducted between November 6, 2001 and January 2, 2002. The approximate exploration locations are shown on the Site and Exploration Plans, Figures 3A through 3G. Logs of the test borings are attached. These logs should be included in the contract documents.

These borings were completed using four types of drill rigs. Four of the borings were complete using a BK-81 skid mounted drill rig, three using a CME 45 skid-mounted drill rig, eleven using a CME-850 track-mounted drill rig, and three using a CME-55 truck-mounted drill rig. The test holes were advanced to depths between 9 and 40 meters (29.5 and 131.0) feet below the ground surface using mud rotary drilling methods.

At each location, soil samples were obtained using a SPT (Standard Penetration Test) sampler, in general accordance with ASTM T 206-87. SPTs are obtained by driving a 50 mm (2-inch) outside diameter split-spoon sampler 450 mm (18-inches) into the soil with a 63-kg (140-pound) hammer. The number of blows required to achieve each 150 mm (6 inches) of penetration is recorded and the soil's SPT resistance, or N-value, is calculated as the number of blows required to achieve the final 300 mm (12 inches) of penetration. Each drill rig is equipped with an automatic trip hammer to drive the split-spoon sampler. The automatic hammers on these two rigs are rated at approximately 70 percent efficiency, as compared to approximately 60 percent for manual hammers.

In addition to the SPT sampler, thin walled Shelby tubes were used to obtain soil samples at selected depths in most of the borings in general accordance with ASTM T-207-96. The samples are pushed into the soil using the hydraulics of the drill rig. Because they are pushed and not driven, and are obtained using a thin walled sampler, they are relatively undisturbed and suitable for strength and consolidation testing.

Following completion of the drilling program, select soil samples were then submitted to the OSC Materials Laboratory for laboratory testing.

The in-situ characteristics of the soils in five of the borings (TH-4-99, TH-8-99, TH-9-99, TH-10-99 and TH-12-99) were evaluated at selected depths using a vane shear test, in general accordance with ASTM T 223-96. This test consists of placing a four bladed vane in the undisturbed soil and rotating it from the surface to determine the torsional shear resistance required to cause a cylindrical surface to be sheared by the vane. This force is then converted to a unit shearing resistance of the cylindrical surface. The results of these tests are shown on the boring logs in this appendix and on Table B1 below:

Table B1 – Vane Shear Tests

Boring No.	Sample No.	Soil Type	Soil Consistency	Depth (m)	Depth (ft)	Undisturbed Shear Strength (kPa)	Undisturbed Shear Strength (psf)
TH-4-99	VS-4	SILT with gravel	Medium Dense	4.9	16	70.6	1475
TH-4-99	VS-6	SILT with occasional gravel	Very Loose	7.9	26	12.0	250
TH-4-99	VS-12	Clayey SAND	Very Loose	13.7	45	49.8	1040
TH-8-99	VS-14	Clayey Sand	Very Loose	10.4	34	38.3	800
TH-9-99	VS-18	Sandy Lean CLAY	Soft to Very Soft	13.7	45	74.2	1550
TH-9-99	VS-22	Sandy Lean CLAY	Soft	16.8	55	29.7	620
TH-10-99	VS-20	Fat CLAY with Sand	Very Soft	15.2	50	47.4	990
TH-10-99	VS-28	Lean CLAY with Sand	Very Soft	21.3	70	100.5	2100
TH-12-99	VS-12	Sandy lean CLAY	Soft to Medium Stiff	8.8	29	50.3	1050
TH-12-99	VS-20	Lean CLAY with Sand	Very Soft	14.9	49	29.7	620

The groundwater levels in the borings were measured at various times following completion of the borings. A complete record of these measurements is shown in Table B2 below:

Table B2 - Groundwater Level Measurements

Boring Number	Boring Elevation (m)	Boring Elevation (ft)	Date	Depth to Ground Water (m)	Depth to Ground Water (feet)	Ground Water Elevation (m)	Ground Water Elevation (feet)
TH-1-99	35.5	116.6	2/26/99	1.5*	5.0*	34.0*	111.6*
"	"	"	10/6/99	11.3	37.0	24.2	79.6
"	"	"	12/29/99	10.4	34.2	25.1	82.4
"	"	"	2/3/00	10.1	33.2	25.4	83.4
"	"	"	1/11/02	9.8	32.2	25.7	84.4
"	"	"	3/15/02	9.6	31.6	25.9	85.0
TH-2-99	30.1	98.8	N/A	No Data	No Data	No Data	No Data
TH-3-99	31.2	102.5	N/A	No Data	No Data	No Data	No Data
TH-4-99	34.5	113.3	6/4/99	8.1*	26.7*	26.4*	86.6*
"	"	"	10/6/99	11.3	37.2	23.2	76.1
"	"	"	12/29/99	10.4	34.2	24.1	79.1
"	"	"	2/3/00	10.1	33.2	24.4	80.1
"	"	"	1/11/02	10.1	33.0	24.5	80.3
TH-8-99	32.2	105.8	8/26/99	1.9*	6.1*	30.4*	99.7*
"	"	"	9/9/99	2.7	8.7	29.6	97.1
"	"	"	10/6/99	4.0	13.0	28.3	92.8
"	"	"	12/29/99	1.5	4.9	30.8	100.9
"	"	"	2/3/00	1.3	4.1	31.0	101.7
"	"	"	11/20/01	1.4	4.5	30.9	101.3
"	"	"	1/11/02	1.4	4.7	30.8	101.1
TH-9-99	36.8	120.9	8/25/99	4.1*	13.3*	32.8*	107.6*
TH-10-99	38.3	125.7	9/1/99	3.7*	12.1*	34.6*	113.6*
"	"	"	9/9/99	6.6	21.5	31.8	104.2
"	"	"	10/6/99	7.9	25.8	30.4	99.9
"	"	"	12/29/99	9.4	30.7	29.0	95.0
"	"	"	2/3/00	9.0	29.6	29.3	96.1
"	"	"	1/17/02	9.5	31.2	28.8	94.5
TH-11-99	36.8	120.8	9/7/99	10.2*	33.6*	26.6*	87.2*
TH-12-99(1)	33.3	109.1	9/9/99	11.2*	36.7*	22.1*	72.4*
"	"	"	10/6/99	9.9	32.6	23.3	76.5
"	"	"	12/29/99	9.1	29.7	24.2	79.4
"	"	"	2/3/00	8.8	28.9	24.4	80.2
"	"	"	3/15/02	8.2	26.9	25.1	82.2

Table B2 - Groundwater Level Measurements (Continued)

Boring Number	Boring Elevation (m)	Boring Elevation (ft)	Date	Depth to Ground Water (m)	Depth to Ground Water (feet)	Ground Water Elevation (m)	Ground Water Elevation (feet)
TH-12-99(2)	33.3	109.1	9/9/99	4.5	14.6	28.8	94.5
"	"	"	10/6/99	3.3	10.8	30.0	98.3
"	"	"	12/29/99	2.1	6.7	31.2	102.4
"	"	"	2/3/00	1.8	5.8	31.5	103.3
"	"	"	3/15/02	1.2	3.8	32.1	105.3
TH-1-01	21.3	69.7	11/20/01	0.8	2.6	20.5	67.1
"	"	"	1/11/02	0.8	2.5	20.5	67.2
TH-2-01	21.6	71.0	11/20/01	0.6	2.1	21.0	68.9
"	"	"	1/11/02	0.8	2.6	20.9	68.4
TH-3-01	22.5	73.8	12/12/01	2.4*	8.0*	20.1*	65.8*
TH-4-01	23.0	75.6	11/20/01	0.3	1.1	22.7	74.5
"	"	"	1/11/02	0.3	1.0	22.7	74.6
TH-5-01	26.8	87.9	12/20/01	4.9*	16.0*	21.9*	71.9*
"	"	"	1/11/02	1.3	4.4	25.5	83.5
TH-6-01	34.1	111.9	11/20/01	5.2	16.9	29.0	95.0
TH-6-01	34.1	111.9	1/11/02	6.2	20.4	27.9	91.5
TH-7-01	29.4	96.4	N/A	No Data	No Data	No Data	No Data
TH-8-01	28.6	93.8	N/A	No Data	No Data	No Data	No Data
TH-9-01	28.6	93.8	12/19/01	4.3*	14.0*	24.3*	79.8*
"	"	"	1/11/02	2.2	7.3	26.4	86.5
TH-10-01	22.9	75.2	1/2/02	7.0*	23.0*	15.9*	52.2*
TH-11-01	23.3	76.5	N/A	No Data	No Data	No Data	No Data
TH-12-01	24.7	80.9	12/18/01	4.3*	14.0*	20.4*	66.9*
"	"	"	1/11/02	2.0	6.4	22.7	74.5

* Groundwater level data obtained at time of drilling.

In addition to the borings, three cone penetration tests, designated CPT-5, CPT-6 and CPT-7 were made at the project site. However, when the data from these tests were analyzed, it was discovered that the data was inaccurate due to an electronic fault in the cone penetration test equipment. Since the data is not usable, it is not reported in this technical memorandum.

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-1-99

PROJECT I-5 to International Boundary Sheet 1 of 5

Inspector Williams

Station 1+736 (LR LINE) Offset 1.4 m Rt. Equipment CME 45 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323898.297 Easting 460847.909 Casing HW/HQ

Ground Elevation 116.6 (35.5 m) Start Date February 24, 1999 Completion Date February 26, 1999

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			5 3 5 (8)		D-1		02/26/1999 Clayey SAND, loose, gray, wet, homogenous, no HCL reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	▽	
10	2			1 4 4 (8)		D-2	GS MC PI	SC, MC=18%, PI=13 Clayey SAND, loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
15	3			1 1 1 (2)		D-3		Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
20	4			1 1		D-4	GS MC	SC, MC=20%, PI=13 Clayey SAND, very loose, gray, wet, Homogeneous, no		

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-1-99

PROJECT I-5 to International Boundary Sheet 2 of 5

Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater
		1 (2)			PI	HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	
	7						
25		0 2 2 (4)		D-5	GS MC PI	CL, MC=19%, PI=10 Sandy Lean CLAY, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	
	8						
30	9	0 1 1 (2)		D-6		No Recovery	1/11/02
	10						
35		0 (0)		D-7		Lean CLAY with sand, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	
	11						
40	12	0 0 1 (1)		D-8	GS MC PI	CL, MC=21%, PI=22 Lean CLAY with sand, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	
	13						
45		1 0		D-9		Lean CLAY with sand, very soft, gray, wet, Homogeneous, no HCl reaction	

Standard Penetration Blows/ft: 10 20 30 40

Profile

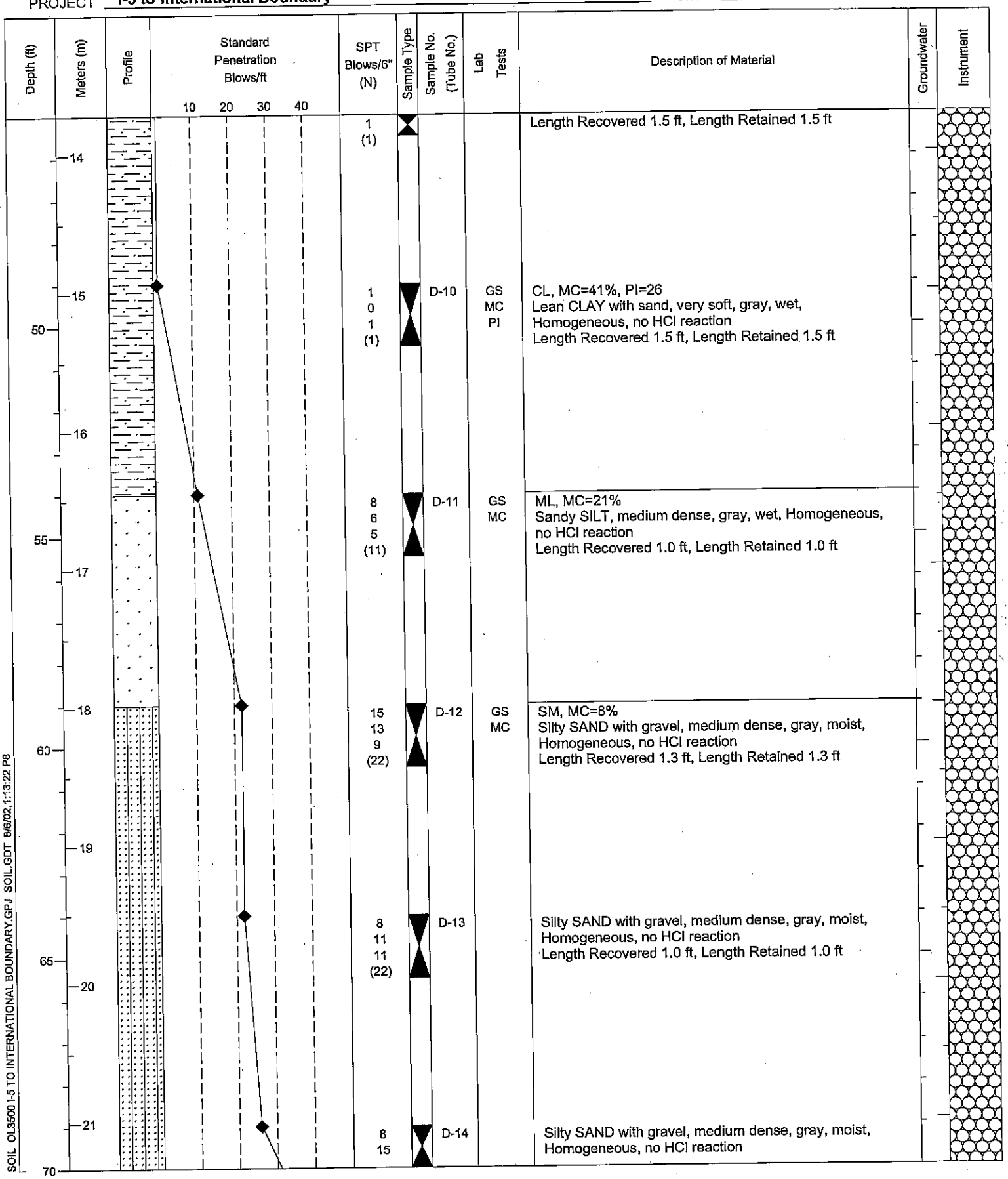
Instrument

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-1-99

PROJECT I-5 to International Boundary Sheet 3 of 5



Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-1-99

PROJECT I-5 to International Boundary Sheet 4 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				11 (26)				Length Recovered 1.0 ft, Length Retained 1.0 ft		
	22									
			>>	23 28 24 (52)		D-15	GS MC	SM, MC=9% Silty SAND, dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
75	23									
	24		>>	16 37 28 (65)		D-16		Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
80										
	25									
				50/4" (50/4")		D-17		Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 0.1 ft, Length Retained 0.1 ft		
85	26									
	27			50/4" (50/4")		D-18		Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 0.2 ft, Length Retained 0.2 ft		
90										
	28									
				50/4" (50/4")		D-19		Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction		
95										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-1-99

PROJECT I-5 to International Boundary Sheet 5 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29							Length Recovered 0.2 ft, Length Retained 0.2 ft		
	30			50/4" (50/4")		D-20		Silty SAND, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.1 ft, Length Retained 0.1 ft		
100								End of test hole boring at 99.3 ft below ground elevation.		
	31							This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
105	32									
	33									
110										
	34									
115	35									
	36									
120										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-2-99

PROJECT I-5 to International Boundary Sheet 1 of 5

Inspector Williams

Station 1+843 (LL LINE) Offset 0.3 m Rt. Equipment CME 45 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 324006.029 Easting 460818.166 Casing HQ

Ground Elevation 98.9 (30.1 m) Start Date February 26, 1999 Completion Date February 27, 1999

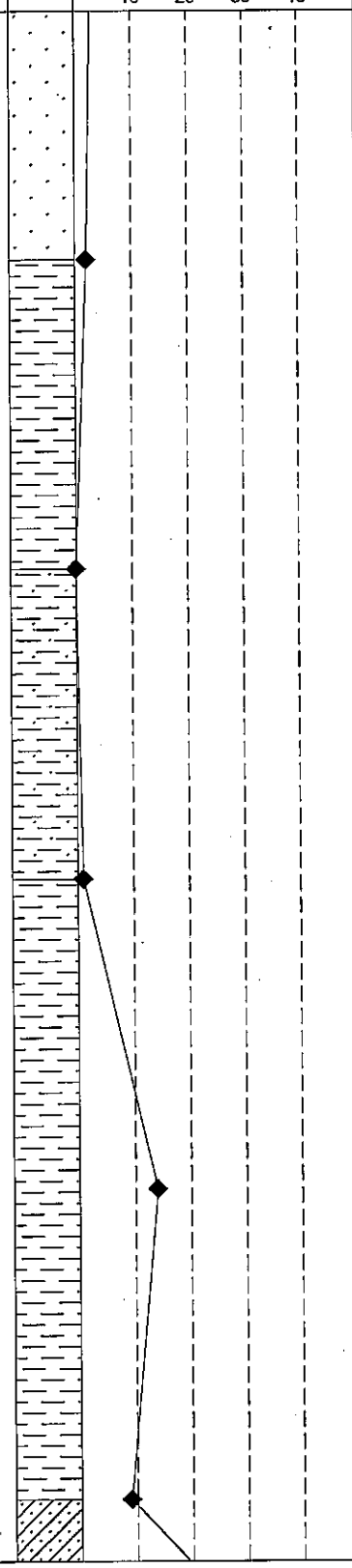
Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1, 2			2 3 3 (6)		D-1		Sandy Elastic SILT with gravel, loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.1 ft, Length Retained 0.1 ft		
10	3			0 1 2 (3)		D-2	GS MC PI	SC, MC=24%, PI=15 Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
15	4, 5			1 1 1 (2)		D-3	GS MC PI	SC-SM, MC=16%, PI=4 Silty, clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
20	6			0 1		D-4		Elastic SILT with sand, very loose, gray, wet, Homogeneous, no HCl reaction		

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-2-99

PROJECT I-5 to International Boundary Sheet 2 of 5



Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
		2 (3)				Length Recovered 1.5 ft, Length Retained 1.5 ft		
	7							
25		0 1 1 (2)		D-5		Fat CLAY with sand, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	8							
30	9	0 0 0 (0)		D-6	GS MC PI	CL, MC=27%, PI=11 Sandy lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	10							
35	11	0 0 1 (1)		D-7		Fat CLAY with sand, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
40	12	0 7 7 (14)		D-8		Fat CLAY with sand, stiff, gray, wet, Laminated,Fissured, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	13							
45		0 0		D-9	GS MC	SC, MC=21%, PI=14 Clayey SAND, loose, gray, wet, Homogeneous, no HCl		

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-2-99

PROJECT I-5 to International Boundary Sheet 3 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				9 (9)			PI	reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	14									
	15		>>	13 28 33 (61)		D-10	GS MC	SM, MC=11% Silty SAND with gravel, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
50										
	16									
			>>	10 22 50 (72)		D-11		Silty SAND, very dense, gray, moist, Laminated, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
55										
	17									
	18		>>	19 35 44 (79)		D-12		Silty SAND, very dense, gray, wet, Laminated, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
60										
	19									
			>>	28 36 48 (84)		D-13		Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
65										
	20									
	21									
70										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-2-99

PROJECT I-5 to International Boundary Sheet 4 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	22									
75	23		>>	30 38 45 (83)		D-14	GS MC	SP-SM, MC=20% Poorly graded SAND with silt, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 0.9 ft, Length Retained 0.9 ft		
	24		>>	26 44 50 (94)		D-16		Silty SAND, very dense, gray, moist, Laminated, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
80	25									
85	26		>>	23 30 40 (70)		D-17		Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
90	27			50 (50)		D-18		Silty SAND with gravel, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 0.3 ft, Length Retained 0.3 ft		
	28									
95				30 50		D-19		Silty SAND with gravel, very dense, gray, moist, Homogeneous, no HCl reaction		

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-2-99

PROJECT I-5 to International Boundary Sheet 5 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29			(50)				Length Recovered 0.8 ft, Length Retained 0.8 ft		
	30			50 (50)		D-20		No Recovery		
100								End of test hole boring at 99.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	31									
105	32									
	33									
110	34									
115	35									
	36									
120										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-99

PROJECT I-5 to International Boundary Sheet 1 of 5

Inspector Williams

Station 1+593 (LL LINE) Offset 3.7 m Lt. Equipment CME 45 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323756.344 Easting 460818.838 Casing HW/HQ

Ground Elevation 102.5 (31.2 m) Start Date March 1, 1999 Completion Date March 2, 1999

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			7 7 12 (19)		D-1	GS MC	SM, MC=9% Silty SAND with gravel, medium dense, brown, wet, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
10	2, 3			3 4 7 (11)		D-2	GS MC	SM, MC=18% Silty SAND, medium dense, brown, wet, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
15	4, 5			11 11 14 (25)		D-3	GS MC	SM, MC=15% Silty SAND with some seashells, medium dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
20	6									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-99

PROJECT I-5 to International Boundary Sheet 2 of 5

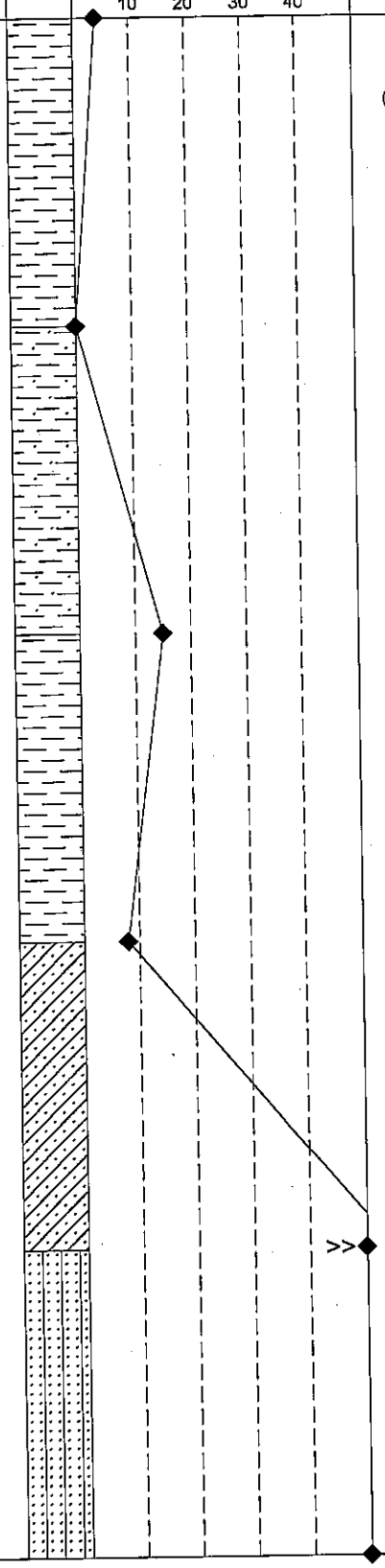
Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				3 4 5 (9)		D-4		Sandy Elastic SILT with gravel and some seashells, loose, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
25	7 8			3 2 4 (6)		D-5	GS MC PI	SC, MC=17%, PI=12 Clayey SAND, loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
30	9 10			3 3 4 (7)		D-6		Sandy Elastic SILT with gravel, loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.1 ft, Length Retained 0.1 ft		
35	11 12			1 2 2 (4)		D-7		Fat CLAY with sand, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
40	13			0 1 1 (2)		D-8	GS MC PI	SC-SM, MC=22%, PI=7 Silty, clayey SAND with some seashells, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-99

PROJECT I-5 to International Boundary Sheet 3 of 5



Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14, 15	1 2 2 (4)		D-9		Fat CLAY with sand, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
50	16	0 0 0 (0)		D-10	GS MC PI	CL, MC=33%, PI=15 Sandy lean CLAY with some seashells, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
55	17, 18	0 4 11 (15)		D-11		Fat CLAY with sand, stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.4 ft, Length Retained 0.4 ft		
60	19	4 4 4 (8)		D-12	GS MC PI	SC, MC=20%, PI=8 Clayey SAND, loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
65	20, 21	>> 20 24 31 (55)		D-13		Silty SAND with gravel, dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
70								

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-99

PROJECT I-5 to International Boundary Sheet 4 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				50 (50)		D-14		Silty SAND with gravel, dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
	22									
75	23			30 50 (50)		D-15		Silty GRAVEL with sand, subrounded, dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.2 ft, Length Retained 0.2 ft		
	24									
80			>>	30 39 50 (89)		D-16		Silty GRAVEL with sand, subrounded, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
	25									
85	26		>>	30 32 39 (71)		D-17	GS MC	GP, MC=10% Poorly graded GRAVEL with sand, subrounded, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	27									
90				50 (50)		D-18		Silty GRAVEL with sand, subrounded, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.3 ft, Length Retained 0.3 ft		
	28									
95										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-99

PROJECT I-5 to International Boundary Sheet 5 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29			50 (50)		D-19		Silty GRAVEL with sand, subrounded, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.3 ft, Length Retained 0.3 ft		
	30									
100				50 (50)		D-20		No Recovery		
	31							End of test hole boring at 100.2 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
105	32									
	33									
110										
	34									
115	35									
	36									
120										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-4-99

PROJECT I-5 to International Boundary Sheet 1 of 5

Inspector TONY PITTELKAU

Station 1+697 (LL LINE) Offset 2.5 m Lt. Equipment BK-81 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323860.046 Easting 460818.154 Casing HWX27 HQX102

Ground Elevation 113.3 (34.5 m) Start Date June 1, 1999 Completion Date June 4, 1999

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	1		>>	9 24 38 (62)		D-1	GS MC	SM, MC=17% Silty SAND with silt layers and FeO staining, very dense, olive brown, moist, Laminated, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
5	2									
						U-2 A B C	MC	MC=15% (U-2A)SILT with gravel, gray,wet, homogeneous, no HCl reaction SC, MC=13%, PI=10 (U-2B)Clayey SAND, dark gray MC=13% (U-2C) Length Recovered 1.0 ft, Length Retained 1.0 ft		
10	3			7 8 10 (18)		D-3		SILT with gravel, medium dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	4					U-4 AB CD EF	GS MC PI	MC=22% (U-4A) SILT with gravel, gray, moist, Homogeneous, no HCl reaction CL, MC=17%, PI=15 (U-4B) Sandy lean CLAY		
15	5					VS-4		SC, MC=17%, PI=13 (U-4C) Clayey SAND, dark gray SC, MC=16%, PI=14 (U-4D) Clayey SAND, dark gray Length Recovered 2.0 ft, Length Retained 2.0 ft		
				2 3 3 (6)		D-5	GS MC PI	Undistured shear strength=70.6kPa(1475psf) SC, MC=19%, PI=11 Clayey SAND, loose, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
20	6									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-4-99

PROJECT I-5 to International Boundary Sheet 2 of 5

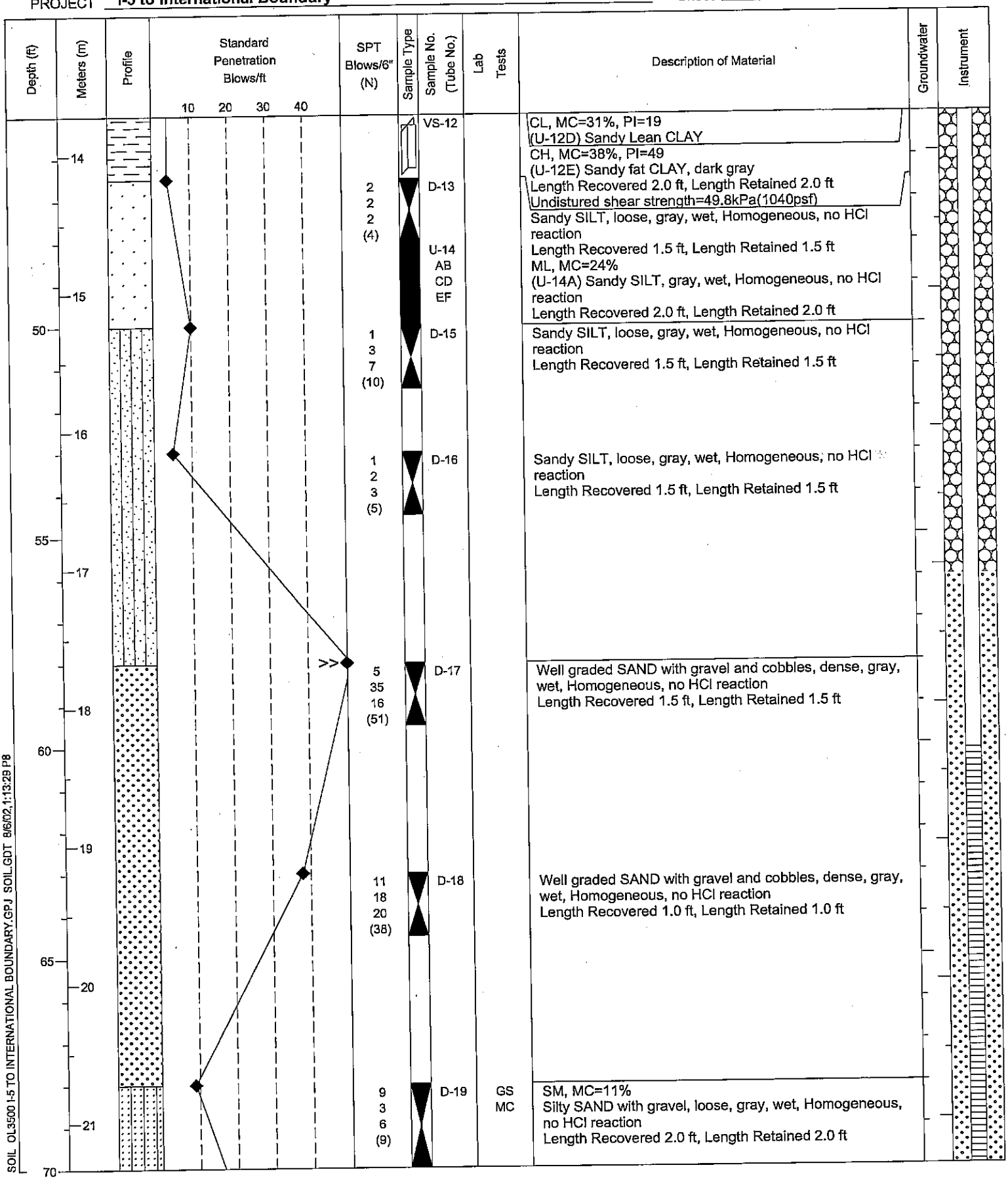
Depth (ft)	Meters (m)	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	7								
25					U-6 AB CD EF	GS MC PI	MC=21% (U-6A) SILT with occasional gravel, gray, wet, Homogeneous, no HCl reaction CL, MC=22%, PI=20 (U-6B) Lean CLAY with sand SC, MC=21%, PI=16 (U-6E) Clayey SAND, dark gray CL, MC=21%, PI=15 (U-6F) Sandy lean CLAY, dark gray Length Recovered 2.0 ft, Length Retained 2.0 ft		
	8				VS-6			6/4/99	
			1 1 1 (2)		D-7	GS MC PI	Undistured shear strength=12.0kPa(250psf) CL, MC=22%, PI=15 Sandy lean CLAY, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
30	9								
	10				U-8		No Recovery	1/11/02	
35			1 1 2 (3)		D-9	GS MC PI	SC, MC=25%, PI=11 Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction, undisturbed missed due to shoe shattering. Length Recovered 1.5 ft, Length Retained 1.5 ft		
	11								
					U-10 AB CD EF	GS MC PI	SC-SM, MC=20%, PI=5 (U-10A) Silty, clayey SAND, gray, wet, Homogeneous, no HCl reaction. MC=19% (U-10B) SILT with gravel SM, MC=20%, PI=3 (U-10C) Silty SAND, gray		
	12								
40			2 2 2 (4)		D-11		CL, MC=26%, PI=13 (U-10D) Sandy lean CLAY, dark gray MC=18% (U-10E) MC=20% (U-10F) Length Recovered 2.0 ft, Length Retained 2.0 ft SILT with gravel, loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	13								
					U-12 AB CD EF	GS MC PI	SC, MC=30%, PI=21 (U-12B) Clayey SAND, dark gray, wet, Homogeneous, no HCl reaction SC, MC=34%, PI=37 (U-12C) Clayey SAND, dark gray		
45									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-4-99

PROJECT I-5 to International Boundary Sheet 3 of 5



SOIL OL3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 8/6/02,1:13:29 P8

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-4-99

PROJECT I-5 to International Boundary Sheet 4 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	22									
75	23			16 16 12 (28)		D-20		Well graded SAND with gravel and cobbles, medium dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
80	24		>>	10 41 44 (85)		D-21	GS MC	SM, MC=8% Silty SAND with gravel, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
85	25		>>	11 18 34 (52)		D-22	GS MC	ML, MC=25% SILT with sand, dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
90	26			12 19 29 (48)		D-23		Silty SAND, dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	27									
	28			18 21 24 (45)		D-24	GS MC	SM, MC=23% Silty SAND, dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
95										

SOIL 0L3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 8/6/02,1:13:29 PB

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-4-99

PROJECT I-5 to International Boundary Sheet 5 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29									
	30			27 24 23 (47)		D-25		Well graded SAND with gravel, dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
100								End of test hole boring at 100 ft below ground elevation.		
	31							This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
105	32									
	33									
110										
	34									
115	35									
	36									
120										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-8-99

PROJECT I-5 to International Boundary Sheet 1 of 3

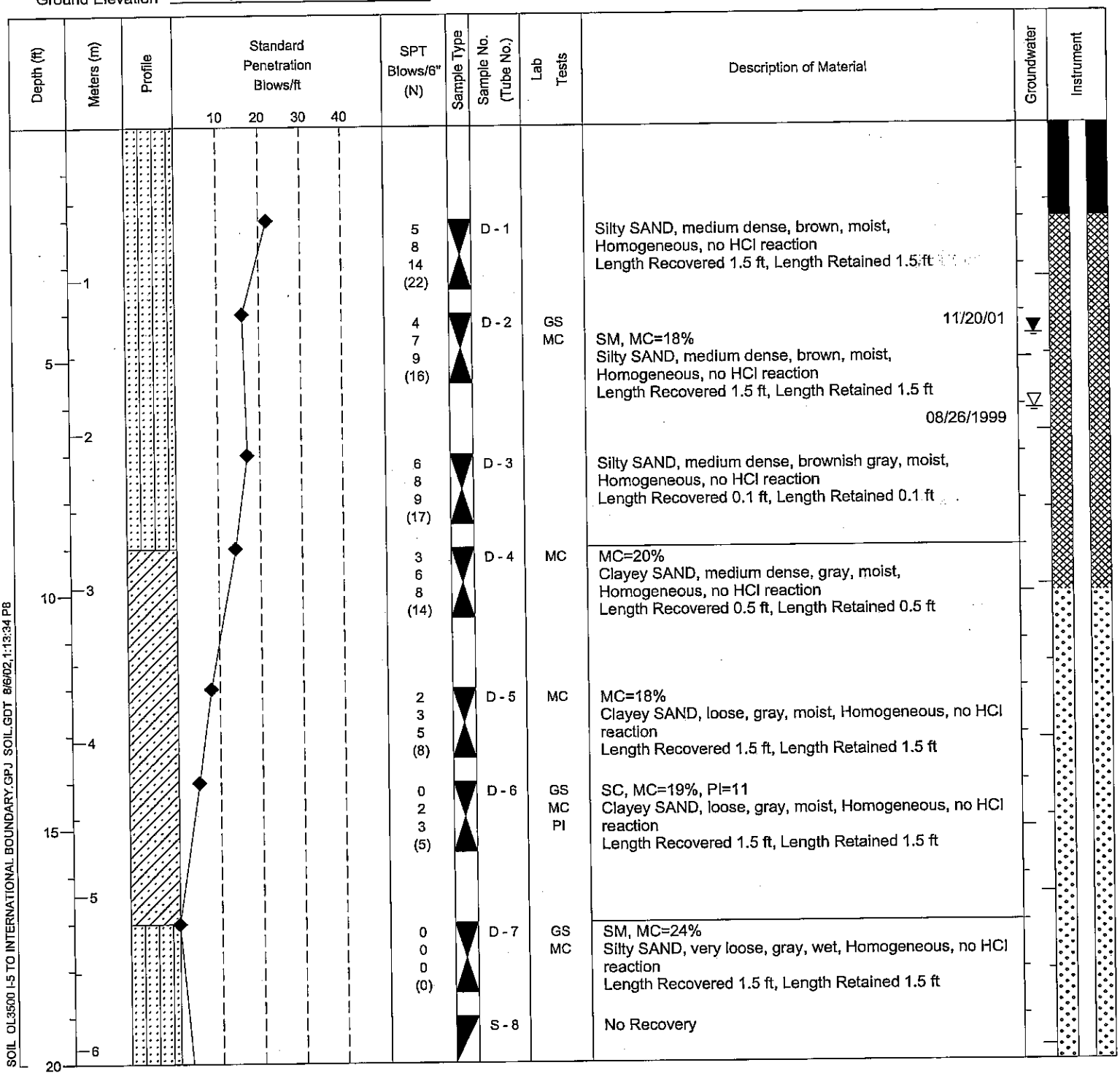
Inspector Brian M. Breck

Station 1+921 (LL LINE) Offset 17.3 m Lt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 324083.68 Easting 460798.88 Casing HW

Ground Elevation 105.8 (32.2 m) Start Date August 25, 1999 Completion Date August 26, 1999



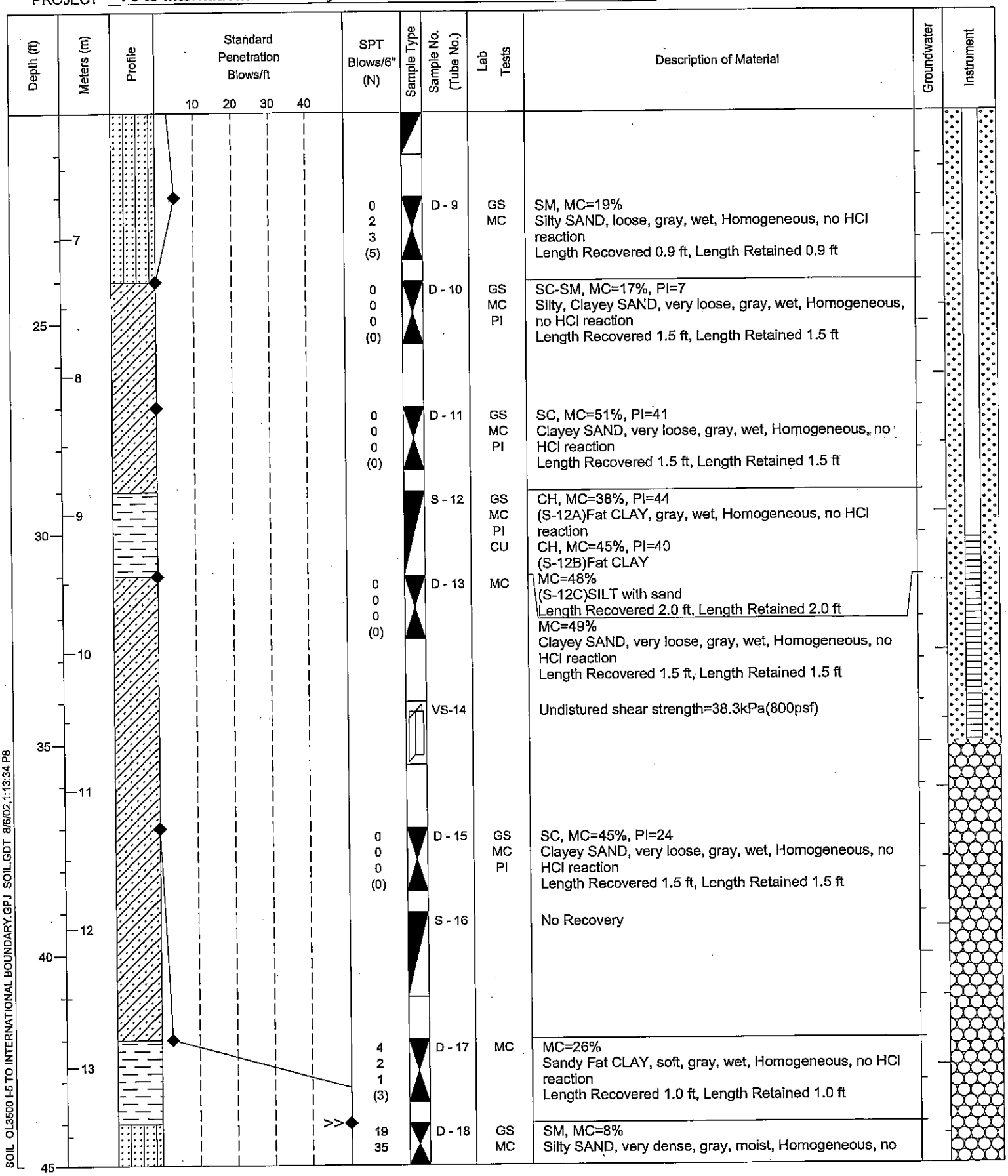
SOIL OL3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 8/6/02,1:13:34 P8

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-8-99

PROJECT I-5 to International Boundary Sheet 2 of 3



SPT Blows/6" (N)	Sample No. (Tube No.)	Lab Tests	Description of Material
0 2 3 (5)	D - 9	GS MC	SM, MC=19% Silty SAND, loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.9 ft, Length Retained 0.9 ft
0 0 0 (0)	D - 10	GS MC PI	SC-SM, MC=17%, PI=7 Silty, Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft
0 0 0 (0)	D - 11	GS MC PI	SC, MC=51%, PI=41 Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft
	S - 12	GS MC PI CU	CH, MC=38%, PI=44 (S-12A)Fat CLAY, gray, wet, Homogeneous, no HCl reaction CH, MC=45%, PI=40 (S-12B)Fat CLAY
0 0 0 (0)	D - 13	MC	MC=48% (S-12C)SILT with sand Length Recovered 2.0 ft, Length Retained 2.0 ft MC=49% Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft
	VS-14		Undistured shear strength=38.3kPa(800psf)
0 0 0 (0)	D - 15	GS MC PI	SC, MC=45%, PI=24 Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft
	S - 16		No Recovery
4 2 1 (3)	D - 17	MC	MC=26% Sandy Fat CLAY, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft
>> 19 35	D - 18	GS MC	SM, MC=8% Silty SAND, very dense, gray, moist, Homogeneous, no

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-8-99

PROJECT I-5 to International Boundary Sheet 3 of 3

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				50 (85)				HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	14									
	15			30 50/6" (50/6")		D - 19	GS MC	SM, MC=19% Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
50										
	16									
			>>	22 38 47 (85)		D - 20		Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
55	17									
	18		>>	21 37 49 (86)		D - 21	GS MC	SP-SM, MC=18% Poorly graded SAND with silt, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
60	19									
				50/6" (50/6")		D - 22		Poorly graded SAND with silt, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
65	20							End of test hole boring at 64.5 ft below ground elevation.		
	21							This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
70										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-9-99

PROJECT I-5 to International Boundary Sheet 1 of 4

Inspector Brian M. Breck

Station 1+824 (LL LINE) Offset 17.2 m Lt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323986.851 Easting 460801.097 Casing HW

Ground Elevation 120.9 (36.8 m) Start Date August 23, 1999 Completion Date August 25, 1999

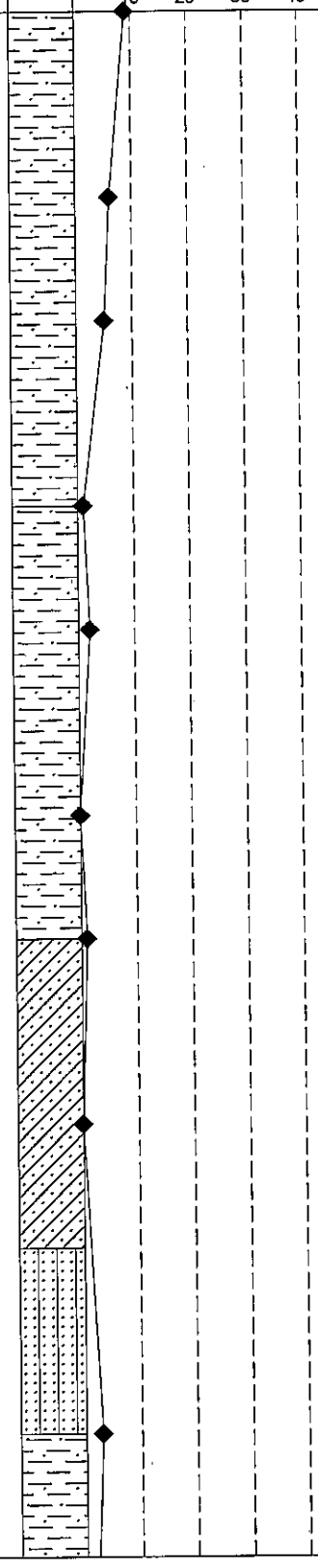
Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	1		>>	20 38 50 (88)		D-1	GS MC	SP-SM, MC=10% Poorly graded SAND with silt and gravel, very dense, gray and brown, wet, Laminated, no HCl reaction Length Recovered 0.9 ft, Length Retained 0.9 ft		
5	2			14 14 19 (33)		D-2	GS MC	SM, MC=14% Silty SAND, dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
				6 50 (50)		D-3		Silty SAND, dense, brownish gray, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
10	3			11 10 12 (22)		D-4	GS MC	SM, MC=15% Silty SAND, medium dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
	4			12 14 14 (28)		D-5		08/25/1999 Silty SAND, medium dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.4 ft, Length Retained 1.4 ft	▽	
15	5			9 8 9 (17)		D-6	GS MC PI	CL, MC=13%, PI=14 Lean CLAY with sand, very stiff, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
				3 4 5 (9)		D-7		Lean CLAY with sand, stiff, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
20	6									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-9-99

PROJECT I-5 to International Boundary Sheet 2 of 4



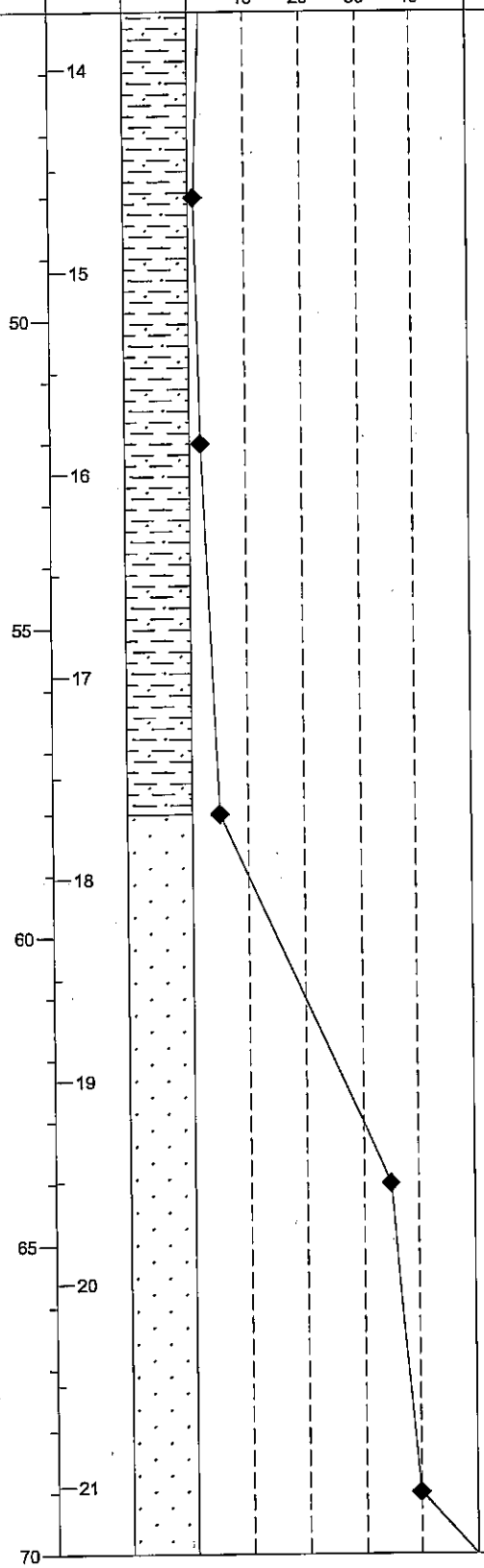
Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
		3 4 5 (9)		D-8	MC	MC=22% Lean CLAY with sand, stiff, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	7	2 3 3 (6)		D-9	GS MC PI	CL, MC=21%, PI=15 Lean CLAY with sand, medium stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.9 ft, Length Retained 0.9 ft		
25	8	2 2 3 (5)		D-10		Lean CLAY with sand, medium stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
		0 0 1 (1)		D-11		Sandy lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
30	9	1 1 1 (2)		D-12	GS MC PI	CL, MC=22%, PI=12 Sandy lean CLAY, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	10	0 0 0 (0)		D-13		Sandy lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
35	11	2 1 0 (1)		D-14	GS MC PI	SC-SM, MC=22%, PI=7 Silty, Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	12	0 0 0 (0)		D-15		Silty, Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
40	13			S-16	GS MC CU	SM, MC=25% Silty SAND, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
45		0 1 2 (3)		D-17	GS MC PI	CL, MC=48%, PI=29 Sandy lean CLAY, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-9-99

PROJECT I-5 to International Boundary Sheet 3 of 4



Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				VS-18	MC	MC=48% Undistured shear strength=74.2kPa(1550psf)		
	14							
		0 0 1 (1)		D-19		Sandy lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	15							
50				S-20		Fat CLAY, gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
		1 1 1 (2)		D-21		Sandy lean CLAY, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	16							
55				VS-22	MC	MC=35% Undistured shear strength=29.7kPa(620psf)		
	17							
		2 3 2 (5)		D-23	GS MC	ML, MC=33% Sandy SILT, loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	18							
60				S-24		No Recovery		
	19							
		10 14 21 (35)		D-25		SILT with sand and sand layers, dense, gray, moist, Homogeneous, no HCl reaction, Note - Drilling became hader at 61.5'. Length Recovered 1.5 ft, Length Retained 1.5 ft		
65	20							
	21	18 22		D-26	GS MC	ML, MC=25% SILT with sand, dense, gray, moist, Homogeneous, no		
70								

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-9-99

PROJECT I-5 to International Boundary Sheet 4 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				28 (40)				HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	22									
			>>	23 40 50 (90)		D-27		Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
75	23									
	24			20 50 (50)		D-28		Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
80								End of test hole boring at 80 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	25									
85	26									
	27									
90										
	28									
95										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-10-99

PROJECT I-5 to International Boundary Sheet 1 of 5

Inspector Brian M. Breck

Station 1+834 (T LINE) Offset 18.8 m Rt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323998.567 Easting 460864.102 Casing HW

Ground Elevation 125.7 (38.3 m) Start Date August 30, 1999 Completion Date September 1, 1999

Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater
		10 9 10 (19)		D - 1		Silty SAND with gravel, medium dense, brown, moist, Homogeneous, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft	
5	1	>>25 45 38 (83)		D - 2		Silty SAND with gravel, very dense, brownish gray, moist, Homogeneous, no HCl reaction Length Recovered 0.2 ft, Length Retained 0.2 ft	
	2	8 16 23 (39)		D - 3	GS MC	SM, MC=12% Silty SAND, dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	
10	3	>>9 32 32 (64)		D - 4	MC	MC=12% Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft 09/01/1999	▽
	4	7 8 11 (19)		D - 5	GS MC	ML, MC=19% Sandy SILT, medium dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	
15	5	6 12 14 (26)		D - 6		Sandy SILT, medium, dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft	
20	6	2 3 4 (7)		D - 7	MC	MC=23% Lean CLAY with sand, medium stiff, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	

Standard Penetration Blows/ft: 10 20 30 40

Instrument

SOIL OL3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 8/6/02,1:13:16 PB

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-10-99

PROJECT I-5 to International Boundary Sheet 2 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
						S - 8		Sandy Lean CLAY, gray, moist, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
	7			2 2 3 (5)		D - 9	GS MC PI	CL, MC=21%, PI=20 Lean CLAY with sand, medium stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
25	8			1 2 2 (4)		D - 10	MC	MC=30% Sandy Lean CLAY, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	9			0 0 1 (1)		D - 11	GS MC PI	SC, MC=24%, PI=10 Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	2/3/00	
30				0 0 0 (0)		D - 12		Clayey SAND, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	10			0 0 0 (0)		D - 13	GS MC PI	CL-ML, MC=24%, PI=7 Sandy silty CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
35	11					S - 14		No Recovery		
	12			0 0 0 (0)		D - 15	GS MC PI	CL, MC=27%, PI=24 Lean CLAY with sand, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
40						S - 16		No Recovery		
	13			0 0 1 (1)		D - 17	GS MC PI	CH, MC=45%, PI=45 Fat CLAY with sand, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-10-99

PROJECT I-5 to International Boundary Sheet 3 of 5

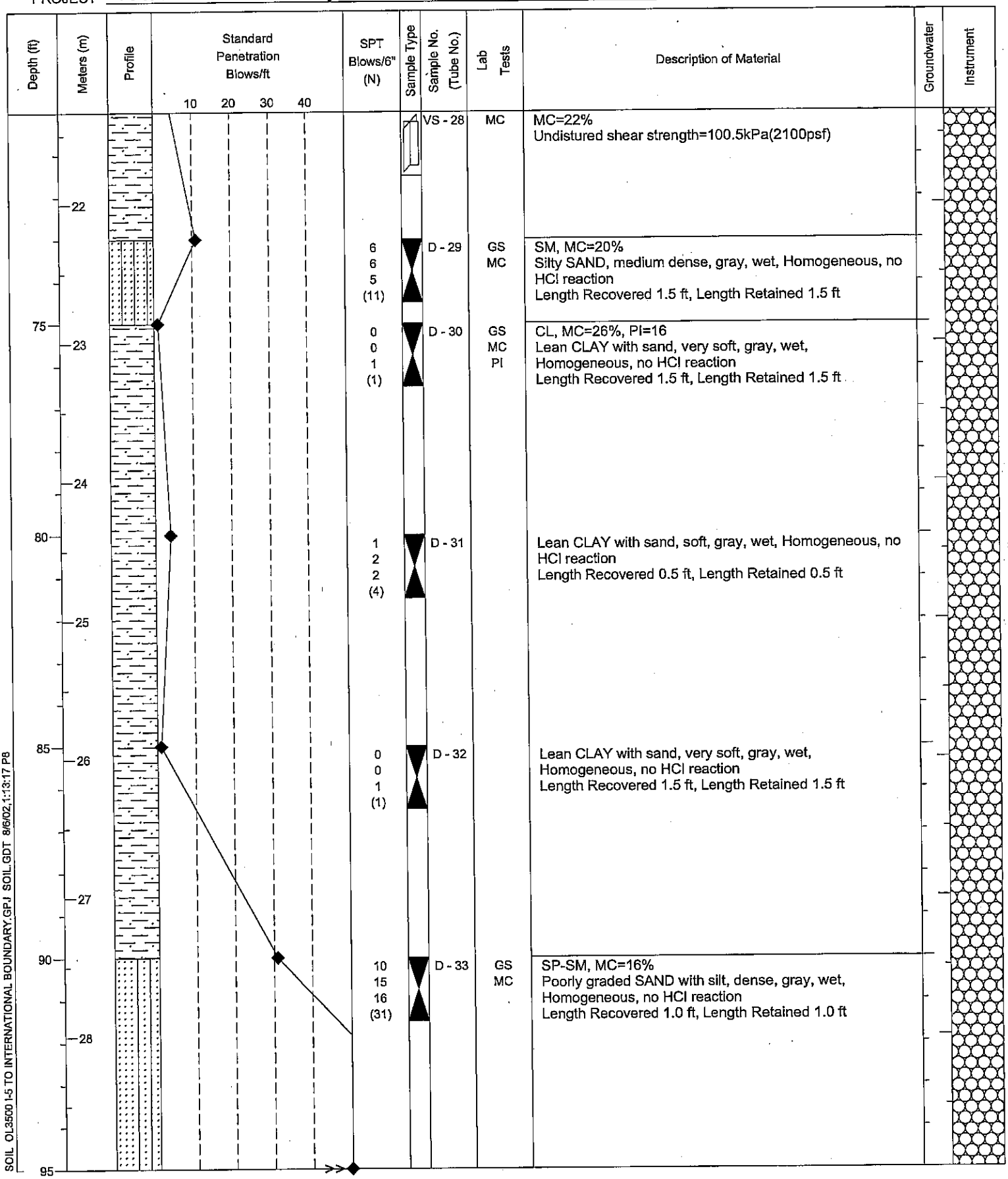
Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
						S - 18	GS MC PI CU	CH, MC=39%, PI=38 (S-18B)Fat CLAY, gray, wet, Homogeneous, no HCl reaction CH, MC=41%, PI=38 (S-18C)Fat CLAY		
	14			0 0 1 (1)		D - 19	MC	CH, MC=41%, PI=44 (S-18D)Fat CLAY Length Recovered 2.0 ft, Length Retained 2.0 ft MC=47% Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	15									
50						VS-20	GS MC PI	CH, MC=52%, PI=44 Fat CLAY with sand Undistured shear strength=47.4kPa(990psf)		
	16			0 0 0 (0)		D - 21	GS MC PI	CL, MC=30%, PI=17 Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction. Length Recovered 1.5 ft, Length Retained 1.5 ft		
55						S - 22		No Recovery		
	17									
	18			1 1 2 (3)		D - 23	GS MC	SM, MC=13% Silty SAND with sand lenses, very loose, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
60						S - 24		No Recovery		
	19			0 0 0 (0)		D - 25	GS MC	ML, MC=36% SILT with sand lenses, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
65						S - 26		No Recovery		
	20									
	21			0 0 0 (0)		D - 27	GS MC PI	CL, MC=30%, PI=13 Lean CLAY with sand, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
70										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-10-99

PROJECT I-5 to International Boundary Sheet 4 of 5



SOIL OL3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 8/6/02,1:13:17 P8

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-10-99

PROJECT I-5 to International Boundary Sheet 5 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29			27 33 50 (83)		D - 34		Poorly graded SAND with silt, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.2 ft, Length Retained 0.2 ft		
	30									
100				37 50/6" (50/6")		D - 35		Poorly graded SAND with silt, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	31									
105	32			41 50/6" (50/6")		D - 36		Poorly graded SAND with silt, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	33									
110				50/6" (50/6")		D - 37		Poorly graded SAND with silt and gravel, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
	34							End of test hole boring at 111 ft below ground elevation.		
								This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
115	35									
	36									
120										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-11-99

PROJECT I-5 to International Boundary Sheet 1 of 5

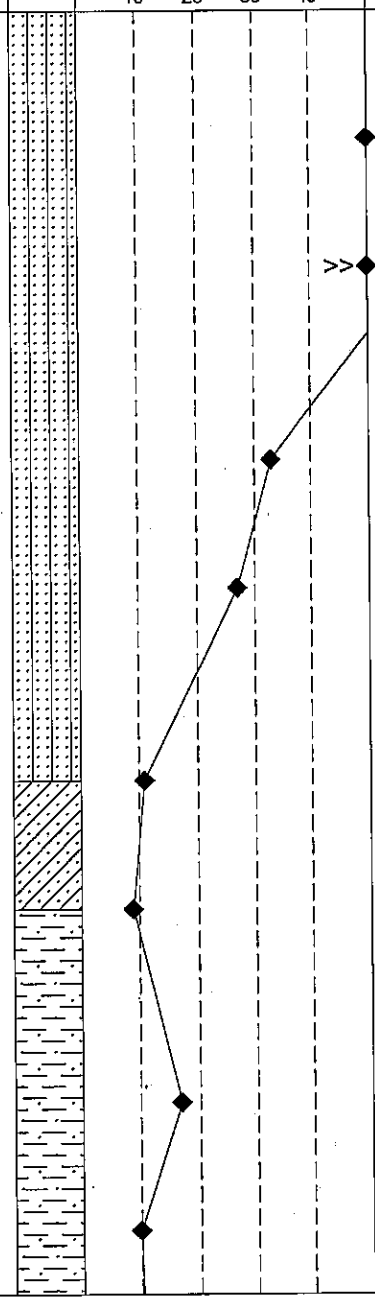
Inspector Brian M. Breck

Station 1+701 (LR LINE) Offset 15.8 m Rt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323863.011 Easting 460863.057 Casing HW x 87 HQ x 102

Ground Elevation 120.8 (36.8 m) Start Date September 2, 1999 Completion Date September 7, 1999



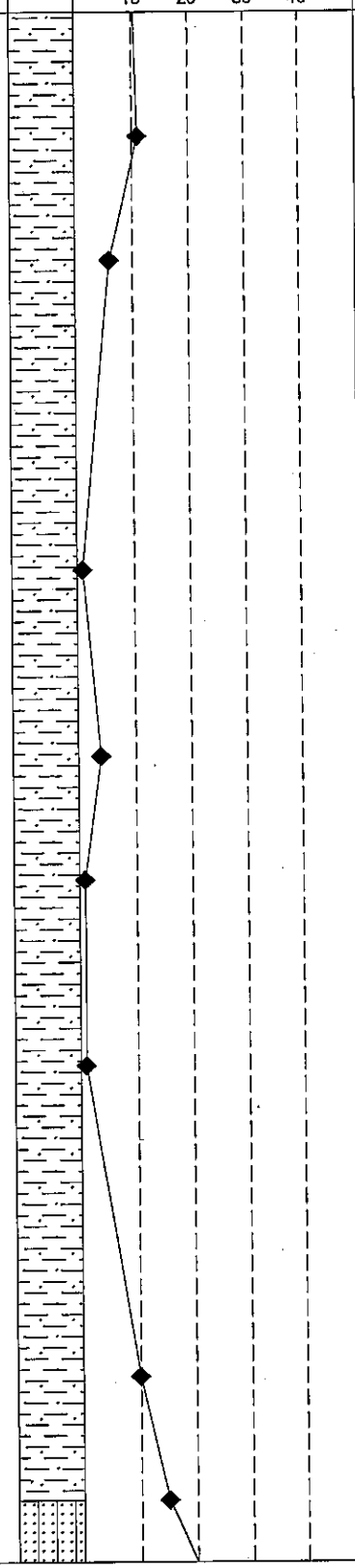
Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
		9 19 31 (50)		D - 1		Silty SAND, dense, Brownish gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
5	1	21 28 31 (59)		D - 2	GS MC	SM, MC=11% Silty SAND, dense, brownish gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	2	6 10 23 (33)		D - 3	GS MC	SM, MC=12% Silty SAND, dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
10	3	8 11 16 (27)		D - 4		Silty SAND, medium dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
	4	5 5 6 (11)		D - 5	GS MC PI	SC, MC=17%, PI=9 Clayey SAND, medium dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
15		2 4 5 (9)		D - 6		Sandy Lean CLAY, stiff, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	5	6 8 9 (17)		D - 7		No Recovery		
20	6	3 5		D - 8	GS MC	CL, MC=15%, PI=12 Sandy Lean CLAY, stiff, gray, wet, Homogeneous, no		

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-11-99

PROJECT I-5 to International Boundary Sheet 2 of 5



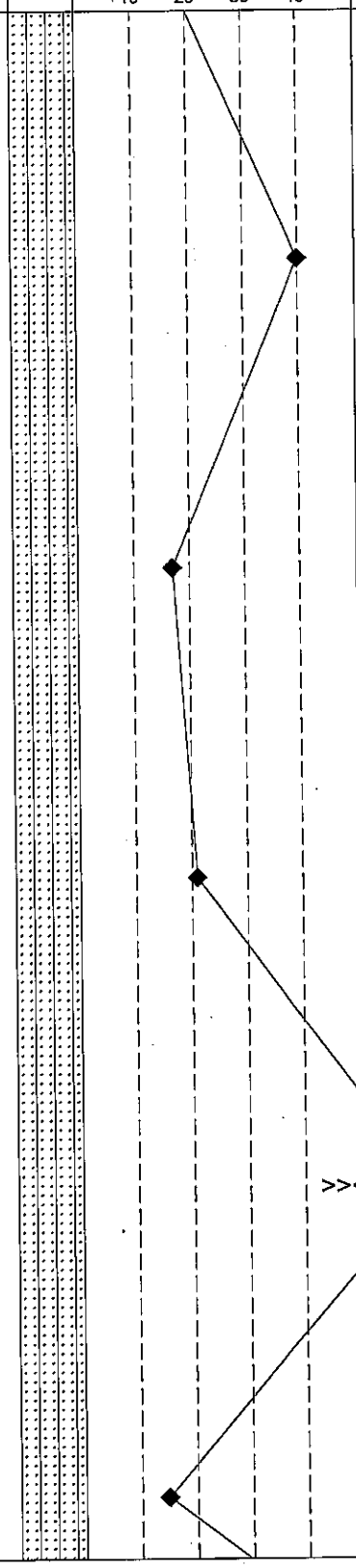
Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
		5 (10)			PI	HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
		6 6 5 (11)		D - 9		Sandy Lean CLAY, stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
25	7	2 3 3 (6)		D - 10	GS MC PI	09/03/1999 CL, MC=29%, PI=15 Sandy Lean CLAY, medium stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	▽	
	8			S - 11		No Recovery		
30	9	0 0 1 (1)		D - 12	GS MC PI	CL, MC=19%, PI=9 Sandy Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	10	1 2 2 (4)		D - 13		Sandy Lean CLAY, medium stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft	▼	
35		0 0 1 (1)		D - 14		09/07/1999 Sandy Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.2 ft, Length Retained 0.2 ft		
	11	1 0 1 (1)		D - 15	GS MC PI	CL, MC=17%, PI=14 Sandy Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
40	12			S - 16		Sandy Lean CLAY, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	13	4 6 4 (10)		D - 17		Sandy Lean CLAY, stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.3 ft, Length Retained 0.3 ft		
45		7 8		D - 18	GS MC	SM, MC=19% Silty SAND, medium dense, gray, wet, Homogeneous, no		

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-11-99

PROJECT I-5 to International Boundary Sheet 3 of 5



Depth (ft)	Meters (m)	Profile	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			7 (15)				HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	14								
	15		7 20 20 (40)		D - 19		Silty SAND with gravel, dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft		
50									
	16								
			6 8 9 (17)		D - 20	GS MC	SM, MC=10% Silty SAND with gravel, medium dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.1 ft, Length Retained 1.1 ft		
55									
	17								
	18		7 14 7 (21)		D - 21		Silty SAND with gravel, medium dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
60									
	19								
		>>	7 23 39 (62)		D - 22		Silty SAND with gravel, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
65									
	20								
	21		11 7		D - 23	GS MC	SM, MC=11% Silty SAND with gravel, medium dense, gray, wet,		
70									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-11-99

PROJECT I-5 to International Boundary Sheet 4 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				8 (15)				Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	22									
75	23		>>	25 38 50 (88)		D - 24		Silty SAND with gravel, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.1 ft, Length Retained 1.1 ft		
	24		>>	26 35 28 (63)		D - 25		Well graded GRAVEL with sand, subangular, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
80	25									
85	26		>>	21 31 35 (66)		D - 26	GS MC	ML, MC=26% SILT with sand, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	27		>>	21 32 48 (80)		D - 27		SILT with sand, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
90	28									
95			>>	29 32		D - 28		SILT with sand, very dense, gray, wet, Homogeneous, no HCl reaction		

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-11-99

PROJECT I-5 to International Boundary Sheet 5 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29			41 (73)				Length Recovered 1.5 ft, Length Retained 1.5 ft		
	30		>>	28 38 52 (90)		D - 29		SILT with sand, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
100										
	31							End of test hole boring at 100.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
105	32									
	33									
110										
	34									
115	35									
	36									
120										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-12-99

PROJECT I-5 to International Boundary Sheet 1 of 4

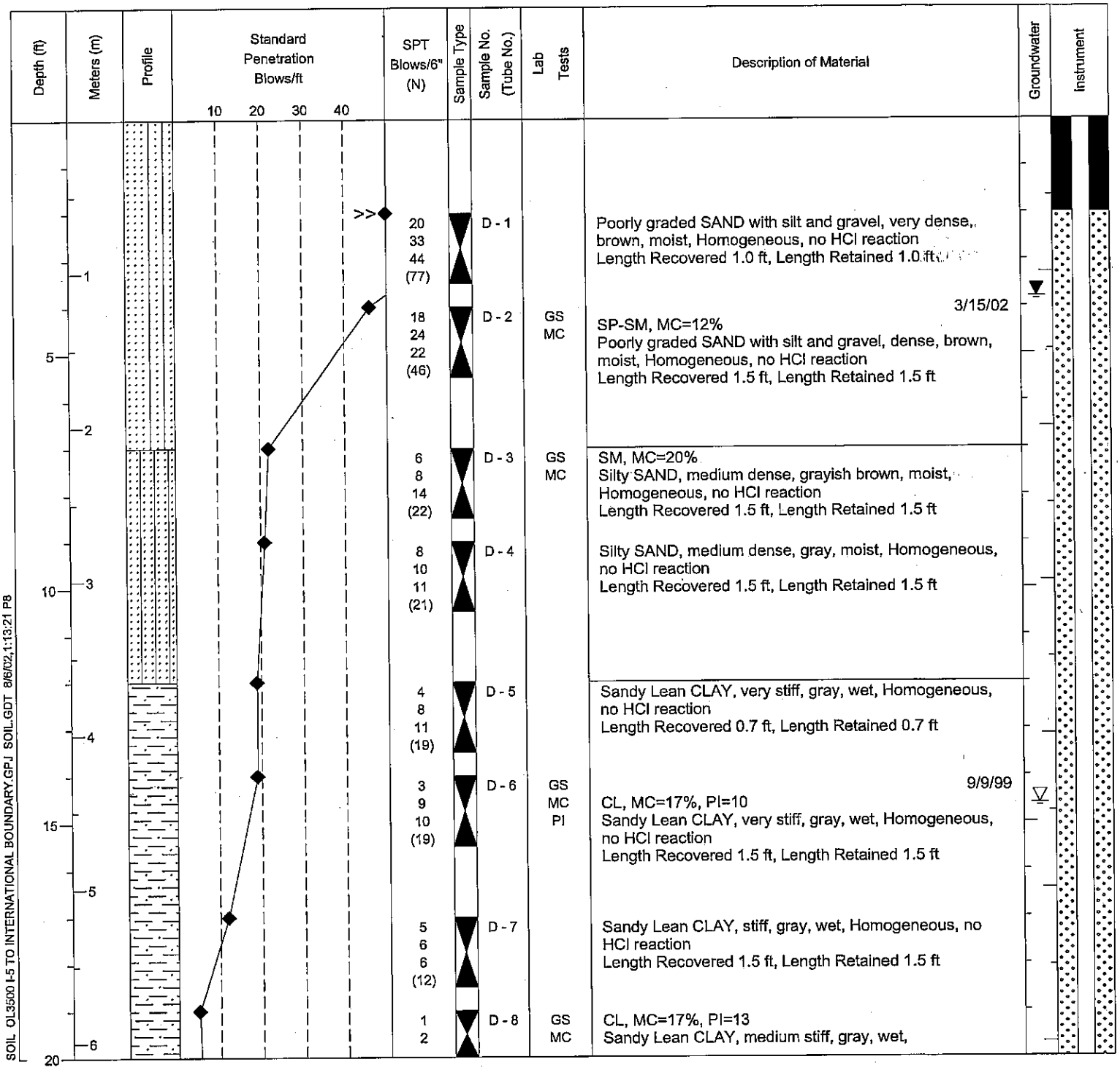
Inspector Brian M Breck

Station 1+625 (LR LINE) Offset 13.0 m Rt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323786.465 Easting 460857.048 Casing HW x 82

Ground Elevation 109.2 (33.3 m) Start Date September 7, 1999 Completion Date September 9, 1999



SOIL 0L3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 8/6/02,1:13:21 P8

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-12-99

PROJECT I-5 to International Boundary Sheet 2 of 4

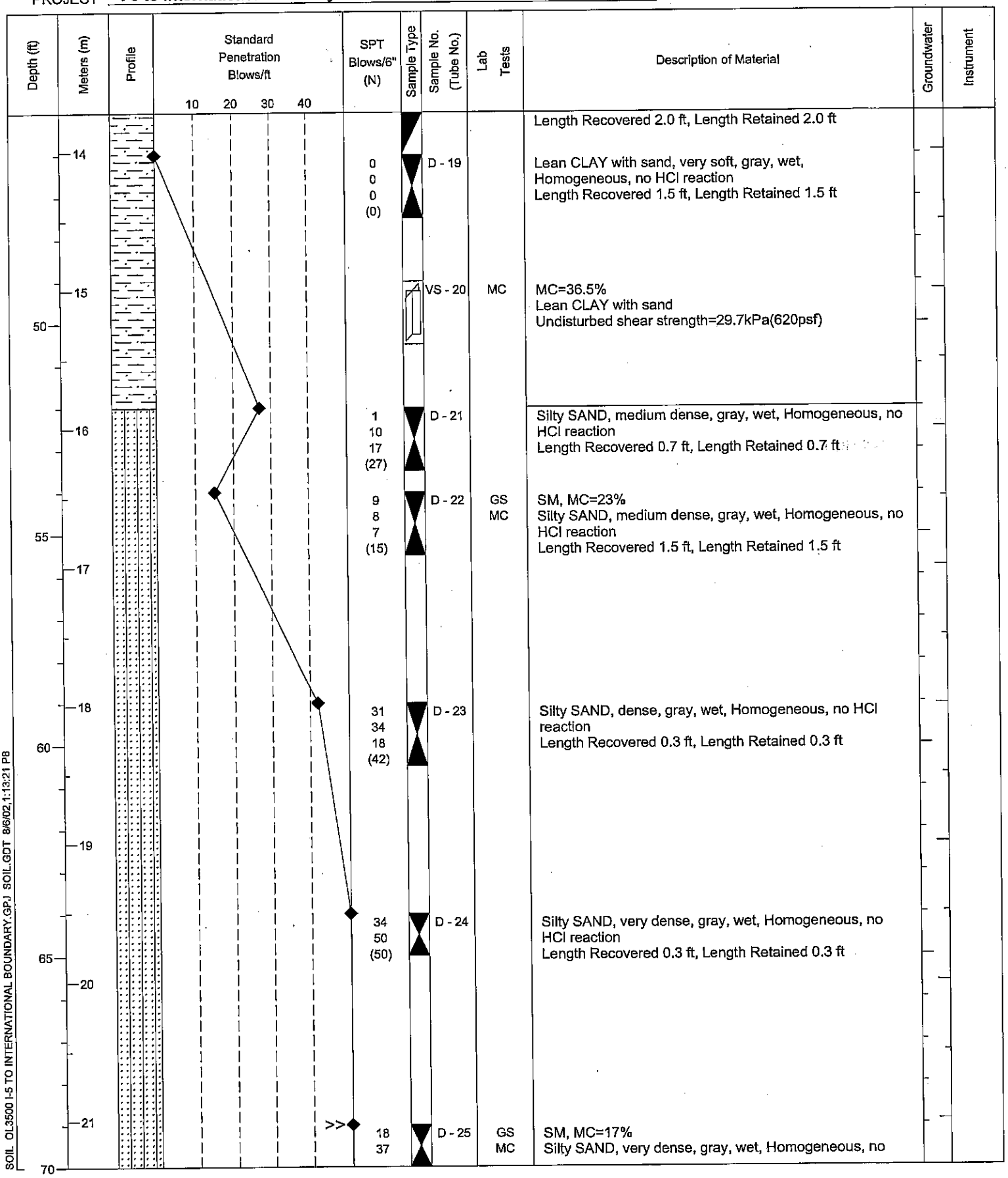
Depth (ft)	Meters (m)	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
			3 (5)			PI	Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	7		1 2 4 (6)		D - 9		Sandy Lean CLAY, medium stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
25					S - 10		Sandy Lean CLAY, gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
	8		2 2 3 (5)		D - 11		Sandy lean CLAY, medium stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
30	9				VS - 12	GS MC PI	CL, MC=23%, PI=13 Sandy lean CLAY. Undisturbed shear strength=50.3kPa(1050psf)		
	10		0 0 0 (0)		D - 13	GS MC PI	CL, MC=27%, PI=14 Sandy lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
35					S - 14		Sandy Fat CLAY, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	11		0 1 1 (2)		D - 15		Sandy lean CLAY, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
40	12		0 0 0 (0)		D - 16		Lean CLAY with sand, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	13		0 0 0 (0)		D - 17	GS MC PI	CL, MC=27%, PI=12 Lean CLAY with sand, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
45					S - 18		Sandy Fat CLAY, gray, wet, Homogeneous, no HCl reaction		

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-12-99

PROJECT I-5 to International Boundary Sheet 3 of 4



Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-12-99

PROJECT I-5 to International Boundary Sheet 4 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				50 (87)				HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	22									
			>>	17 38 37 (75)		D - 26		Silty SAND, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
75	23									
	24			33 50 (50)		D - 27		Well graded GRAVEL, subangular, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.4 ft, Length Retained 0.4 ft		
80								End of test hole boring at 80 ft below ground elevation.		
	25							This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
85	26							NOTE: A second piezometer was installed in the borehole. This piezometer was installed to a depth of 79.0 feet. A bentonite seal was placed in the hole from 30ft to 60ft to isolate the two piezometer from each other.		
	27									
90										
	28									
95										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-1-01

PROJECT I-5 to International Boundary Sheet 1 of 2

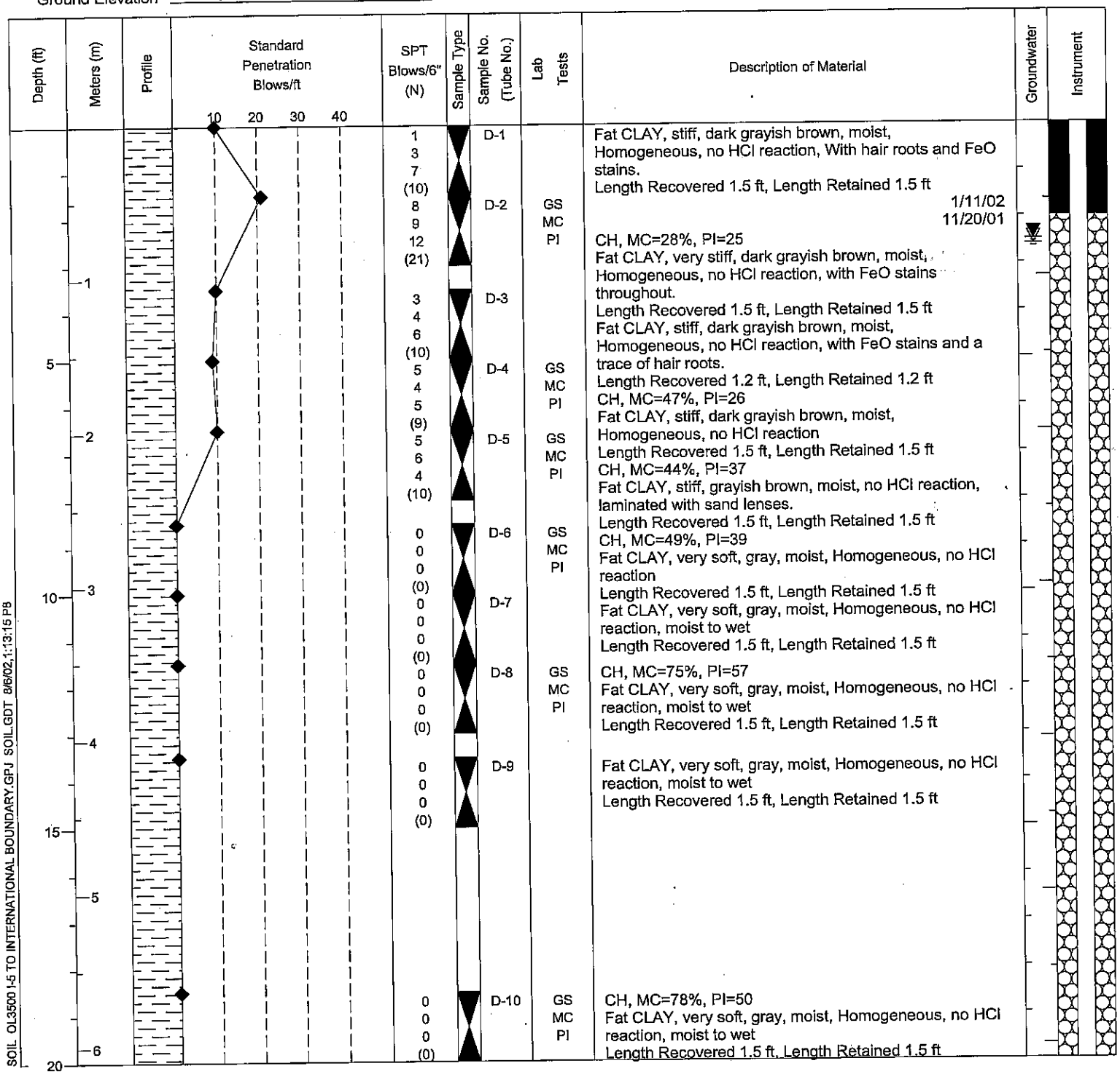
Inspector Brian Hilts

Station 0+924 (L LINE) Offset 19.1 m Lt. Equipment CME 55 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323096.5 Easting 460797.6 Casing HQx32

Ground Elevation 69.8 (21.3 m) Start Date November 6, 2001 Completion Date November 6, 2001



Fat CLAY, stiff, dark grayish brown, moist, Homogeneous, no HCl reaction, With hair roots and FeO stains.
Length Recovered 1.5 ft, Length Retained 1.5 ft

CH, MC=28%, PI=25
Fat CLAY, very stiff, dark grayish brown, moist, Homogeneous, no HCl reaction, with FeO stains throughout.
Length Recovered 1.5 ft, Length Retained 1.5 ft
Fat CLAY, stiff, dark grayish brown, moist, Homogeneous, no HCl reaction, with FeO stains and a trace of hair roots.
Length Recovered 1.2 ft, Length Retained 1.2 ft
CH, MC=47%, PI=26
Fat CLAY, stiff, dark grayish brown, moist, Homogeneous, no HCl reaction
Length Recovered 1.5 ft, Length Retained 1.5 ft
CH, MC=44%, PI=37
Fat CLAY, stiff, grayish brown, moist, no HCl reaction, laminated with sand lenses.
Length Recovered 1.5 ft, Length Retained 1.5 ft
CH, MC=49%, PI=39
Fat CLAY, very soft, gray, moist, Homogeneous, no HCl reaction
Length Recovered 1.5 ft, Length Retained 1.5 ft
Fat CLAY, very soft, gray, moist, Homogeneous, no HCl reaction, moist to wet
Length Recovered 1.5 ft, Length Retained 1.5 ft
CH, MC=75%, PI=57
Fat CLAY, very soft, gray, moist, Homogeneous, no HCl reaction, moist to wet
Length Recovered 1.5 ft, Length Retained 1.5 ft
Fat CLAY, very soft, gray, moist, Homogeneous, no HCl reaction, moist to wet
Length Recovered 1.5 ft, Length Retained 1.5 ft
CH, MC=78%, PI=50
Fat CLAY, very soft, gray, moist, Homogeneous, no HCl reaction, moist to wet
Length Recovered 1.5 ft, Length Retained 1.5 ft

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-1-01

PROJECT I-5 to International Boundary Sheet 2 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
25	7			0 0 0 (0)		D-11	GS MC PI	CH, MC=72%, PI=59 Fat CLAY, very soft, gray, moist, Homogeneous, no HCl reaction, possibly lean clay Length Recovered 1.5 ft, Length Retained 1.5 ft		
	8									
30	9			0 0 0 (0)		D-12		Fat CLAY, very soft, gray , moist, Homogeneous, no HCl reaction, moist to wet Length Recovered 1.5 ft, Length Retained 1.5 ft		
35	10							End of test hole boring at 30 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
40	11									
45	12									
	13									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-2-01

PROJECT I-5 to International Boundary Sheet 1 of 2

Inspector Mike Mulhern

Station 0+941 (L LINE) Offset 18.9 m Rt. Equipment BK-81 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323103.4 Easting 460835.8 Casing HQ

Ground Elevation 71.0 (21.6 m) Start Date November 6, 2001 Completion Date November 6, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 2 2 (4)		D-1		Elastic SILT, loose, olive brown, moist, Homogeneous, no HCl reaction, organics throughout Length Recovered 0.5 ft, Length Retained 0.5 ft		
	1			2 3 5 (8)		D-2	GS MC PI	MH, MC=37%, PI=24 Elastic SILT, loose, olive brown, moist, Homogeneous, no HCl reaction, very moist Length Recovered 1.5 ft, Length Retained 1.0 ft	11/20/01 1/11/02	
5	2			2 2 5 (7)		D-3	GS MC PI	CL, MC=47%, PI=25 Lean CLAY, medium stiff, olive brown, moist, Homogeneous, no HCl reaction, some organics, trace sand Length Recovered 1.5 ft, Length Retained 1.0 ft		
				1 1 1 (2)		D-4	GS MC PI	CH, MC=61%, PI=50 Fat CLAY, soft, grayish brown, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
10	3					U-1 A B C D E F		Lean CLAY, grayish brown, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
	4			0 0 1 (1)		D-5	GS MC PI	CH, MC=74%, PI=44 Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
15	5			0 0 1 (1)		D-6	GS MC PI	CH, MC=77%, PI=42 Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
20	6			0 0		D-7		Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction		

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-2-01

PROJECT I-5 to International Boundary Sheet 2 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 (1)				Length Recovered 1.5 ft, Length Retained 1.0 ft		
	7									
25				0 0 1 (1)		D-8		Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
	8									
30	9			0 0 1 (1)		D-9	GS MC PI	CL, MC=73%, PI=15 Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
	10							End of test hole boring at 30.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
35	11									
40	12									
45	13									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-01

PROJECT I-5 to International Boundary Sheet 1 of 6

Inspector Hanning

Station 1+317 (L LINE) Offset 17.5 m Lt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323480.8 Easting 460808.1 Casing HQ

Ground Elevation 73.8 (22.5 m) Start Date December 11, 2001 Completion Date December 12, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 1 1 2 (2)		D-1	GS MC PI	CH, MC=48%, PI=36 Fat CLAY, soft, gray brown, moist, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
				2 3 2 3 (5)		D-2		Fat CLAY, medium stiff, gray brown, moist, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
5	1					U-3 A B C		Fat CLAY, gray brown, moist, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	2			0 0 0 1 (0)		D-4	GS MC PI	CH, MC=62%, PI=39 Fat CLAY, very soft, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft	▽ 12/12/01	
10	3			0 0 0 0 (0)		D-5		Fat CLAY, very soft, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
						U-6 A B C D E F		Fat CLAY, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
	4			0 0 0 0 (0)		D-7	GS MC PI	CH, MC=62%, PI=40 Fat CLAY, very soft, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
15	5									
20	6			0 0		D-8	GS MC	ML, MC=32%, PI=22 SILT with sand, very loose, dark gray, moist,		

SOIL OL3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 8/6/02,1:13:25 P8

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-01

PROJECT I-5 to International Boundary Sheet 2 of 6

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				0 0 (0)			PI	Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	7									
25				0 0 0 0 (0)		D-9		SILT with sand, very loose, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	8									
30	9			0 0 0 0 (0)		D-10		SILT with sand, very loose, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
						S-11		SILT with sand, very loose, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
	10									
35						S-12		No Recovery		
	11					S-13		SILT with sand, very loose, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft		
40	12			0 0 0 0 (0)		D-14	GS MC PI	CH, MC=35%, PI=38 Fat CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	13									
45				0 0		D-15		Fat CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction		

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-01

PROJECT I-5 to International Boundary Sheet 3 of 6

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				0 0 (0)				Length Recovered 1.3 ft, Length Retained 1.3 ft		
	14									
	15			0 0 0 0 (0)		D-16		Fat CLAY, very soft, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
50										
	16									
				1 2 1 1 (3)		D-17		Fat CLAY, very soft, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
55										
	17									
	18			0 0 0 0 (0)		D-18	GS MC PI	CL, MC=37%, PI=24 Lean CLAY, very soft, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
60										
	19									
				0 0 0 0 (0)		D-19		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
65										
	20									
	21			0 0		D-20		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction		
70										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-01

PROJECT I-5 to International Boundary Sheet 4 of 6

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				0 0 (0)				Length Recovered 1.5 ft, Length Retained 1.5 ft		
	22									
75	23			0 0 0 1 (0)		D-21		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
80	24			0 0 0 1 (0)		D-22	GS MC PI	CL, MC=31%, PI=16 Lean CLAY with sand, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	25									
85	26			0 0 0 0 (0)		D-23		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	27									
90	28			0 0 0 0 (0)		D-24		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
95				0 0		D-25		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction		

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-01

PROJECT I-5 to International Boundary Sheet 5 of 6

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29			2 3 (2)				Length Recovered 1.0 ft, Length Retained 1.0 ft		
	30			0 0 1 2 (1)		D-26	GS MC PI	CL, MC=31%, PI=28 Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
100	31			0 0 2 3 (2)		D-27		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
105	32			0 0 1 3 (1)		D-28		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
110	33			0 0 1 2 (1)		D-29		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
115	34			0 0		D-30	GS MC	CL, MC=30%, PI=10 Lean CLAY, very soft, dark gray, wet, Homogeneous, no		
	35									
	36									
120										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-3-01

PROJECT I-5 to International Boundary Sheet 6 of 6

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 3 (1)			PI	HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	37									
				0 0 1 3 (1)		D-31		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
125	38									
	39									
				0 1 3 3 (4)		D-32		Lean CLAY, soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
130										
	40							End of test hole boring at 131 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	41									
135										
	42									
140										
	43									
	44									
145										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-4-01

PROJECT I-5 to International Boundary Sheet 1 of 2

Inspector Brian Hilts

Station 1+317 (L LINE) Offset 19.6 m Rt. Equipment CME 55 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323479.5 Easting 460845.2 Casing HQx32

Ground Elevation 75.6 (23.0 m) Start Date November 7, 2001 Completion Date November 7, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 2 1 (3)		D-1	GS MC	SP, MC=9% Poorly graded SAND with gravel, very loose, grayish brown, moist, Stratified, no HCl reaction, with hair roots and the bottom .4' was sandy silt and dark brown.		
				2 3 4 (7)		D-2	GS MC PI	Length Recovered 0.8 ft, Length Retained 0.8 ft	1/11/02 11/20/01	
	1			2 3 4 (7)		D-3	GS MC PI	CL, MC=27%, PI=19 Sandy lean CLAY, medium stiff, very dark grayish brown, moist, Homogeneous, no HCl reaction, with a trace of dark brown organics and hair roots Length Recovered 0.7 ft, Length Retained 0.7 ft		
5				3 3 5 (8)		D-4		CH, MC=45%, PI=29 Fat CLAY, medium stiff, grayish brown, moist, Stratified, no HCl reaction, moist to dry, mottled orange and black with hair roots. Length Recovered 1.5 ft, Length Retained 1.5 ft		
	2			0 1 1 (2)		D-5	GS MC PI	Fat CLAY, medium stiff, grayish brown, moist, Homogeneous, no HCl reaction, moist to dry with FeO stains and hair roots. Length Recovered 1.3 ft, Length Retained 1.3 ft		
				1 2 1 (3)		D-6	GS MC PI	CL, MC=54%, PI=9 Lean CLAY, soft, gray, moist, Homogeneous, no HCl reaction, with FeO stains Length Recovered 1.5 ft, Length Retained 1.5 ft		
10	3			0 0 0 (0)		D-7	GS MC PI	CH, MC=64%, PI=37 Fat CLAY, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft CH, MC=64%, PI=42 Fat CLAY, very soft, gray, moist, Homogeneous, no HCl reaction, moist to wet		
	4			0 0 0 (0)		D-8		Length Recovered 1.5 ft, Length Retained 1.5 ft Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
15				0 0 0 (0)		D-9		Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	5			3 1 1 (2)		D-10	GS MC PI	ML, MC=28%, PI=21 Sandy SILT, very loose, gray, wet, Stratified,Laminated, no HCl reaction, with sand lenses Length Recovered 1.1 ft, Length Retained 1.1 ft		
20	6									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-4-01

PROJECT I-5 to International Boundary Sheet 2 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
25	7			0 0 0 (0)		D-11	GS MC PI	CL, MC=31%, PI=12 Lean CLAY, very soft, gray, wet, Laminated, no HCl reaction, with sand lenses Length Recovered 1.0 ft, Length Retained 1.0 ft		
	8			0 0 0 0 (0)		D-12		Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 1.5 ft		
30	9							NOTE: At approx.14' we lost all water return and got a little back every so often. The soil is very soupy and difficult to install a piezometer. End of test hole boring at 29.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
35	10									
40	11									
	12									
45	13									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-5-01

PROJECT I-5 to International Boundary Sheet 1 of 5

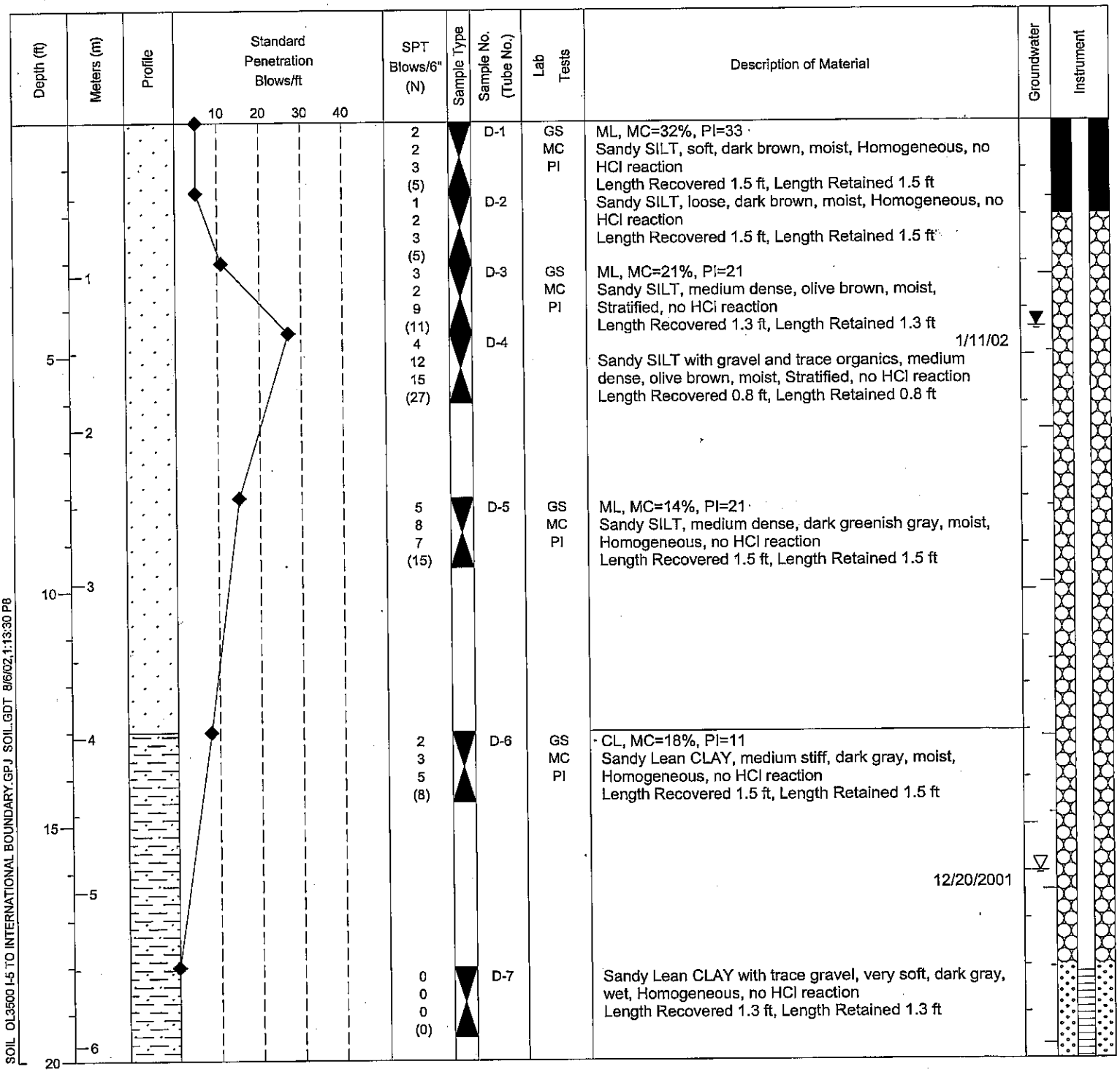
Inspector Hanning

Station 1+500 (LR LINE) Offset 9.6 m Rt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323662.5 Easting 460845.8 Casing HQ

Ground Elevation 87.9 (26.8 m) Start Date December 20, 2001 Completion Date December 20, 2001



SOIL 0L3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 8/6/02,1:13:30 PB

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-5-01

PROJECT I-5 to International Boundary Sheet 2 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	7			0 0 0 (0)		D-8		Sandy Lean CLAY with trace gravel, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
25										
	8									
	9									
30										
	10			0 0 0 (0)		D-9	GS MC PI	CL, MC=24%, PI=17 Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
35										
	11									
	12									
40										
	13			0 0 2 (2)		D-10		Lean CLAY with gravel, soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 0.6 ft, Length Retained 0.6 ft		
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-5-01

PROJECT I-5 to International Boundary Sheet 3 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14									
	15									
50										
						S-11		No Recovery		
	16									
				0 1 2 (3)		D-12	GS MC PI	CL, MC=20%, PI=10 Sandy Lean CLAY, soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
55										
	17									
				3 3 2 (5)		D-13		Sandy Lean CLAY with gravel, medium stiff, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft		
	18									
60										
	19									
				0 0 2 (2)		D-14		Sandy Lean CLAY with gravel, soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
65										
	20									
			>>	31 48 50/4" (98)		D-15	GS MC	GW-GM, MC=7% Well graded GRAVEL with silt and sand, subangular, very dense, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 0.6 ft, Length Retained 0.6 ft		
	21									
70										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-5-01

PROJECT I-5 to International Boundary Sheet 4 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	22									
			>>	17 28 32 (60)		D-16	GS MC	SP-SM, MC=21% Poorly graded SAND with silt, very dense, dark gray, moist, Stratified, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
75	23									
			>>	24 32 36 (68)		D-17	GS MC	SM, MC=21% Silty SAND, very dense, dark gray, wet, Stratified, no HCl reaction Length Recovered 0.9 ft, Length Retained 0.9 ft		
80	24									
	25									
			>>	18 28 41 (69)		D-18		Silty SAND, very dense, dark gray, wet, Stratified, no HCl reaction Length Recovered 0.9 ft, Length Retained 0.9 ft		
85	26									
			>>	17 21 30 (51)		D-19		Silty SAND, dense, dark gray, wet, Stratified, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
	27									
90										
	28									
				14 22 28 (50)		D-20	GS MC PI	ML, MC=17%, PI=27 SILT, dense, dark gray, moist, Laminated, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
95										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-5-01

PROJECT I-5 to International Boundary Sheet 5 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29									
	30		>>	17 26 40 (66)		D-21	GS MC PI	CL, MC=21%, PI=14 Lean CLAY, hard, dark gray, moist, Homogeneous, no HCl reaction Length Recovered 0.9 ft, Length Retained 0.9 ft		
100								End of test hole boring at 99.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	31									
105	32									
	33									
110										
	34									
115	35									
	36									
120										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-6-01

PROJECT I-5 to International Boundary Sheet 1 of 5

Inspector Mike Mulhern

Station 1+728 (LL LINE) Offset 2.0 m Lt. Equipment BK-81 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323891 Easting 460818 Casing HQ

Ground Elevation 111.9 (34.1 m) Start Date November 7, 2001 Completion Date November 14, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				3 5 9 (14)		D-1	GS MC PI	CL, MC=19%, PI=9 Sandy lean CLAY, stiff, olive gray, moist, Homogeneous, no HCl reaction, few organics throughout Length Recovered 1.5 ft, Length Retained 1.0 ft		
				4 8 12 (20)		D-2	GS MC PI	CL, MC=27%, PI=11 Sandy lean CLAY, very stiff, grayish brown, moist, Homogeneous, no HCl reaction, moist to wet Length Recovered 1.3 ft, Length Retained 1.0 ft		
				2 3 4 (7)		D-3	GS MC PI	ML, MC=15%, PI=2 Sandy SILT, medium stiff, gray, wet, Homogeneous, no HCl reaction, trace gravel Length Recovered 1.5 ft, Length Retained 1.0 ft 11/20/01	▽	
				1 1 2 (3)		D-4	GS MC PI	CL, MC=32%, PI=15 Lean CLAY with sand, soft, gray, wet, Homogeneous, no HCl reaction, trace gravel Length Recovered 1.5 ft, Length Retained 1.0 ft		

Depth (ft): 5, 10, 15, 20
Meters (m): 1, 2, 3, 4, 5, 6

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-6-01

PROJECT I-5 to International Boundary Sheet 2 of 5

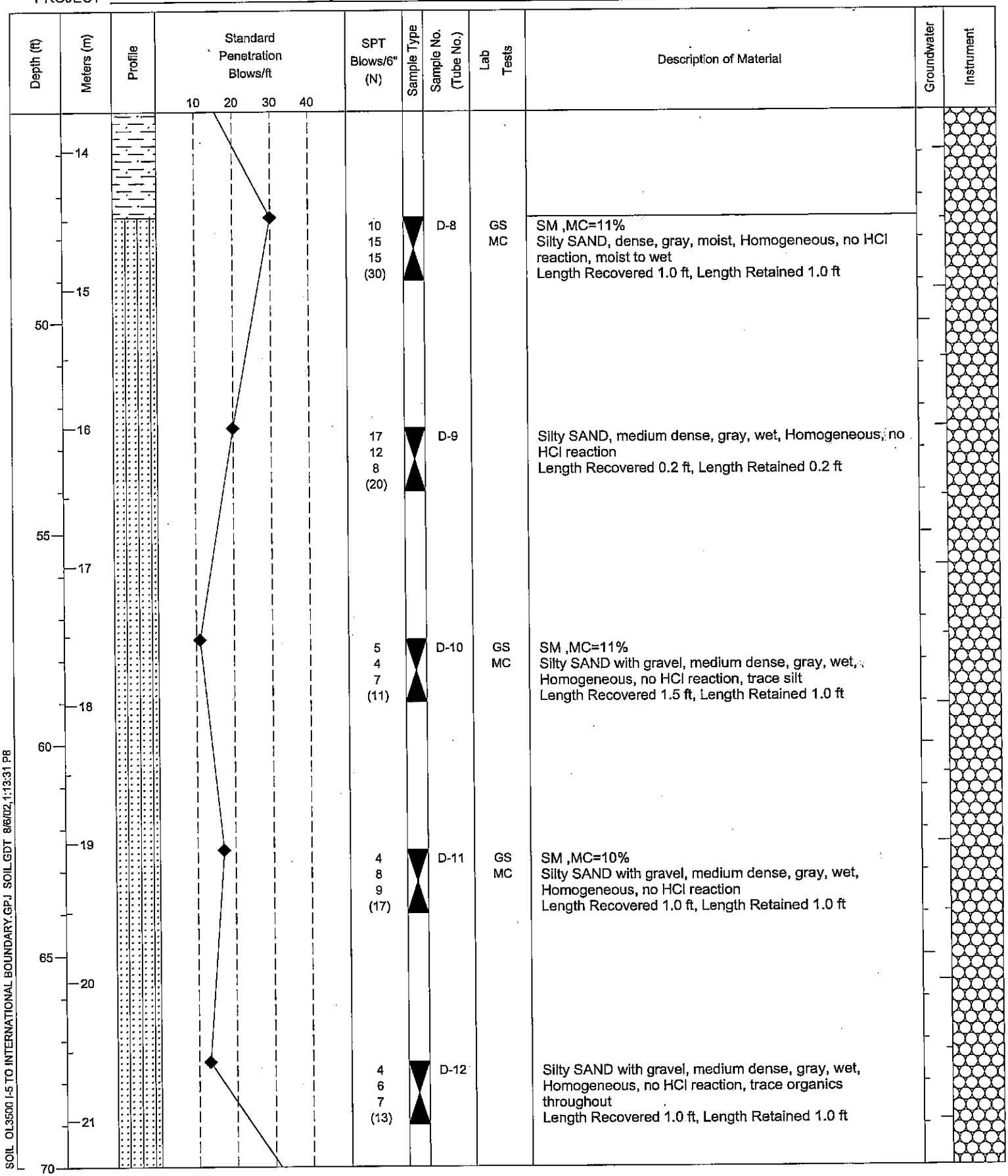
Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								1/11/02	▼	
25	7, 8					U-1 A B C D E F		Fat CLAY with sand, gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
30	9			0 0 1 (1)		D-5		Lean CLAY with sand, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
35	10, 11			0 0 1 (1)		D-6	GS MC PI	CL-ML, MC=22%, PI=4 Sandy silty CLAY, very soft, gray, wet, Homogeneous, no HCl reaction, trace gravel Length Recovered 1.5 ft, Length Retained 1.0 ft		
40	12					U-2 A B C D E F		Sandy silty CLAY, gray, wet, Homogeneous, no HCl reaction Length Recovered 2.0 ft, Length Retained 2.0 ft		
45	13			0 0 1 (1)		D-7	GS MC PI	CL, MC=39%, PI=15 Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-6-01

PROJECT I-5 to International Boundary Sheet 3 of 5



Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-6-01

PROJECT I-5 to International Boundary Sheet 4 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	22			15 35 50/3" (50)		D-13	GS MC	SM ,MC=10% Silty SAND, dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
75	23									
			>>	16 25 30 (55)		D-14		Silty SAND, dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.0 ft		
	24									
80										
	25									
			>>	17 25 35 (60)		D-15	GS MC	ML, MC=23% Sandy SILT, very dense, olive, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.0 ft		
85	26									
			>>	19 25 34 (59)		D-16	GS MC	SM ,MC=24% Silty SAND, dense, olive gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
	27									
90										
	28									
				29 50/6" (50/6")		D-17	GS MC	SP-SM, MC=16% Poorly graded SAND with silt, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
95										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-6-01

PROJECT I-5 to International Boundary Sheet 5 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29									
	30			22 50/4" (50/4")		D-18		Poorly graded SAND with silt, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
100								End of test hole boring at 99 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	31									
105	32									
	33									
110	34									
115	35									
	36									
120										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-7-01

PROJECT I-5 to International Boundary Sheet 1 of 4

Inspector Brian Hilts

Station 1+965 (T LINE) Offset 15.5 m Rt. Equipment CME 55 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 324105 Easting 460872.8 Casing HQx87

Ground Elevation 96.4 (29.4 m) Start Date November 8, 2001 Completion Date November 14, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1			4 5 7 (12)		D-1	GS MC PI	CL, MC=23%, PI=19 Lean CLAY with sand, stiff, olive brown, moist, Laminated, no HCl reaction, with FeO stains, trace of gravel, with sand lenses. Length Recovered 1.3 ft, Length Retained 1.3 ft		
	2							NOTE: At approximately 8' to 9' we encountered very hard drilling.		
10	3			2 2 3 (5)		D-2		Lean CLAY with sand, medium stiff, olive brown, moist, Laminated, no HCl reaction, with FeO stains and traces of hair roots and sand lenses. Length Recovered 1.5 ft, Length Retained 1.5 ft		
	4					U-3		No Recovery		
15	5			1 2 3 (5)		D-4	GS MC PI	CL, MC=30%, PI=20 Lean CLAY with sand, medium stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.1 ft, Length Retained 1.1 ft		
20	6					U-5 A	GS MC	CL, MC=25%, PI=10 Sandy lean CLAY, gray, wet, Homogeneous, no HCl		

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-7-01

PROJECT I-5 to International Boundary Sheet 2 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
						B C	PI UU	reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
				0 0 0 (0)		D-6	GS MC PI	CH, MC=25%, PI=36% Sandy fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction, with trace of gravel. Length Recovered 0.8 ft, Length Retained 0.8 ft		
	7									
				0 0 0 (0)		D-7		No Recovery		
25										
	8									
				0 0 0 (0)		D-8	GS MC PI	CH, MC=41%, PI=36% Fat CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	9									
30										
	10									
						U-9 A B C D E	GS MC PI UU	CL, MC=39%, PI=24 Lean CLAY, gray, wet, Homogeneous, no HCl reaction, with occasional gravel Length Recovered 1.7 ft, Length Retained 1.7 ft		
35										
	11			0 1 1 (2)		D-10	GS MC PI	CH, MC=55%, PI=37% Fat CLAY with sand, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.1 ft, Length Retained 1.1 ft		
	12			0 0 0 (0)		D-11		Lean CLAY, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
40										
	13									
				1 2		D-12	GS MC	ML, MC=19%, PI=18 Sandy SILT, medium stiff, gray, wet, Stratified,		
45										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-7-01

PROJECT I-5 to International Boundary Sheet 3 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				3 (5)			PI	Laminated, no HCl reaction, with sand lenses. Length Recovered 1.5 ft, Length Retained 1.5 ft		
	14									
								NOTE: At approximately 48.5' denser soil was encountered.		
	15			4 5 24 (29)		D-13	GS MC	SM, MC=11% Silty SAND, medium dense, gray, wet, Stratified, no HCl reaction, with some gravel Length Recovered 1.3 ft, Length Retained 1.3 ft		
50										
	16									
			>>	25 47 39 (86)		D-14	GS MC	SM, MC=10% Silty SAND, very dense, gray, wet, Stratified, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
55										
	17									
	18		>>	27 37 50/5" (87)		D-15	GS MC	SM, MC=9% Silty SAND, very dense, gray, moist, Homogeneous, no HCl reaction Length Recovered 1.4 ft, Length Retained 1.4 ft		
60										
	19									
				32 50/2" (50/2")		D-16		Silty SAND with gravel, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft NOTE: Encountered a 4 to 6" cobble at approx. 65'. On 11/14/01 at 7:30 a.m. the water table inside the casing was at 17'.		
65										
	20									
	21			36 50/3"		D-17		Silty SAND with gravel, very dense, gray, moist, Homogeneous, no HCl reaction		
70										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-7-01

PROJECT I-5 to International Boundary Sheet 4 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				(50/3")				Length Recovered 0.8 ft, Length Retained 0.8 ft		
	22									
75	23		>>	22 33 31 (64)		D-18	GS MC	SM, MC=20% Silty SAND, very dense, gray, wet, Stratified, no HCl reaction, with silty sand lenses and occasional gravel. Length Recovered 1.5 ft, Length Retained 1.5 ft		
80	24		>>	24 60/6" (60/6")		D-19	GS MC	SM, MC=17% Silty SAND with gravel, very dense, gray, wet, Stratified, no HCl reaction Length Recovered 0.9 ft, Length Retained 0.9 ft		
	25									
85	26		>>	64/6" (64/6")		D-20	GS MC	SP-SM, MC=9% Poorly graded SAND with silt and gravel, very dense, gray, wet, Homogeneous, no HCl reaction Length Recovered 0.5 ft, Length Retained 0.5 ft		
	27							End of test hole boring at 84.5 ft below ground elevation.		
90	28							This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
95										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-8-01

PROJECT I-5 to International Boundary Sheet 1 of 4

Inspector Mike Mulhern

Station 1+972 (LL LINE) Offset 14.3 m Lt. Equipment BK-81 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 324134.4 Easting 460798.6 Casing HQ

Ground Elevation 93.8 (28.6 m) Start Date November 15, 2001 Completion Date November 26, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
5	1, 2			4 11 8 (19)		D-1	GS MC	SP-SM, MC=22% Poorly graded SAND with silt, medium dense, dark olive brown, moist, Homogeneous, no HCl reaction Length Recovered 0.3 ft, Length Retained 0.3 ft		
10	3, 4			4 3 4 (7)		D-2	GS MC	SM, MC=28% Silty SAND, loose, olive brown, moist, Stratified, no HCl reaction, with trace gravel, very moist, from 9'6" to 10' Length Recovered 1.0 ft, Length Retained 1.0 ft		
15	5			2 2 3 (5)		U-1 A B C D-3	GS MC	Poorly graded SAND with gravel, loose, olive brown, moist, Homogeneous, no HCl reaction, with trace silt Length Recovered 1.0 ft, Length Retained 1.0 ft; SM, MC=21% Silty SAND, loose, olive brown, moist, Homogeneous, no HCl reaction,with trace silt Length Recovered 1.0 ft, Length Retained 1.0 ft		
20	6			2		D-4	GS	CL, MC=21%, PI=11		

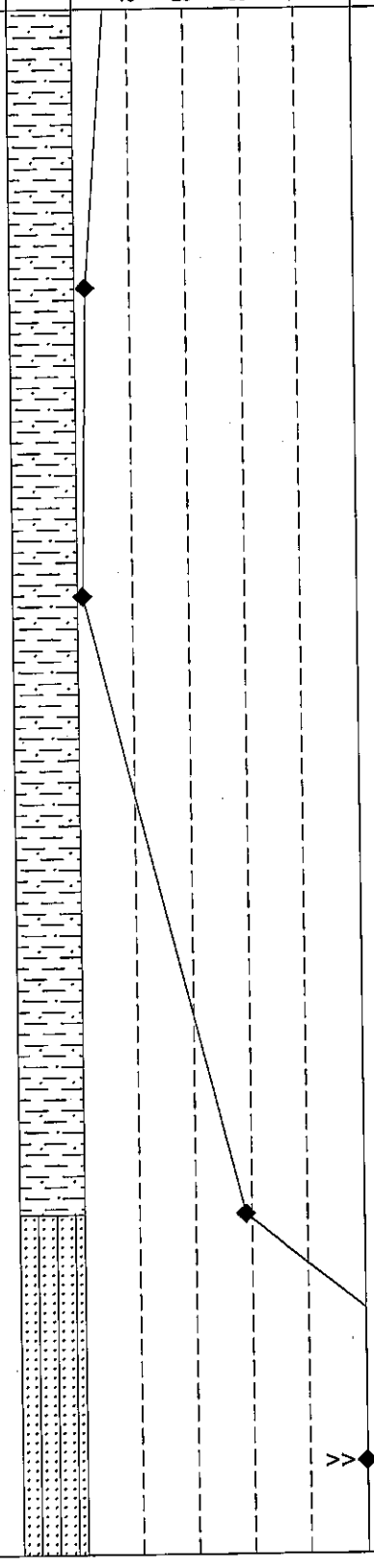
SOIL 0L3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 8/6/02,1:13:33 P8

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-8-01

PROJECT I-5 to International Boundary Sheet 2 of 4



Depth (ft)	Meters (m)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
		3 3 (6)			MC PI	Sandy lean CLAY, medium stiff, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
	7							
25		1 1 1 (2)		D-5	GS MC PI	CL, MC=40%, PI=14 Lean CLAY with sand, soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.0 ft		
	8							
	9	0 0 1 (1)		D-6		Lean CLAY with sand, very soft, gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
30								
	10							
35				U-2 A B C D		Lean CLAY with sand, gray , wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
	11							
	12	9 6 23 (29)		D-7	GS MC	SM, MC=10% Silty SAND with gravel, medium dense, gray, moist, Homogeneous, no HCl reaction, with trace gravel Length Recovered 1.0 ft, Length Retained 1.0 ft		
40								
	13							
		>>24 35 49 (84)		D-8	GS MC	SM, MC=17% Silty SAND, dense, olive gray, moist, Homogeneous, no HCl reaction, with trace silt Length Recovered 1.5 ft, Length Retained 1.0 ft		
45								

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-8-01

PROJECT I-5 to International Boundary Sheet 3 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14									
50	15		>>	27 34 38 (72)		D-9	GS MC	SP-SM, MC=18% Poorly graded SAND with silt, very dense, olive gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
55	16		>>	21 28 32 (60)		D-10		Poorly graded SAND with silt, very dense, olive gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
60	17			45 50/6" (50/6")		D-11	GS MC	SP, MC=9% Poorly graded SAND with gravel, very dense, olive gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
65	18		>>	17 23 28 (51)		D-12	GS MC	SP, MC=20% Poorly graded SAND, dense, olive gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft		
70	19			39 50/6" (50/6")		D-13	GS MC	GP, MC=9% Poorly graded GRAVEL with sand, very dense, olive gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	20									
	21									

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-8-01

PROJECT I-5 to International Boundary Sheet 4 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	22									
			>>	44 44 43 (87)		D-14	GS MC	SM, MC=11% Silty SAND with gravel, very dense, olive gray, wet, Stratified, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.0 ft NOTE: Gravel with sand encountered 74'6" to 75'		
75	23							End of test hole boring at 75 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	24									
80										
	25									
85	26									
	27									
90										
	28									
95										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-9-01

PROJECT I-5 to International Boundary Sheet 1 of 4

Inspector Hanning

Station 2+017 (T LINE) Offset 12.7 m Rt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 324129.1 Easting 460919.6 Casing HQ

Ground Elevation 93.8 (28.6 m) Start Date December 19, 2001 Completion Date December 19, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 2 3 (5)		D-1	GS MC	SM, MC=50% Silty SAND, loose, dark brown, moist, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
				6 10 7 (17)		D-2	GS MC	SM, MC=23% Silty SAND with gravel, medium dense, olive brown, moist, Homogeneous, no HCl reaction, Note top .5 ft organic soil. Length Recovered 1.2 ft, Length Retained 1.2 ft		
	1			4 6 9 (15)		D-3	GS MC PI	CL, MC=23%, PI=13 Lean CLAY with sand, stiff, olive brown, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
5				9 9 9 (18)		D-4	GS MC PI	CL, MC=19%, PI=19 Lean CLAY with sand, very stiff, olive brown, moist, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft	1/11/02	
	2			1 2 3 (5)		D-5	GS MC PI	CL, MC=21%, PI=10 Sandy lean CLAY, medium stiff, olive gray, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
10	3									
	4			0 0 0 (0)		D-6		Sandy Lean CLAY, very soft, dark greenish gray, wet, Homogeneous, no HCl reaction	12/19/2001	
15	5									
	6			0 0		D-7	GS MC	CL, MC=24%, PI=10 Sandy Lean CLAY, very soft, dark gray, wet,		
20										

SOIL OL3500 I-5 TO INTERNATIONAL BOUNDARY.GPJ SOIL.GDT 8/6/02, 1:13:35 PB

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-9-01

PROJECT I-5 to International Boundary Sheet 2 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				0 (0)			PI	Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
	7									
				0 0 0 (0)		D-8	GS MC PI	CL, MC=31%, PI=19 Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
25										
	8									
						S-9		No Recovery		
30	9									
				0 0 0 (0)		D-10	GS MC PI	CL, MC=24%, PI=9 Sandy Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	10					S-11		No Recovery		
				0 0 0 (0)		D-12		Sandy Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.3 ft, Length Retained 1.3 ft		
35	11									
	12			0 0 0 (0)		D-13	GS MC PI	CL-ML, MC=29%, PI=6 Sandy silty CLAY, very soft, dark gray, wet, Stratified, no HCl reaction, Note top .3' sandy silt. Length Recovered 1.5 ft, Length Retained 1.5 ft		
40										
	13									
45				1 0		D-14		Sandy Lean CLAY with gravel, very soft, dark gray, wet, Stratified, no HCl reaction, Note used 2" sampler to		

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-9-01

PROJECT I-5 to International Boundary Sheet 3 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 (1)				recover material. Length Recovered 1.5 ft, Length Retained 1.5 ft		
	14									
	15			1 1 5 (6)		D-15		Sandy Lean CLAY with gravel, medium stiff, dark gray, wet, Stratified, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
50								NOTE: Drilling behavior indicates material change at 51'.		
	16									
			>>	10 34 50 (84)		D-16	GS MC PI	SM, MC=9%, PI=14 Silty SAND with gravel, very dense, dark gray, moist, Stratified, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
55	17									
	18			14 18 22 (40)		D-17		Silty SAND with gravel, dense, dark gray, wet, Stratified, no HCl reaction. NOTE: Drilling indicates increasing gravel. Length Recovered 1.5 ft, Length Retained 1.5 ft		
60	19									
				42 50/4" (50/4")		D-18	GS MC PI	SP-SM, MC=11% Poorly graded SAND with silt and gravel, very dense, dark gray, wet, Stratified, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft		
65	20									
	21			44 50/4"		D-19		Poorly graded SAND with silt and gravel, very dense, dark gray, wet, Stratified, no HCl reaction		
70										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-9-01

PROJECT I-5 to International Boundary Sheet 4 of 4

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				(50/4")				Length Recovered 0.8 ft, Length Retained 0.8 ft		
	22									
75	23			42 50/5" (50/5")		D-20		Poorly graded SAND with silt and gravel, very dense, dark gray, wet, Stratified, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft		
	24			40 50/5" (50/5")		D-21	GS MC PI	SM, MC=12% Silty SAND with gravel, very dense, dark gray, wet, Stratified, no HCl reaction Length Recovered 0.9 ft, Length Retained 0.9 ft		
80	25									
85	26		>>	18 40 50 (90)		D-22		Silty SAND with gravel, very dense, dark gray, wet, Stratified, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	27							NOTE: Bailed water to a depth of 40' prior to installing piezometer. End of test hole boring at 85.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
90	28									
95										

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-10-02

PROJECT I-5 to International Boundary Sheet 1 of 2

Inspector Hanning

Station 2+146 (T LINE) Offset 27.6 m Lt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 324263.3 Easting 460906.7 Casing HQ

Ground Elevation 75.2 (22.9 m) Start Date January 2, 2002 Completion Date January 2, 2002

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								NOTE: Asphalt 0.4ft NOTE: Gravel 2.6ft		
	1			4 4 4 (8)		D-1		Clayey GRAVEL, subangular, loose, dark olive, moist, Homogeneous, no HCl reaction Length Recovered 0.2 ft, Length Retained 0.2 ft		
5				4 3 4 (7)		D-2	GS MC PI	CL, MC=21%, PI=14 Lean CLAY with sand, medium stiff, dark olive, moist, Homogeneous, no HCl reaction Length Recovered 0.6 ft, Length Retained 0.6 ft		
	2									
				2 3 3 (6)		D-3	GS MC PI	CH, MC=35%, PI=31 Fat CLAY, mediun stiff, olive, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
10	3			3 3 4 (7)		D-4		Lean CLAY with sand and trace organics, medium stiff, dark olive, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
	4			0 0 0 (0)		D-5	GS MC PI	CH, MC=55%, PI=34 Fat CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
15	5									
				0 0 0 (0)		D-6		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
20	6									

Washington State Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-10-02

PROJECT I-5 to International Boundary Sheet 2 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
									01/02/2002	
	7			0 0 0 (0)		D-7	GS MC PI	CL, MC=28%, PI=11 Sandy Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
25	8									
				0 0 0 (0)		D-8		Sandy Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
30	9									
	10							End of test hole boring at 30 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
35	11									
40	12									
	13									
45										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-11-02

PROJECT I-5 to International Boundary Sheet 1 of 2

Inspector Hanning

Station 2+143 (T LINE) Offset 25.6 m Rt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 324258.6 Easting 460959.8 Casing HQ

Ground Elevation 76.5 (23.3 m) Start Date January 2, 2002 Completion Date January 2, 2002

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								NOTE: Asphalt 0.4ft NOTE: Gravel 1.2ft		
	1			2 5 4 (9)		D-1	GS MC PI	CL, MC=27%, PI=11 Lean CLAY with sand, stiff, olive, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
5				3 5 6 (11)		D-2		Sandy Lean CLAY with gravel, stiff, olive, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft		
	2									
				1 2 2 (4)		D-3	GS MC PI	CL, MC=28%, PI=11 Sandy Lean CLAY, soft, olive brown, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
10	3			1 2 3 (5)		D-4		Lean CLAY, medium stiff, olive brown, wet, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
	4			0 0 0 (0)		D-5	GS MC PI	CL, MC=28%, PI=12 Lean CLAY with sand, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
15	5									
				0 0 0 (0)		D-6		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
20	6									

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-11-02

PROJECT I-5 to International Boundary Sheet 2 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	7			0 0 0 (0)		D-7		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
25	8									
				0 0 1 (1)		D-8		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
	9									
30								End of test hole boring at 30 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	10									
35	11									
	12									
40	13									
45										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-12-01

PROJECT I-5 to International Boundary Sheet 1 of 5

Inspector Hanning

Station 1+414 (L LINE) Offset 12.5 m Lt. Equipment CME 850 w/ autohammer

Latitude Longitude Method Wet Rotary

Northing 323577.6 Easting 460815.4 Casing HQ

Ground Elevation 80.9 (24.7 m) Start Date December 18, 2001 Completion Date December 18, 2001

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 3 3 (6)		D-1	GS MC PI	CL, MC=34%, PI=12 Sandy lean CLAY with root hairs, medium stiff, brown, moist, Homogeneous, no HCl reaction Length Recovered 0.7 ft, Length Retained 0.7 ft		
				3 8 9 (17)		D-2	GS MC PI	SC-SM, MC=15%, PI=7 Silty, Clayey SAND, medium dense, brown, moist, Homogeneous, no HCl reaction Length Recovered 1.4 ft, Length Retained 1.4 ft		
	1			5 13 16 (29)		D-3		Silty, Clayey SAND, medium dense, dark grayish brown, wet, Stratified, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
5				10 14 12 (26)		D-4	GS MC	SM, MC=15% Silty SAND with gravel and organics, medium dense, dark brown, moist, Homogeneous, no HCl reaction Length Recovered 0.8 ft, Length Retained 0.8 ft 1/11/02	▼	
	2			1 2 3 (5)		D-5	GS MC PI	CH, MC=62%, PI=24 Fat CLAY, medium stiff, dark grayish brown, moist, Homogeneous, no HCl reaction Length Recovered 1.2 ft, Length Retained 1.2 ft		
10	3									
	4			1 3 3 (6)		D-6	GS MC PI	CH, MC=45%, PI=38 Fat CLAY, medium stiff, dark grayish brown, moist, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft 12/18/2001	▽	
15	5									
	6			0 0 0 (0)		D-7	GS MC PI	CH, MC=66%, PI=39 Fat CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.5 ft, Length Retained 1.5 ft		
20										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-12-01

PROJECT I-5 to International Boundary Sheet 2 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10, 20, 30, 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	7					S-8		No Recovery		
25						S-9		No Recovery		
	8									
				0 0 0 (0)		D-10		Fat CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	9									
30										
	10									
35										
	11									
				0 0 0 (0)		D-11	GS MC PI	CL, MC=32%, PI=27 Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	12									
40										
	13									
45										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-12-01

PROJECT I-5 to International Boundary Sheet 3 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	14									
				0 0 0 (0)		D-12		Lean CLAY, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	15									
50										
	16									
55										
	17									
				0 0 0 (0)		D-13	GS MC PI	CL, MC=32%, PI=25 Lean CLAY with sand, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	18									
60										
	19									
65										
	20									
				0 0 0 (0)		D-14		Lean CLAY with sand, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
	21									
70										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-12-01

PROJECT I-5 to International Boundary Sheet 4 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	22									
75	23									
	24			0 0 0 (0)		D-15		Lean CLAY, with sand, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
80	25									
85	26									
	27			0 0 0 (0)		D-16	GS MC PI	CL, MC=26%, PI=20 Lean CLAY with sand, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
90	28									
95										

Washington State
Department of Transportation

LOG OF TEST BORING

Job No. 0L-3500 SR 543 HOLE No. TH-12-01

PROJECT I-5 to International Boundary Sheet 5 of 5

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
	29									
	30			0 0 0 (0)		D-17		Lean CLAY with sand, very soft, dark gray, wet, Homogeneous, no HCl reaction Length Recovered 1.0 ft, Length Retained 1.0 ft		
100								NOTE: Bailed water to a depth of 40ft prior installing piezometer. End of test hole boring at 99.5 ft below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.		
	31									
105	32									
	33									
110										
	34									
115	35									
	36									
120										

APPENDIX C - LABORATORY TESTING

LABORATORY TESTING

Laboratory testing was performed on selected samples from the field exploration program. All disturbed samples were visually examined and then grouped together based upon particle size distribution, consistency and color. Once a group of samples was established that had similar characteristic, a minimum of one sample per group was tested. The testing consisted of performing moisture content, grain size analyses, and Atterberg Limits tests. The tests were done in general accordance with AASHTO T-88, T-89 and T-90 guide specifications, respectively. After testing was complete, the samples were classified in general accordance with the Unified Soil Classification System (USCS).

Specialized testing was performed on selected samples to determine the soil strength and the rate of settlement for the soils. This specialized testing consisted of a) five unconsolidated-undrained (UU) triaxial tests, b) six consolidated-undrained (CU) triaxial tests, c) four direct shear tests and d) three consolidation tests. These tests were conducted in general accordance with ASTM T 297-95, ASTM 297-94, ASTM T 236-92 and ASTM T 216-94 standards, respectively.

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-1-99** Sheet **1** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

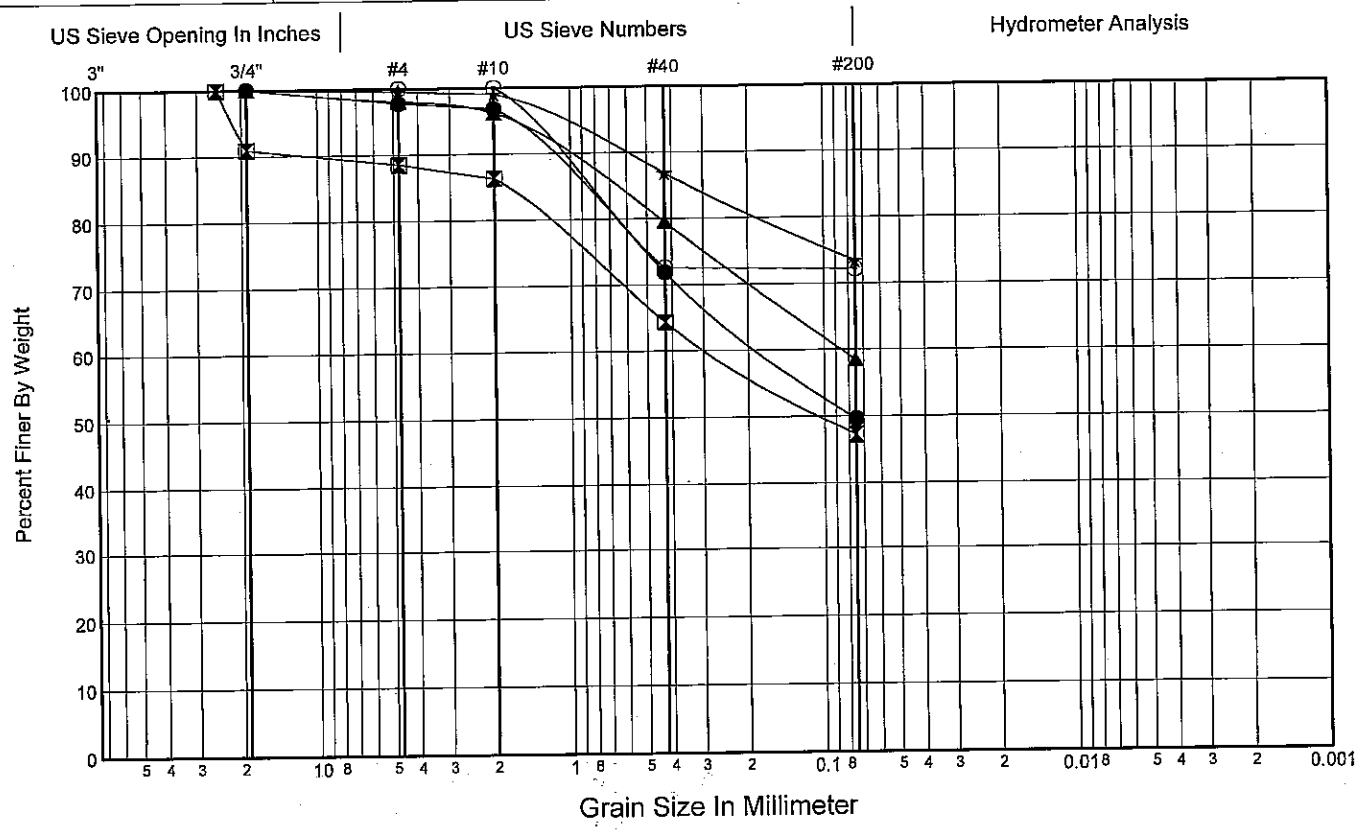
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	9.0	2.74	D-2	SC	See Boring Log	CLAYEY SAND	18	28	15	13
⊠	19.0	5.79	D-4	SC	See Boring Log	CLAYEY SAND	20	28	15	13
▲	24.0	7.32	D-5	CL	See Boring Log	SANDY LEAN CLAY	19	24	14	10
★	39.0	11.89	D-8	CL	See Boring Log	LEAN CLAY with SAND	21	37	15	22
⊙	49.0	14.94	D-10	CL	See Boring Log	LEAN CLAY with SAND	41	44	18	26

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	2.3	48.1	49.6		
⊠	11.6	41.2	47.2		
▲	2.0	39.6	58.4		
★	0.5	26.1	73.4		
⊙	0.0	27.8	72.2		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.169	0.08			
⊠	0.274	0.10			
▲	0.085				
★					
⊙					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-1-99** Sheet **2** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

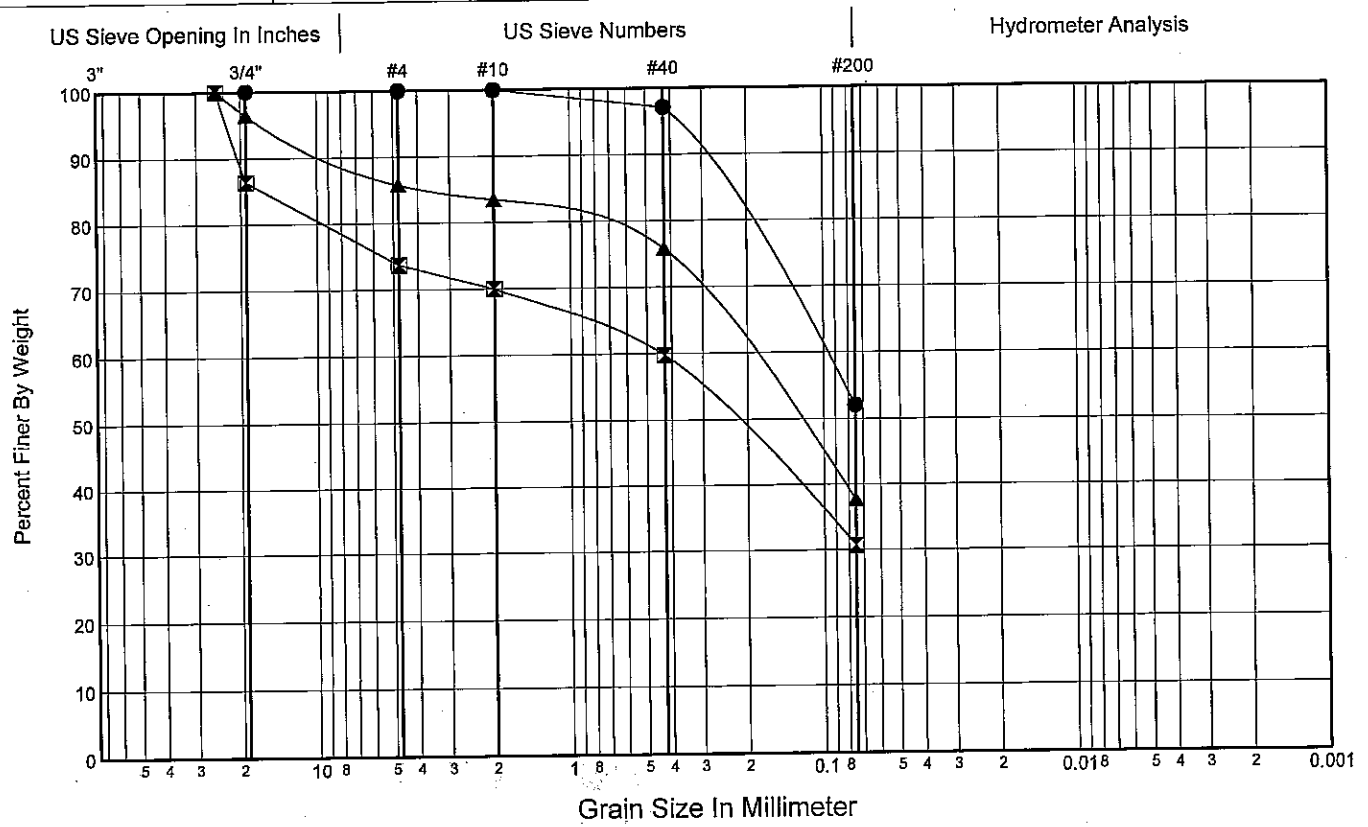
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	54.0	16.46	D-11	ML	See Boring Log	SANDY SILT	21			
⊠	59.0	17.98	D-12	SM	See Boring Log	SILTY SAND with GRAVEL	8			
▲	74.0	22.56	D-15	SM	See Boring Log	SILTY SAND	9			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.1	47.9	52.1		
⊠	26.3	43.0	30.7		
▲	14.3	48.1	37.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.102				
⊠	0.444	0.24			
▲	0.207	0.13			



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-2-99** Sheet **1** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

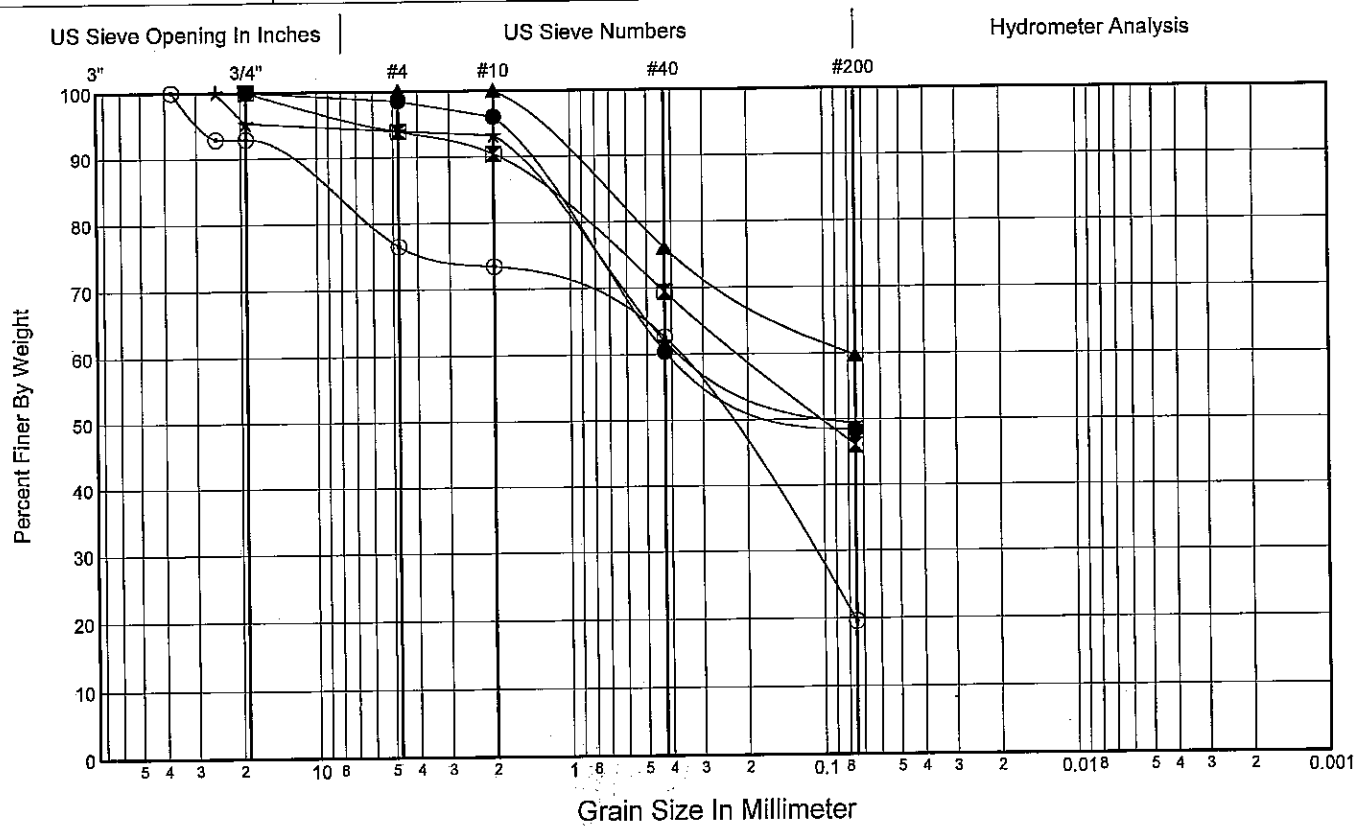
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	9.0	2.74	D-2	SC	See Boring Log	CLAYEY SAND	24	29	14	15
⊠	14.0	4.27	D-3	SC-SM	See Boring Log	SILTY, CLAYEY SAND	16	17	13	4
▲	29.0	8.84	D-6	CL	See Boring Log	SANDY LEAN CLAY	27	27	16	11
★	44.0	13.41	D-9	SC	See Boring Log	CLAYEY SAND	21	32	18	14
⊙	49.0	14.94	D-10	SM	See Boring Log	SILTY SAND with GRAVEL	11			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	1.5	50.2	48.3		
⊠	6.1	47.8	46.1		
▲	0.0	40.3	59.7		
★	6.1	44.6	49.4		
⊙	23.5	57.0	19.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.400	0.10			
⊠	0.211	0.10			
▲	0.077				
★	0.323	0.08			
⊙	0.382	0.26	0.11	0.08	



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-2-99** Sheet **2** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

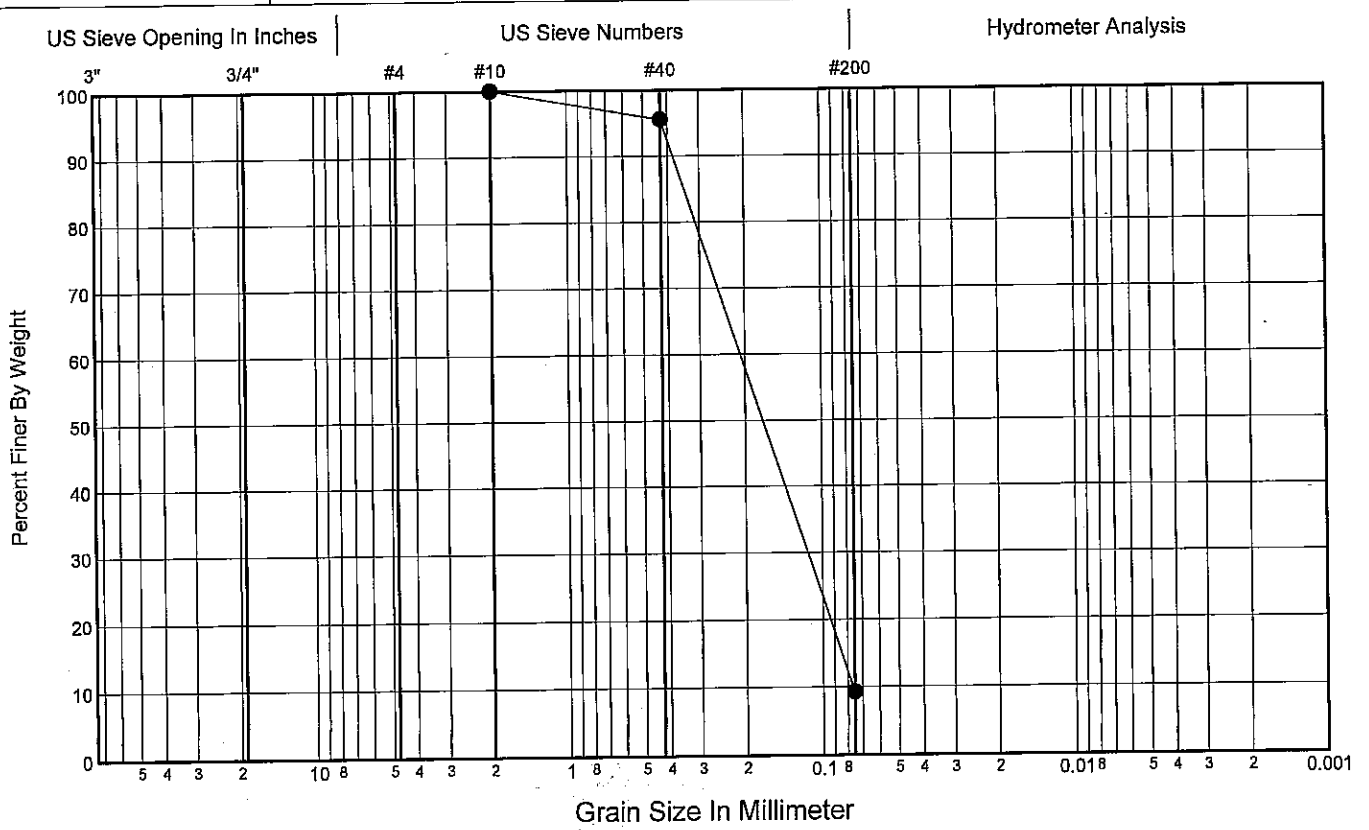
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	74.0	22.56	D-14	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	20			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	90.8	9.2	0.8	2.7

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.208	0.17	0.11	0.09	0.076



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-3-99** Sheet **1** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

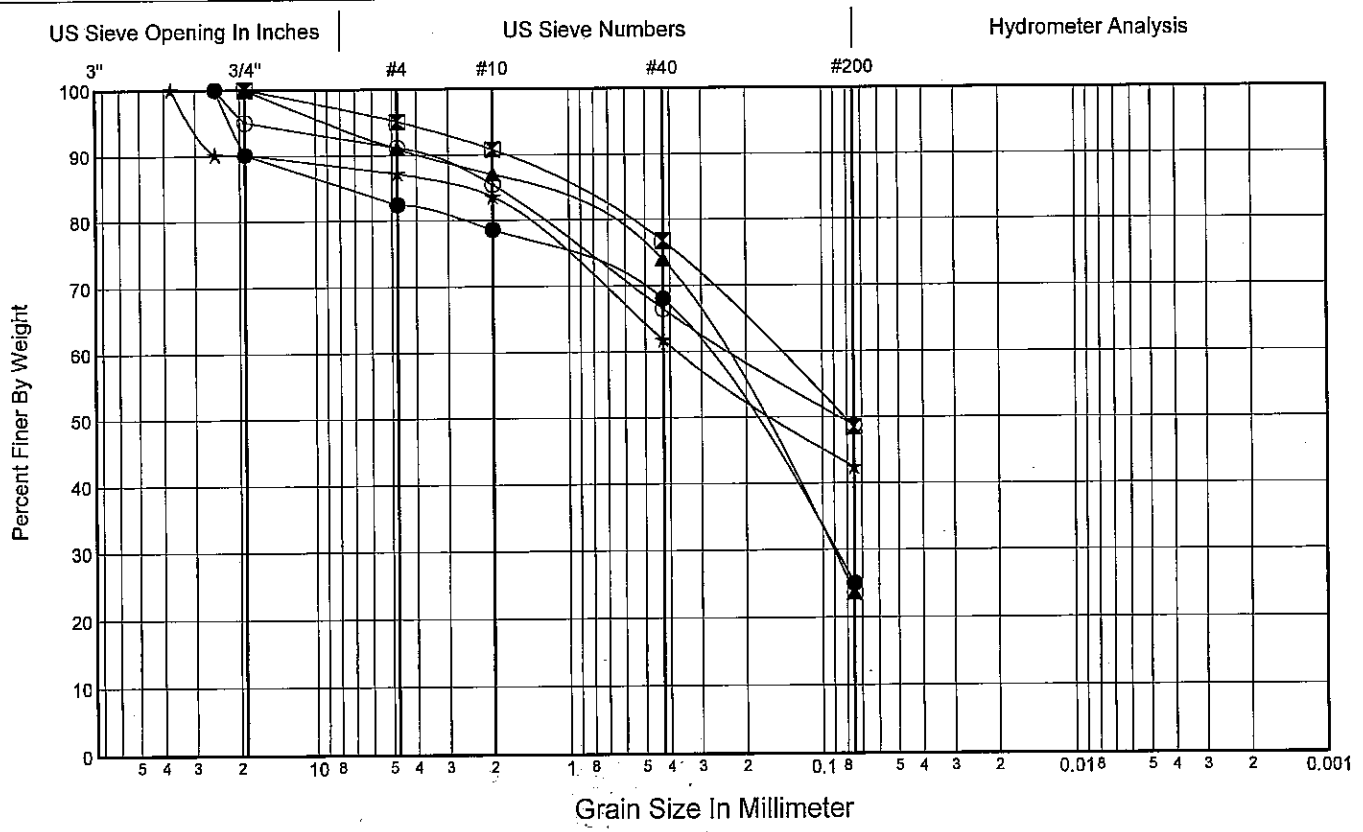
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	5.0	1.52	D-1	SM	See Boring Log	SILTY SAND with GRAVEL	9			
⊠	10.0	3.05	D-2	SM	See Boring Log	SILTY SAND	18			
▲	15.0	4.57	D-3	SM	See Boring Log	SILTY SAND	15			
★	25.0	7.62	D-5	SC	See Boring Log	CLAYEY SAND	17	26	14	12
⊙	40.0	12.19	D-8	SC-SM	See Boring Log	SILTY, CLAYEY SAND	22	21	14	7

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	17.7	57.3	25.0		
⊠	5.0	46.6	48.4		
▲	9.0	67.3	23.6		
★	12.8	44.8	42.4		
⊙	8.9	42.4	48.7		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.308	0.21	0.09		
⊠	0.153	0.08			
▲	0.263	0.19	0.09		
★	0.362	0.15			
⊙	0.226	0.09			



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-3-99** Sheet **2** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

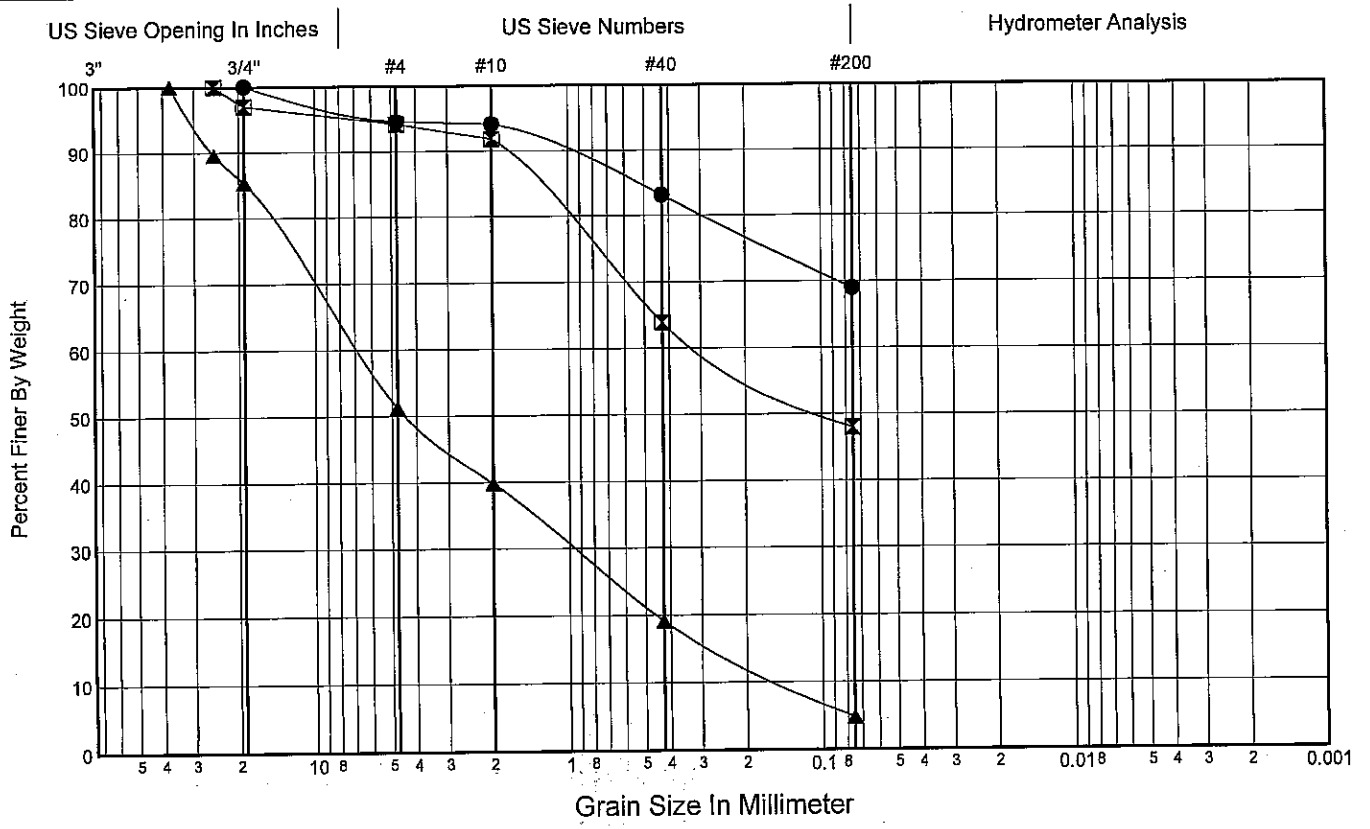
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	50.0	15.24	D-10	CL	See Boring Log	SANDY LEAN CLAY	33	30	15	15
⊠	60.0	18.29	D-12	SC	See Boring Log	CLAYEY SAND	20	24	16	8
▲	85.0	25.91	D-17	GP	See Boring Log	POORLY GRADED GRAVEL with SAND	10			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	5.5	25.6	68.9		
⊠	5.9	46.2	47.9		
▲	48.9	46.4	4.7	1.0	48.0

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠	0.280	0.09			
▲	6.807	4.35	0.96	0.46	0.142



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-4-99** Sheet **1** of **5**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

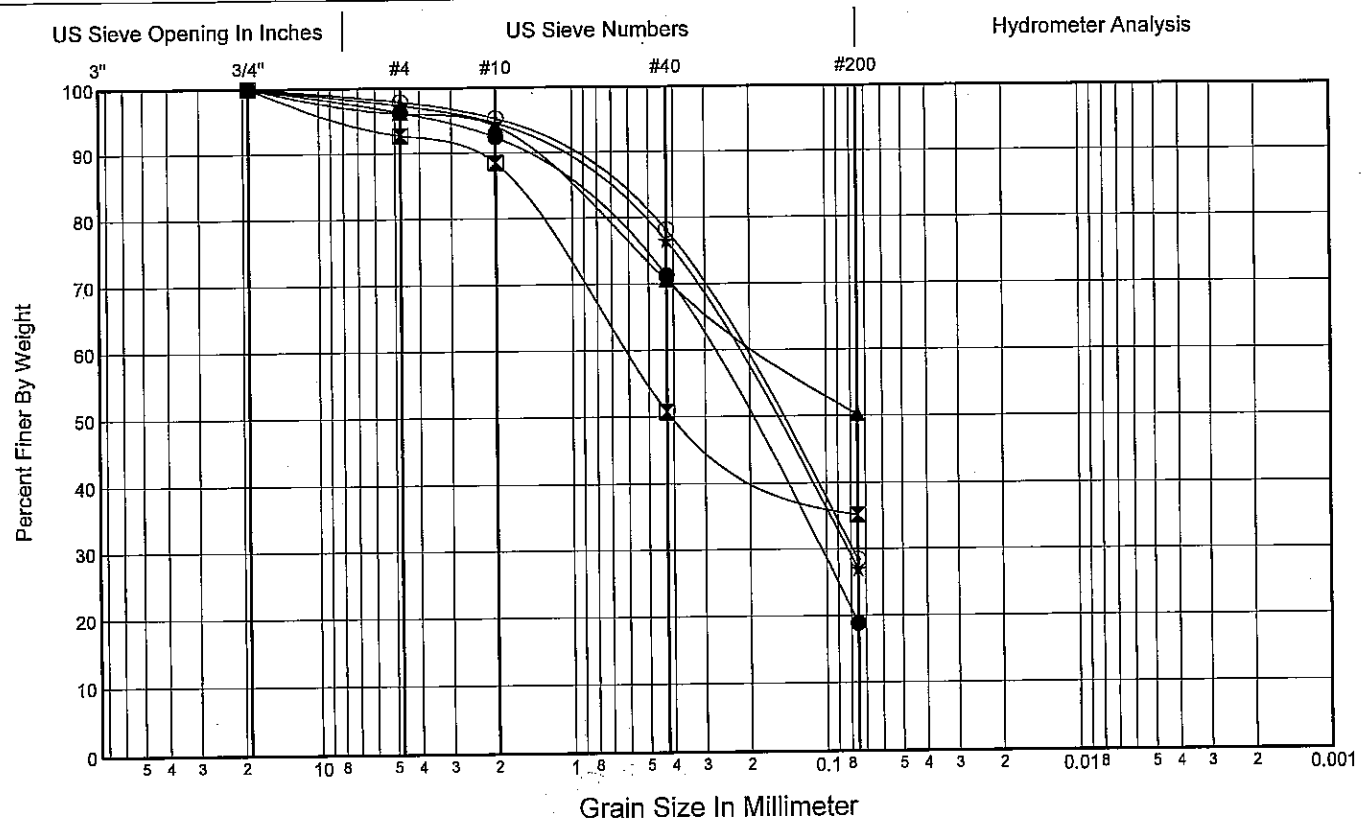
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	4.0	1.22	D-1	SM	See Boring Log	SILTY SAND	17			
⊠	9.3	2.83	U-2B	SC	See Boring Log	CLAYEY SAND	13	24	14	10
▲	14.3	4.36	U-4B	CL	See Boring Log	SANDY LEAN CLAY	17	28	13	15
★	14.7	4.48	U-4C	SC	See Boring Log	CLAYEY SAND	17	27	14	13
⊙	15.0	4.57	U-4D	SC	See Boring Log	CLAYEY SAND	16	28	14	14

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	3.8	77.4	18.8		
⊠	7.3	57.5	35.2		
▲	3.9	46.0	50.1		
★	2.7	70.4	26.9		
⊙	2.1	69.5	28.4		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.293	0.21	0.11	0.08	
⊠	0.623	0.39			
▲	0.174				
★	0.239	0.17	0.08		
⊙	0.226	0.16	0.08		



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-4-99** Sheet **2** of **5**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

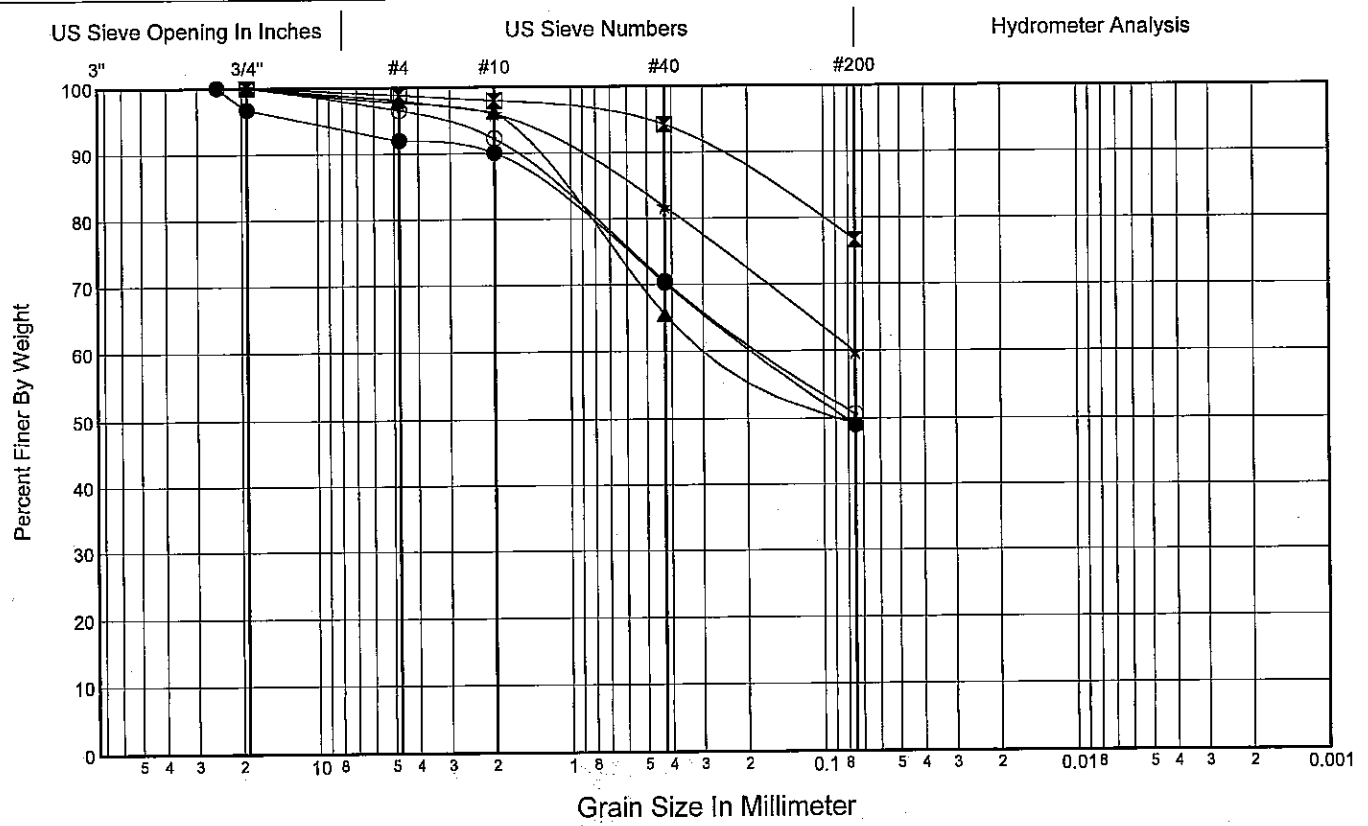
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	17.5	5.33	D-5	SC	See Boring Log	CLAYEY SAND	19	24	13	11
⊠	24.3	7.41	U-6B	CL	See Boring Log	LEAN CLAY with SAND	22	37	17	20
▲	25.3	7.71	U-6E	SC	See Boring Log	CLAYEY SAND	21	31	15	16
★	25.7	7.83	U-6F	CL	See Boring Log	SANDY LEAN CLAY	21	30	15	15
⊙	28.5	8.69	D-7	CL	See Boring Log	SANDY LEAN CLAY	22	29	14	15

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	8.1	42.9	49.0		
⊠	1.2	22.2	76.6		
▲	2.0	48.8	49.2		
★	2.3	37.9	59.8		
⊙	3.5	46.0	50.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.185	0.08			
⊠					
▲	0.236	0.08			
★	0.076				
⊙	0.171				



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-4-99** Sheet **3** of **5**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

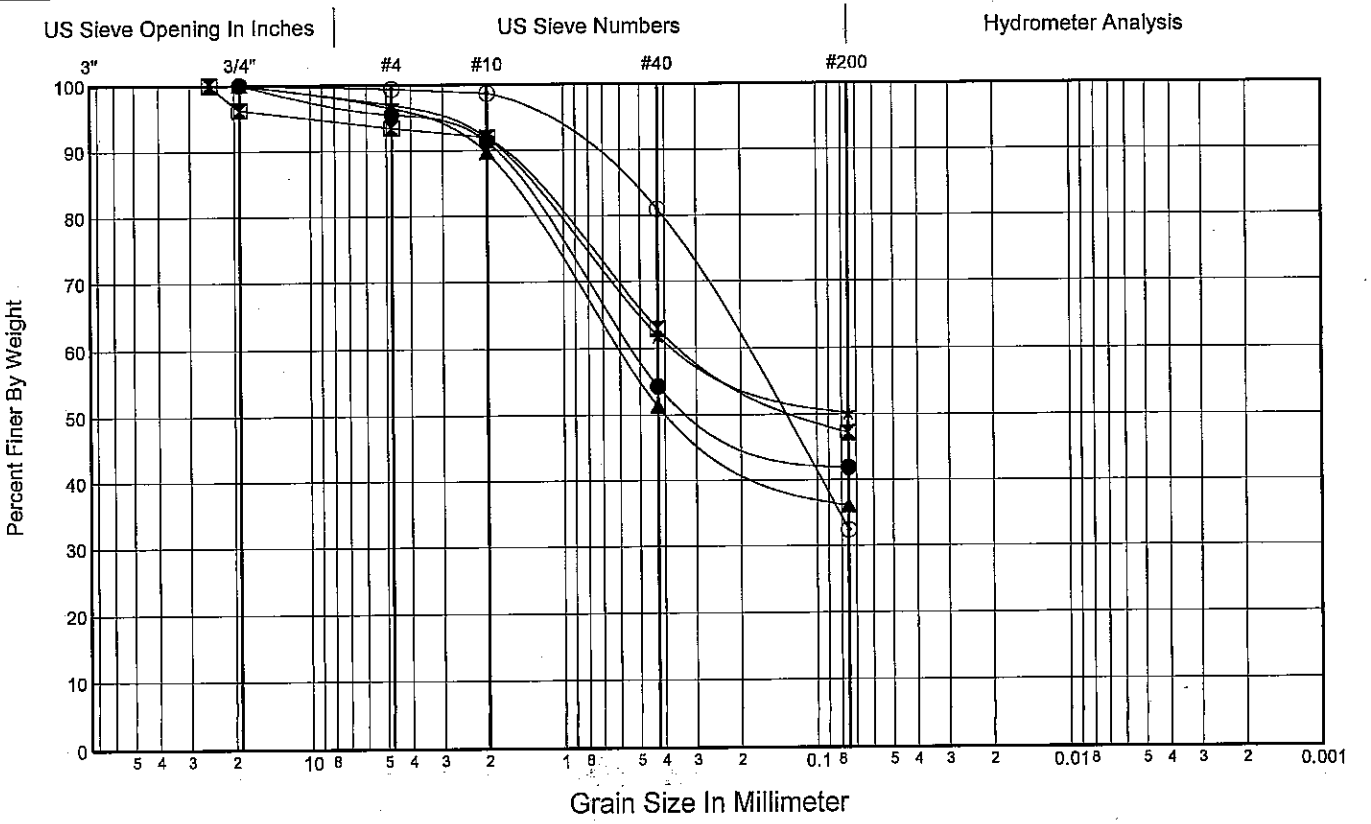
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	35.0	10.67	D-9	SC	See Boring Log	CLAYEY SAND	25	25	14	11
⊠	38.0	11.58	U-10A	SC-SM	See Boring Log	SILTY, CLAYEY SAND	20	19	14	5
▲	38.7	11.80	U-10C	SM	See Boring Log	SILTY SAND	20	17	14	3
★	39.0	11.89	U-10D	CL	See Boring Log	SANDY LEAN CLAY	26	27	14	13
⊙	43.3	13.20	U-12B	SC	See Boring Log	CLAYEY SAND	30	36	15	21

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	4.5	53.6	41.9		
⊠	6.6	46.2	47.2		
▲	3.5	60.5	36.0		
★	3.1	46.7	50.2		
⊙	0.7	67.0	32.3		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.540	0.23			
⊠	0.309	0.10			
▲	0.605	0.37			
★	0.322				
⊙	0.201	0.14			



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-4-99** Sheet **4** of **5**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

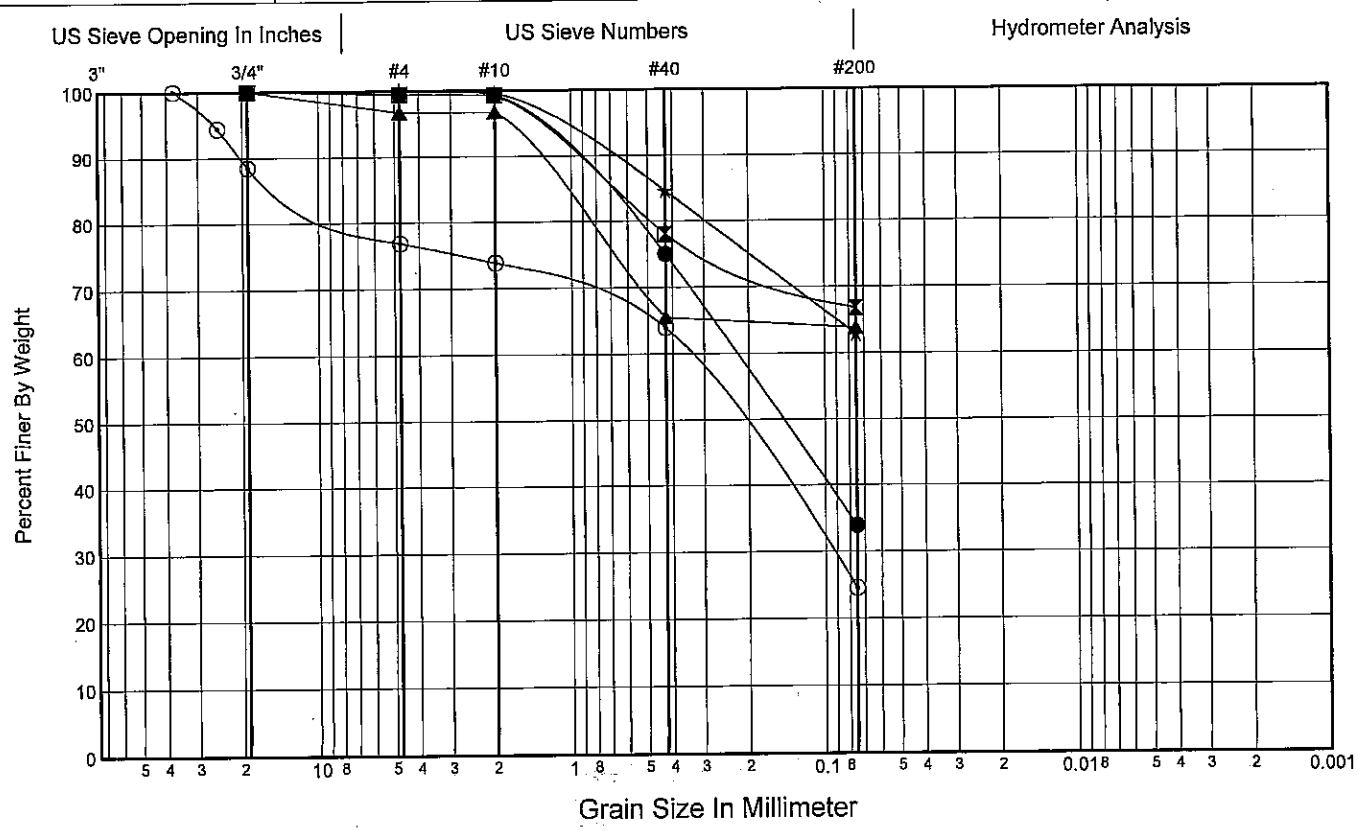
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	43.7	13.32	U-12C	SC	See Boring Log	CLAYEY SAND	34	50	13	37
⊠	44.0	13.41	U-12D	CL	See Boring Log	SANDY LEAN CLAY	31	36	17	19
▲	44.3	13.50	U-12E	CH	See Boring Log	SANDY FAT CLAY	38	68	19	49
★	48.0	14.63	U-14A	ML	See Boring Log	SANDY SILT	24			
⊙	68.0	20.73	D-19	SM	See Boring Log	SILTY SAND with GRAVEL	11			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.6	65.6	33.9		
⊠	0.6	32.7	66.8		
▲	3.3	32.9	63.8		
★	0.0	37.1	62.9		
⊙	23.2	52.3	24.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.226	0.15			
⊠					
▲					
★					
⊙	0.357	0.23	0.10		



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-4-99** Sheet **5** of **5**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

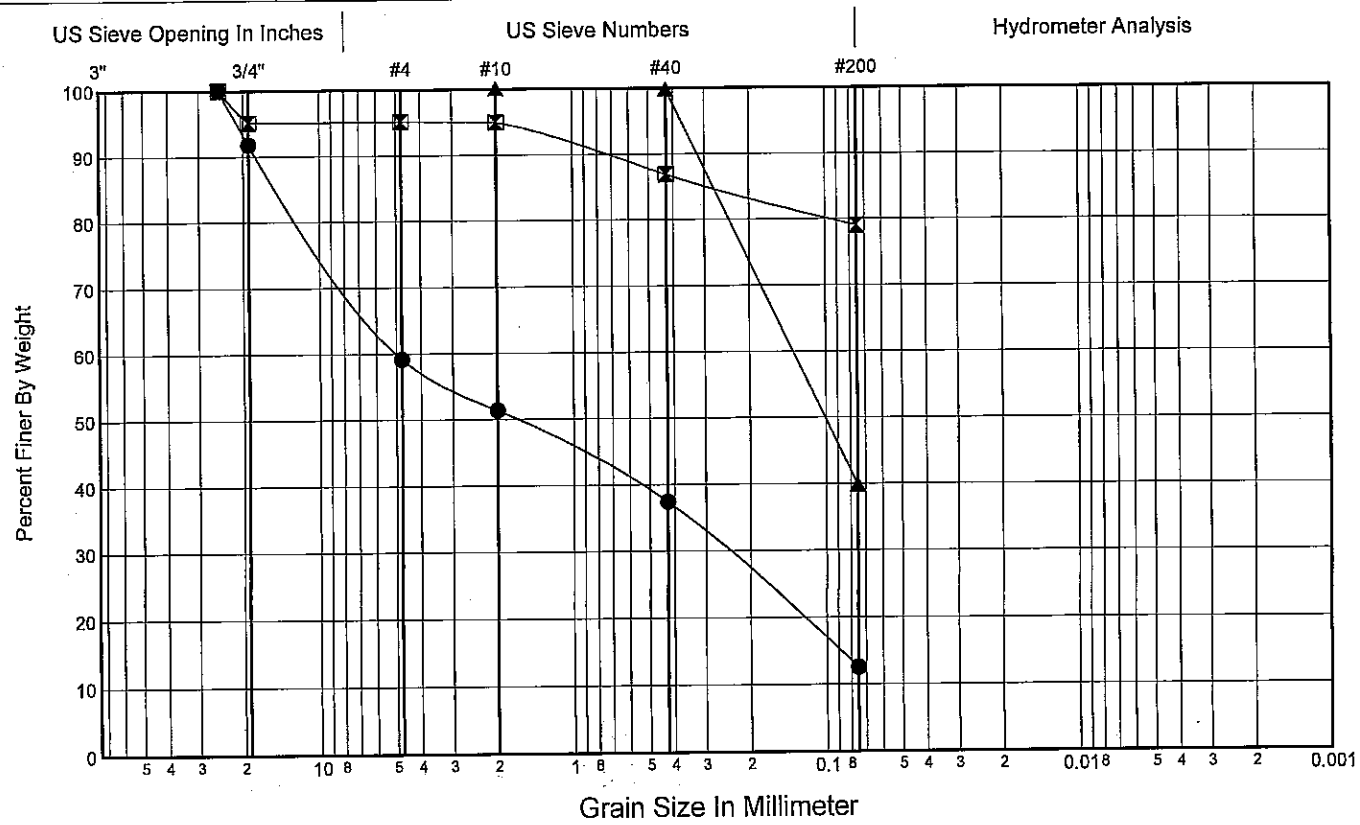
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	78.0	23.77	D-21	SM	See Boring Log	SILTY SAND with GRAVEL	8			
⊠	83.0	25.30	D-22	ML	See Boring Log	SILT with SAND	25			
▲	93.0	28.35	D-24	SM	See Boring Log	SILTY SAND	23			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	40.9	46.7	12.5	0.2	78.1
⊠	4.9	16.1	79.0		
▲	0.0	60.2	39.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	4.929	1.73	0.25	0.13	
⊠					
▲	0.134	0.10			



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-8-99** Sheet **1** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

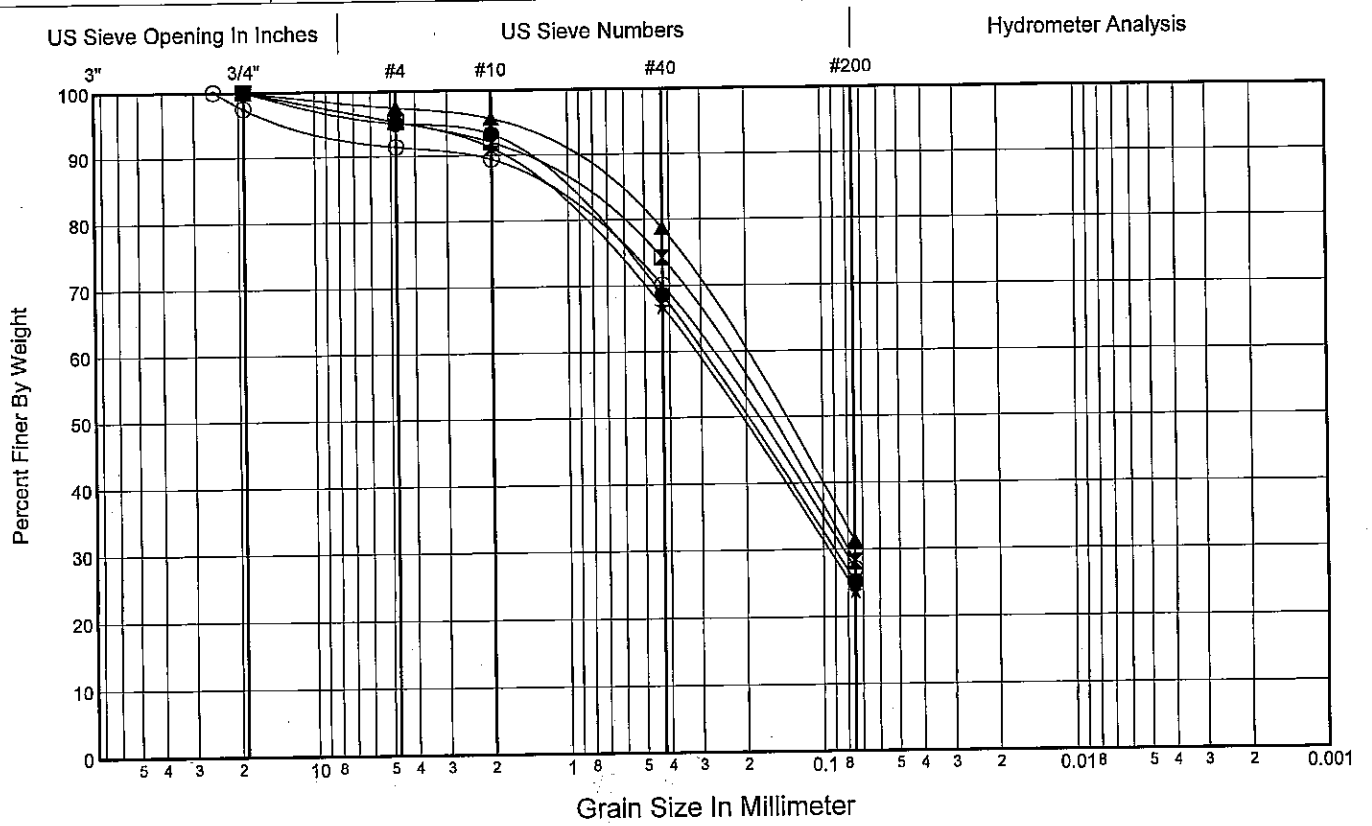
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	4.0	1.22	D-2	SM	See Boring Log	SILTY SAND	18			
⊠	14.0	4.27	D-6	SC	See Boring Log	CLAYEY SAND	19	26	15	11
▲	17.0	5.18	D-7	SM	See Boring Log	SILTY SAND	24			
★	22.0	6.71	D-9	SM	See Boring Log	SILTY SAND	19			
⊙	24.0	7.32	D-10	SC-SM	See Boring Log	SILTY, CLAYEY SAND	17	21	14	7

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	5.0	69.9	25.1		
⊠	4.7	67.1	28.2		
▲	2.6	66.2	31.2		
★	4.7	71.5	23.8		
⊙	8.6	64.3	27.0		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.301	0.20	0.09		
⊠	0.249	0.17	0.08		
▲	0.215	0.15			
★	0.323	0.22	0.10		
⊙	0.283	0.19	0.08		



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-8-99** Sheet **2** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

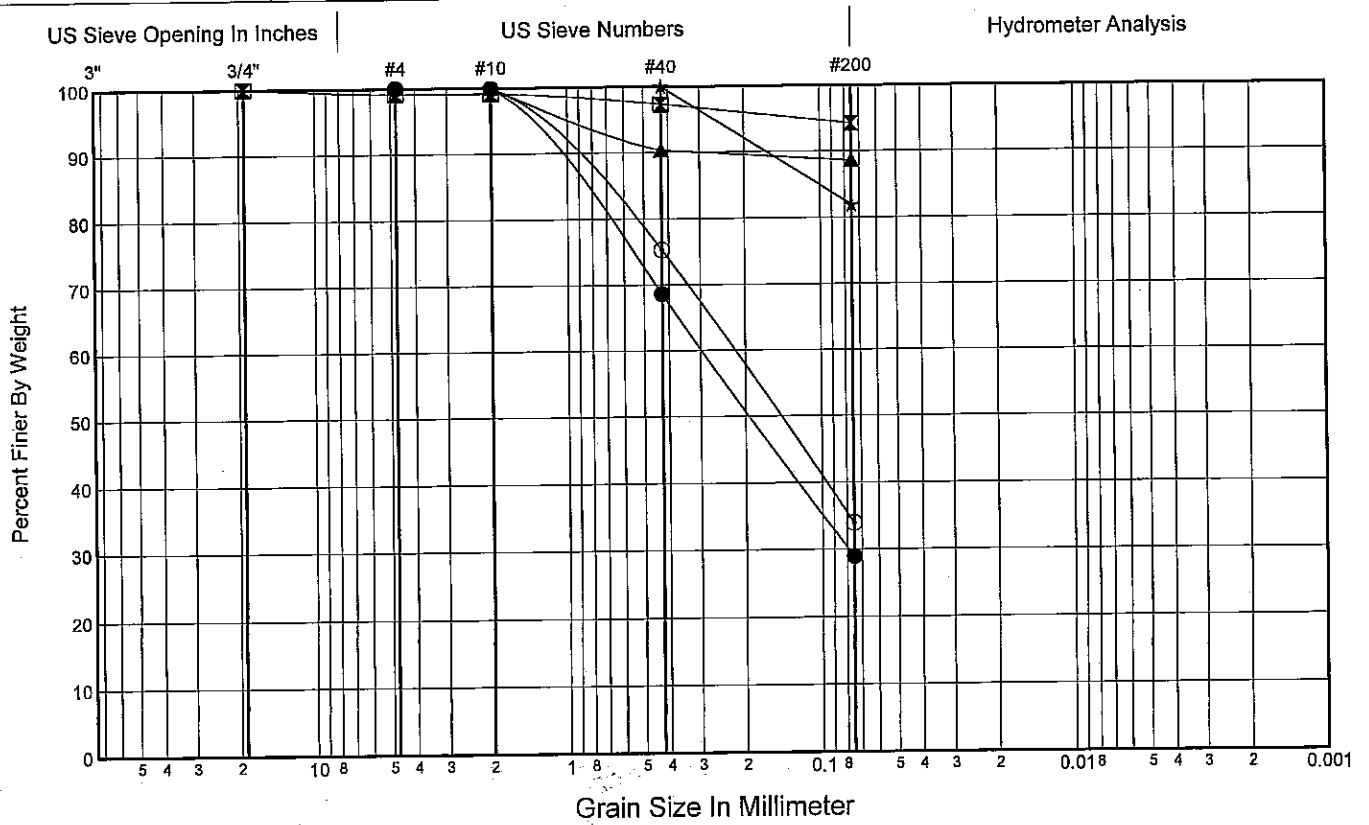
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	27.0	8.23	D-11	SC	See Boring Log	CLAYEY SAND	51	63	22	41
⊠	29.0	8.84	S-12A	CH	See Boring Log	FAT CLAY	38	66	22	44
▲	30.0	9.14	S-12B	CH	See Boring Log	FAT CLAY	45	62	22	40
★	30.5	9.30	S-12C	ML	See Boring Log	SILT with SAND	48			
⊙	37.0	11.28	D-15	SC	See Boring Log	CLAYEY SAND	45	44	20	24

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	71.1	28.9		
⊠	0.8	5.0	94.2		
▲	0.0	11.5	88.5		
★	0.0	18.1	81.9		
⊙	0.0	66.0	34.0		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.292	0.19	0.08		
⊠					
▲					
★					
⊙	0.224	0.15			



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-8-99** Sheet **3** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

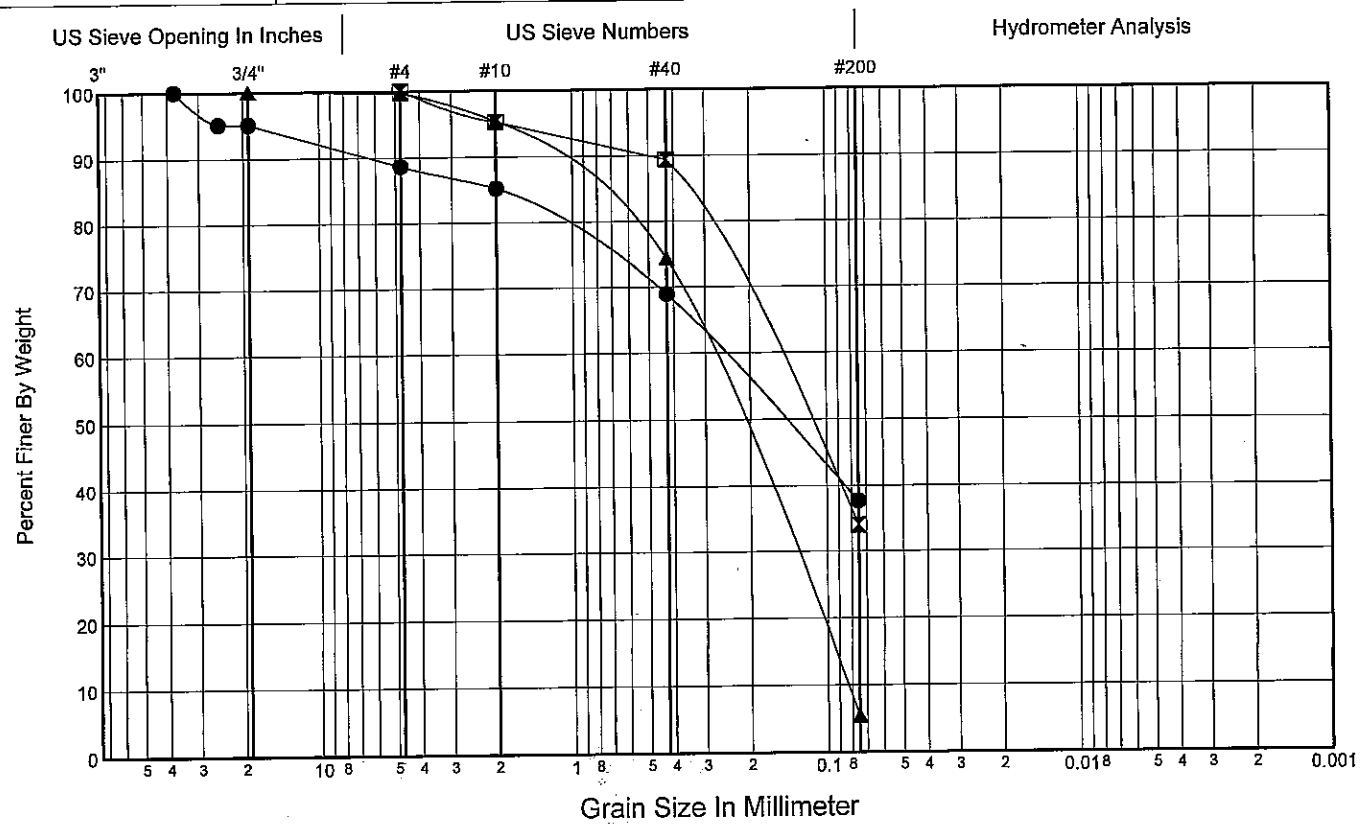
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	44.0	13.41	D-18	SM	See Boring Log	SILTY SAND	8			
⊠	49.0	14.94	D-19	SM	See Boring Log	SILTY SAND	19			
▲	59.0	17.98	D-21	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	18			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	11.4	51.0	37.6		
⊠	0.0	66.0	34.0		
▲	0.3	94.3	5.3	0.8	3.5

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.259	0.15			
⊠	0.170	0.12			
▲	0.297	0.23	0.14	0.11	0.084



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-9-99** Sheet **1** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

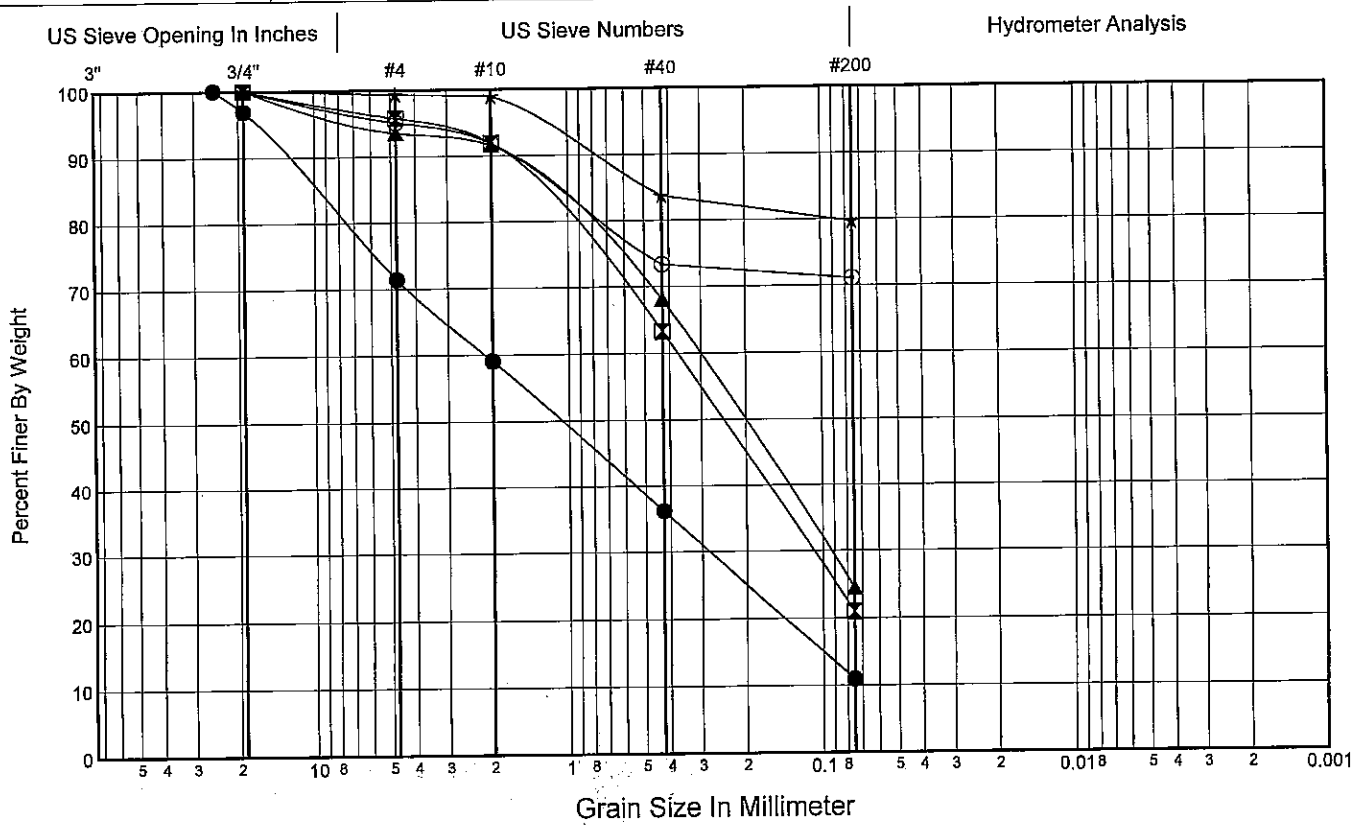
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	3.0	0.91	D-1	SP-SM	See Boring Log	POORLY GRADED SAND with SILT and GRAVEL	10			
⊠	5.0	1.52	D-2	SM	See Boring Log	SILTY SAND	14			
▲	10.0	3.05	D-4	SM	See Boring Log	SILTY SAND	15			
★	15.0	4.57	D-6	CL	See Boring Log	LEAN CLAY with SAND	13	31	17	14
⊙	23.0	7.01	D-9	CL	See Boring Log	LEAN CLAY with SAND	21	32	17	15

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	28.6	60.5	10.9	0.5	30.3
⊠	4.3	74.8	20.9		
▲	6.5	69.0	24.4		
★	0.7	19.7	79.6		
⊙	4.9	24.0	71.1		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	2.139	1.09	0.28	0.14	
⊠	0.372	0.25	0.11		
▲	0.309	0.21	0.09		
★					
⊙					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-9-99** Sheet **2** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

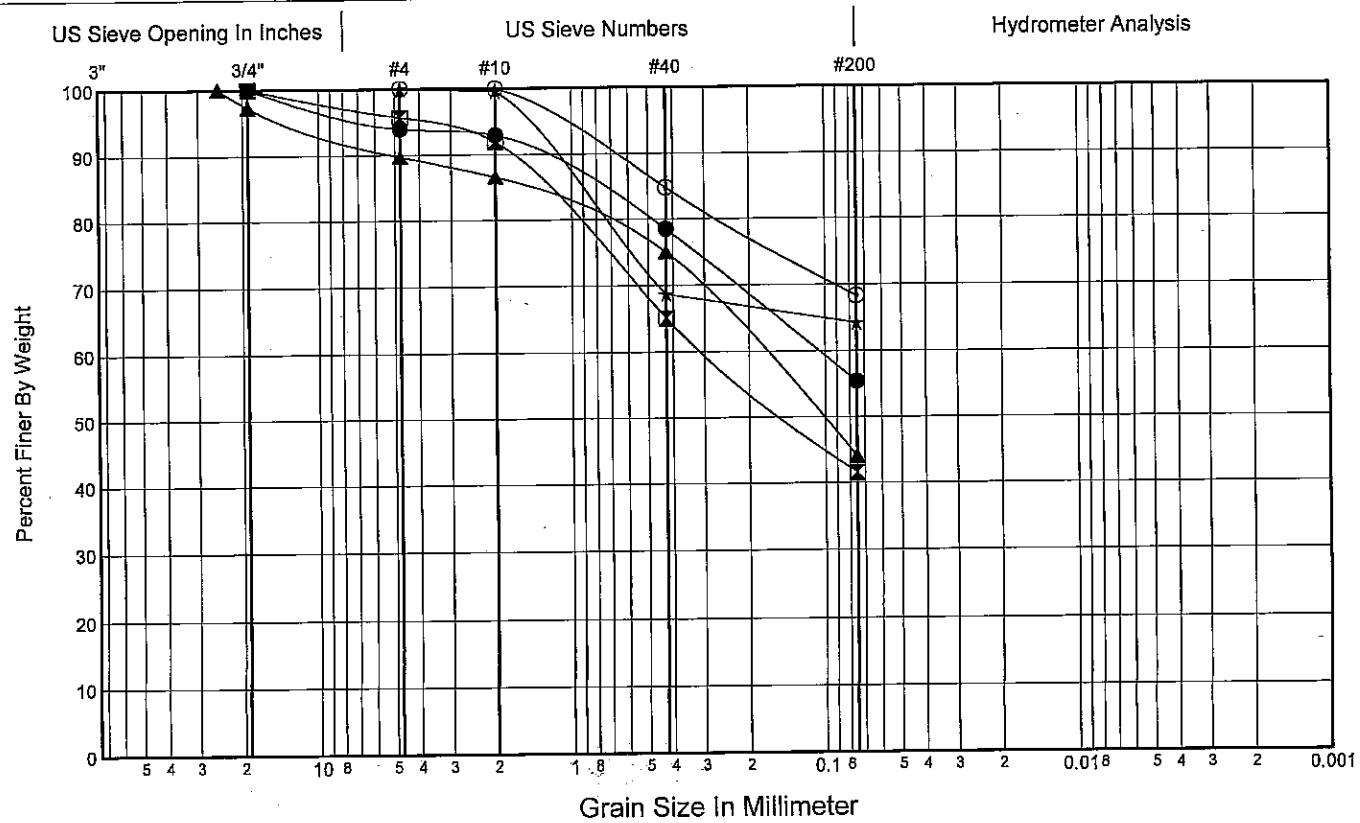
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	30.0	9.14	D-12	CL	See Boring Log	SANDY LEAN CLAY	22	28	16	12
⊠	35.0	10.67	D-14	SC-SM	See Boring Log	SILTY, CLAYEY SAND	22	22	15	7
▲	41.0	12.50	S-16	SM	See Boring Log	SILTY SAND	25			
★	43.0	13.11	D-17	CL	See Boring Log	SANDY LEAN CLAY	48	47	18	29
⊙	58.0	17.68	D-23	ML	See Boring Log	SANDY SILT	33			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	6.1	38.5	55.4		
⊠	4.3	54.1	41.5		
▲	10.3	45.6	44.0		
★	0.1	35.7	64.2		
⊙	0.0	31.7	68.3		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.106				
⊠	0.292	0.14			
▲	0.184	0.10			
★					
⊙					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-9-99** Sheet **3** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

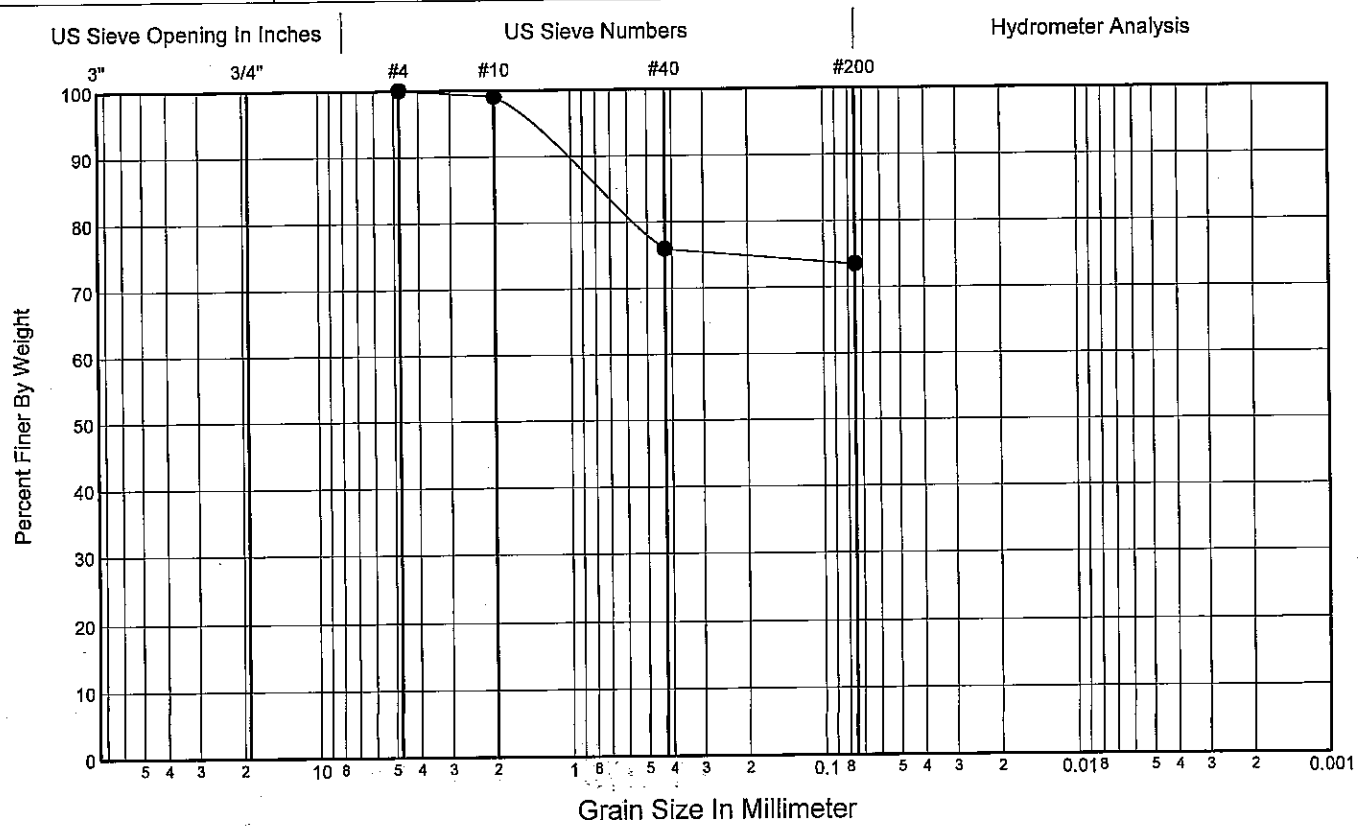
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	69.0	21.03	D-26	ML	See Boring Log	SILT with SAND	25			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	26.5	73.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-10-99** Sheet **1** of **4**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

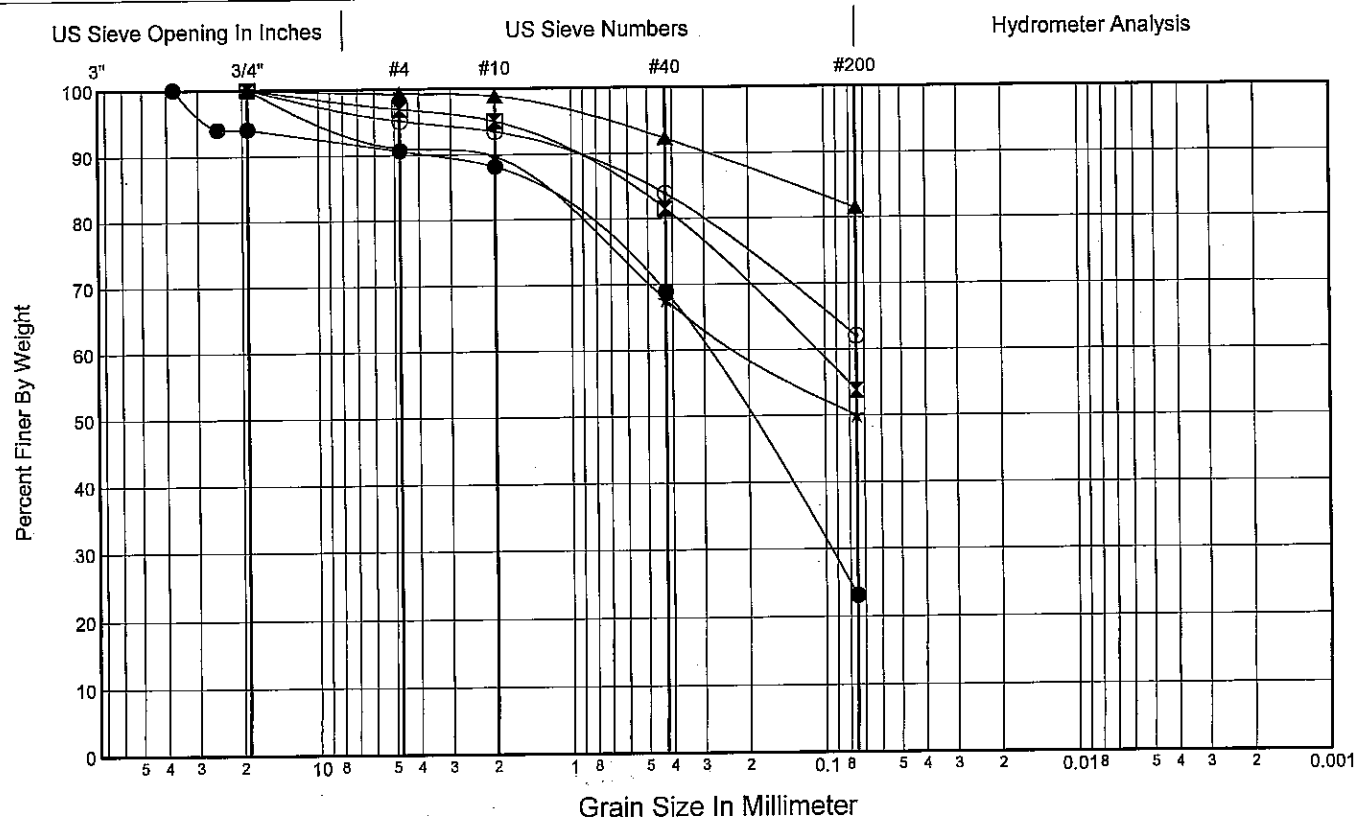
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	8.0	2.44	D-3	SM	See Boring Log	SILTY SAND	12			
⊠	13.0	3.96	D-5	ML	See Boring Log	SANDY SILT	19			
▲	22.0	6.71	D-9	CL	See Boring Log	LEAN CLAY with SAND	21	39	19	20
★	28.0	8.53	D-11	SC	See Boring Log	CLAYEY SAND	24	24	14	10
⊙	33.0	10.06	D-13	CL-ML	See Boring Log	SANDY SILTY CLAY	24	21	14	7

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	9.4	67.5	23.1		
⊠	3.0	43.2	53.8		
▲	0.8	17.8	81.4		
★	9.0	41.0	50.0		
⊙	4.8	33.2	62.0		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.303	0.21	0.10		
⊠	0.111				
▲					
★	0.201	0.08			
⊙					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-10-99** Sheet **2** of **4**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

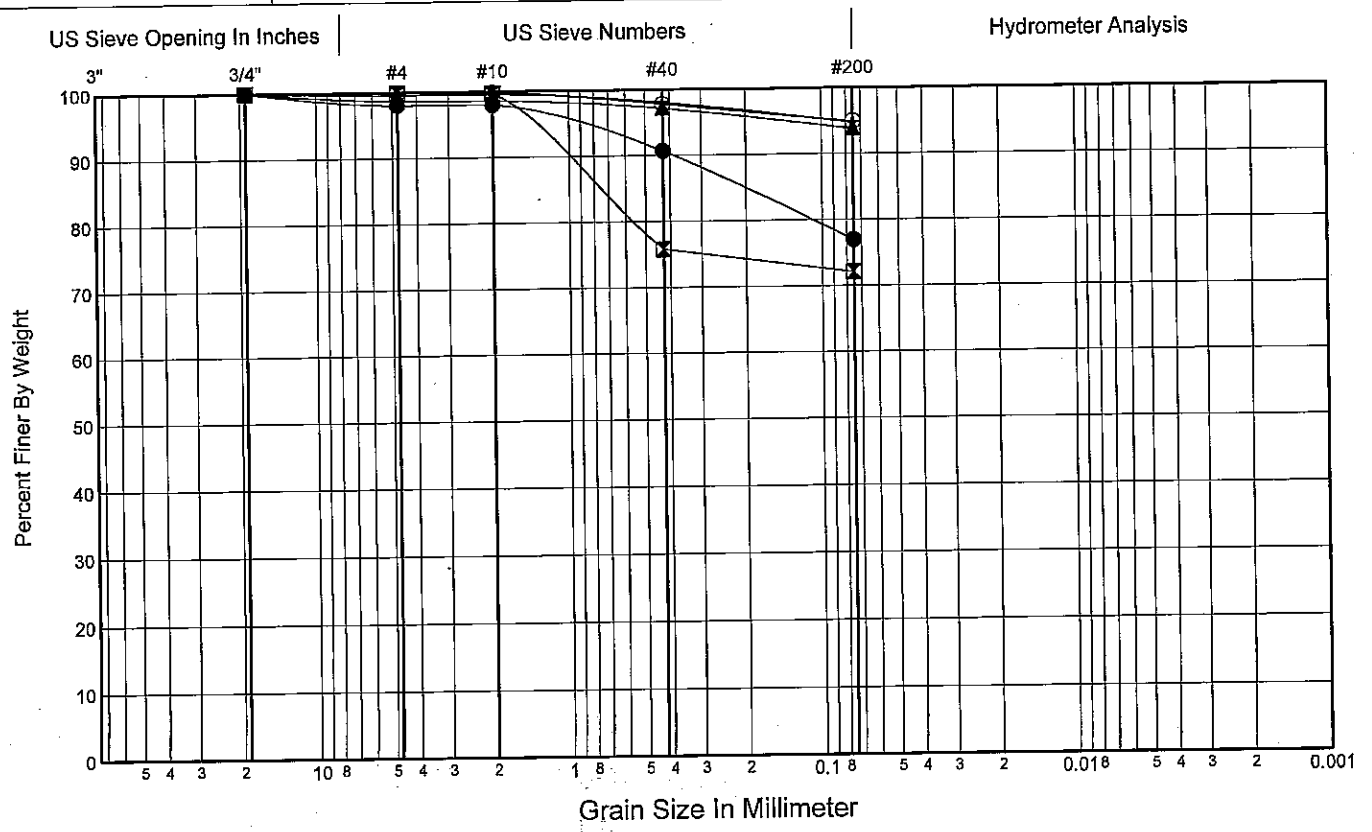
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	38.0	11.58	D-15	CL	See Boring Log	LEAN CLAY with SAND	27	41	17	24
⊠	43.0	13.11	D-17	CH	See Boring Log	FAT CLAY with SAND	45	67	22	45
▲	45.3	13.81	S-18B	CH	See Boring Log	FAT CLAY	39	59	21	38
★	45.8	13.96	S-18C	CH	See Boring Log	FAT CLAY	41	60	22	38
⊙	46.3	14.11	S-18D	CH	See Boring Log	FAT CLAY	41	66	22	44

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	2.0	21.1	76.9		
⊠	0.1	27.8	72.1		
▲	1.4	4.9	93.7		
★	0.5	4.9	94.7		
⊙	0.1	5.1	94.9		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					
★					
⊙					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-10-99** Sheet **3** of **4**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

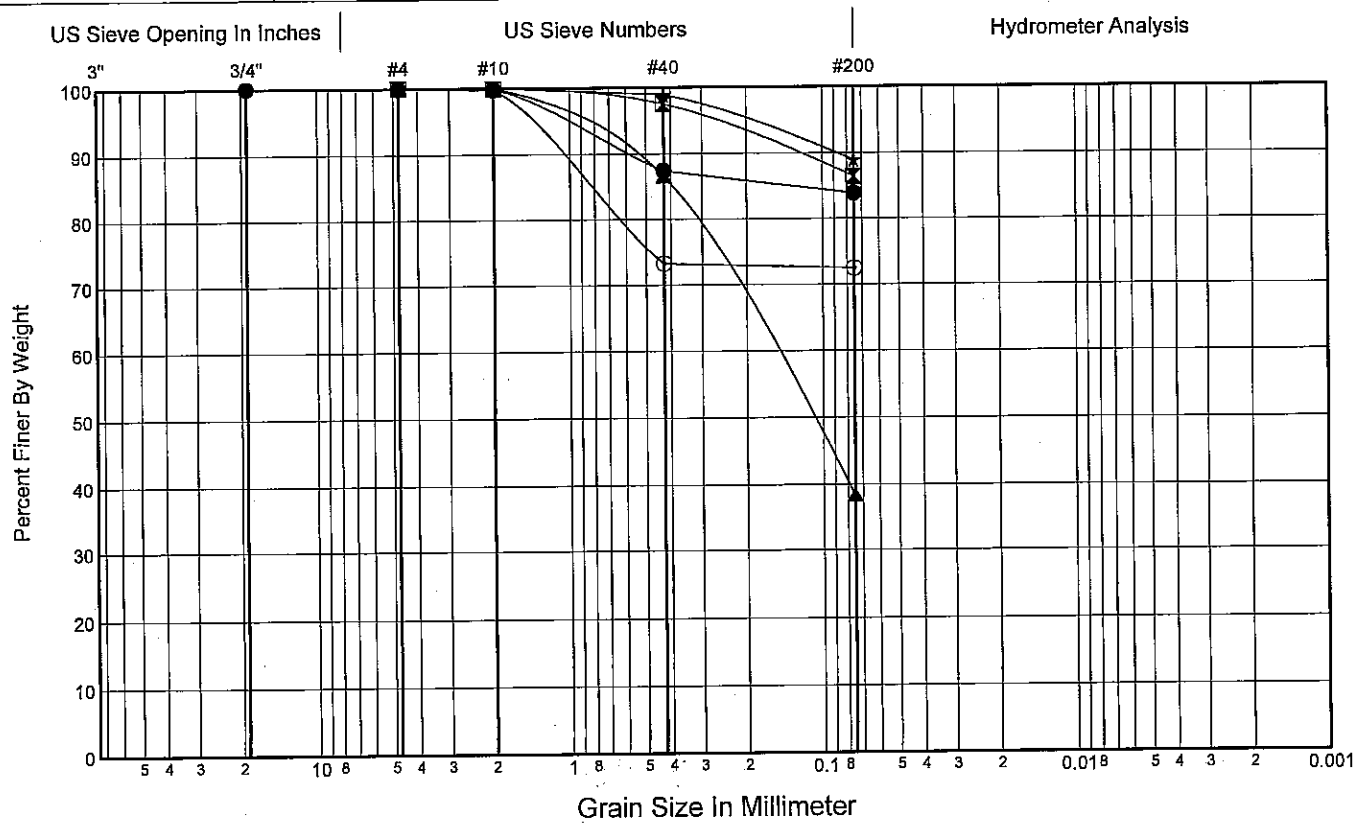
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	50.0	15.24	VS-20	CH	See Boring Log	FAT CLAY with SAND	52	63	19	44
⊠	53.0	16.15	D-21	CL	See Boring Log	LEAN CLAY	30	33	16	17
▲	58.0	17.68	D-23	SM	See Boring Log	SILTY SAND	13			
★	63.0	19.20	D-25	ML	See Boring Log	SILT	36			
⊙	68.0	20.73	D-27	CL	See Boring Log	LEAN CLAY with SAND	30	31	18	13

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.1	16.1	83.8		
⊠	0.0	13.6	86.4		
▲	0.0	61.7	38.3		
★	0.0	11.1	88.9		
⊙	0.1	27.4	72.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲	0.164	0.11			
★					
⊙					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-10-99** Sheet **4** of **4**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

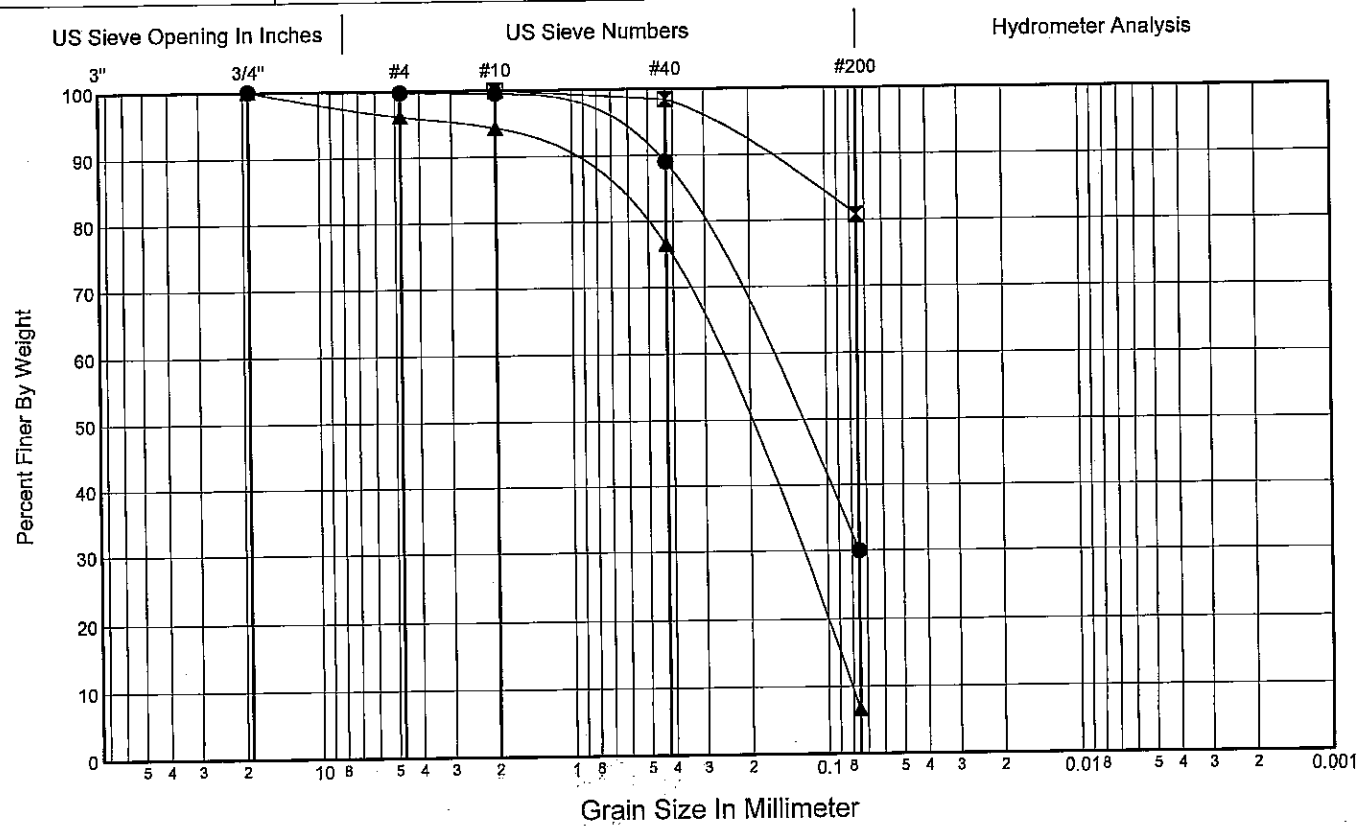
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	73.0	22.25	D-29	SM	See Boring Log	SILTY SAND	20			
⊠	75.0	22.86	D-30	CL	See Boring Log	LEAN CLAY with SAND	26	33	17	16
▲	90.0	27.43	D-33	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	16			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.3	69.8	30.0		
⊠	0.0	19.2	80.8		
▲	3.9	89.6	6.5	0.8	3.5

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.181	0.14	0.08		
⊠					
▲	0.283	0.22	0.13	0.10	0.082



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-11-99** Sheet **1** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

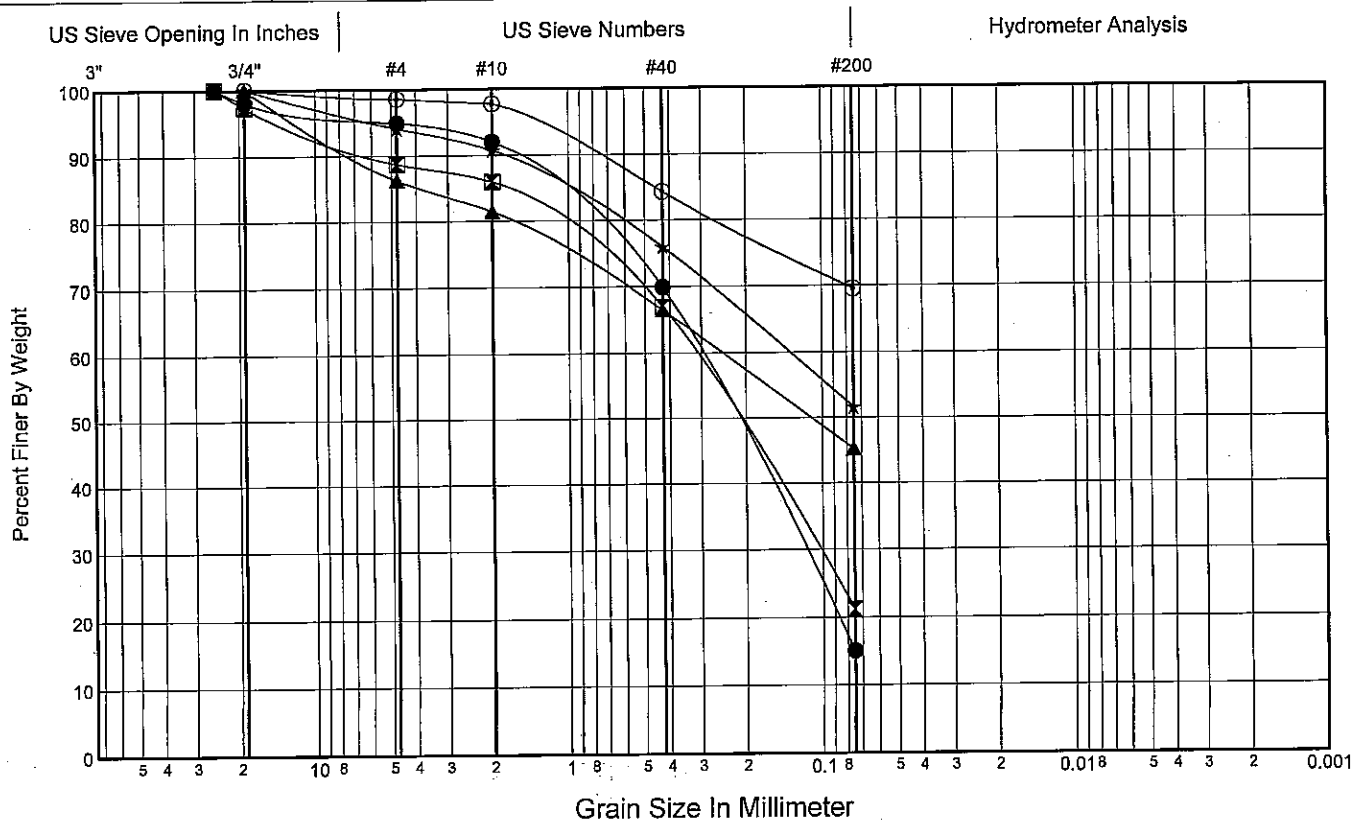
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	4.0	1.22	D-2	SM	See Boring Log	SILTY SAND	11			
⊠	7.0	2.13	D-3	SM	See Boring Log	SILTY SAND	12			
▲	12.0	3.66	D-5	SC	See Boring Log	CLAYEY SAND	17	24	15	9
★	19.0	5.79	D-8	CL	See Boring Log	SANDY LEAN CLAY	15	26	14	12
⊙	24.0	7.32	D-10	CL	See Boring Log	SANDY LEAN CLAY	29	32	17	15

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	5.1	79.8	15.1		
⊠	11.3	67.5	21.1		
▲	13.8	41.0	45.2		
★	5.9	42.5	51.6		
⊙	1.5	29.0	69.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.311	0.23	0.12	0.09	
⊠	0.326	0.22	0.10		
▲	0.251	0.11			
★	0.137				
⊙					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-11-99** Sheet **2** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

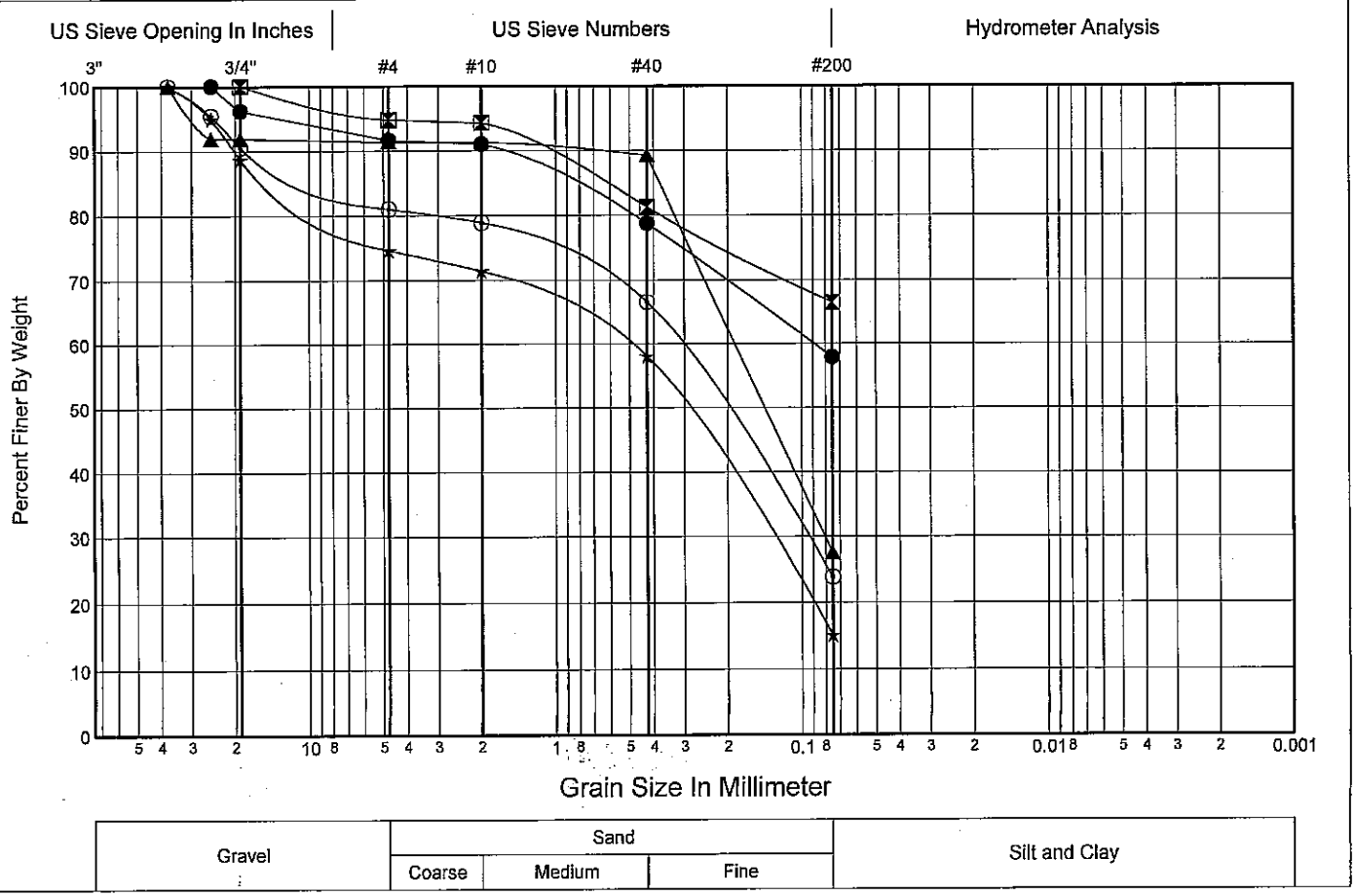
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	29.0	8.84	D-12	CL	See Boring Log	SANDY LEAN CLAY	19	25	16	9
⊠	37.0	11.28	D-15	CL	See Boring Log	SANDY LEAN CLAY	17	30	16	14
▲	44.0	13.41	D-18	SM	See Boring Log	SILTY SAND	19			
★	54.0	16.46	D-20	SM	See Boring Log	SILTY SAND with GRAVEL	10			
⊙	69.0	21.03	D-23	SM	See Boring Log	SILTY SAND with GRAVEL	11			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	8.4	33.8	57.9		
⊠	5.2	28.3	66.5		
▲	8.7	63.8	27.5		
★	25.4	59.5	15.1		
⊙	19.0	57.1	23.9		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.090				
⊠					
▲	0.187	0.14	0.08		
★	0.533	0.31	0.14	0.09	
⊙	0.326	0.22	0.10		



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-11-99** Sheet **3** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

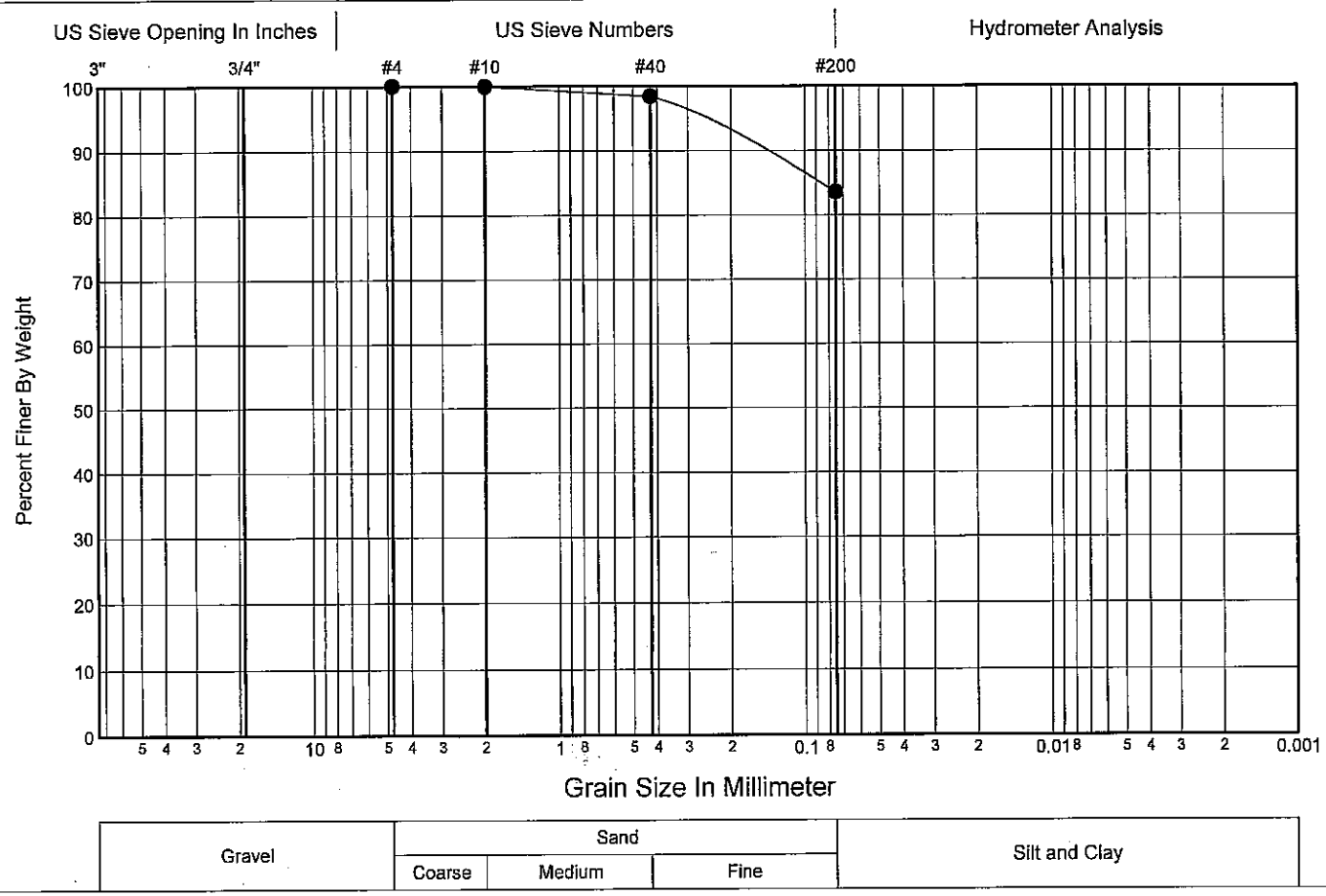
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	84.0	25.60	D-26	ML	See Boring Log	SILT with SAND	26			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	16.5	83.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-12-99** Sheet **1** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

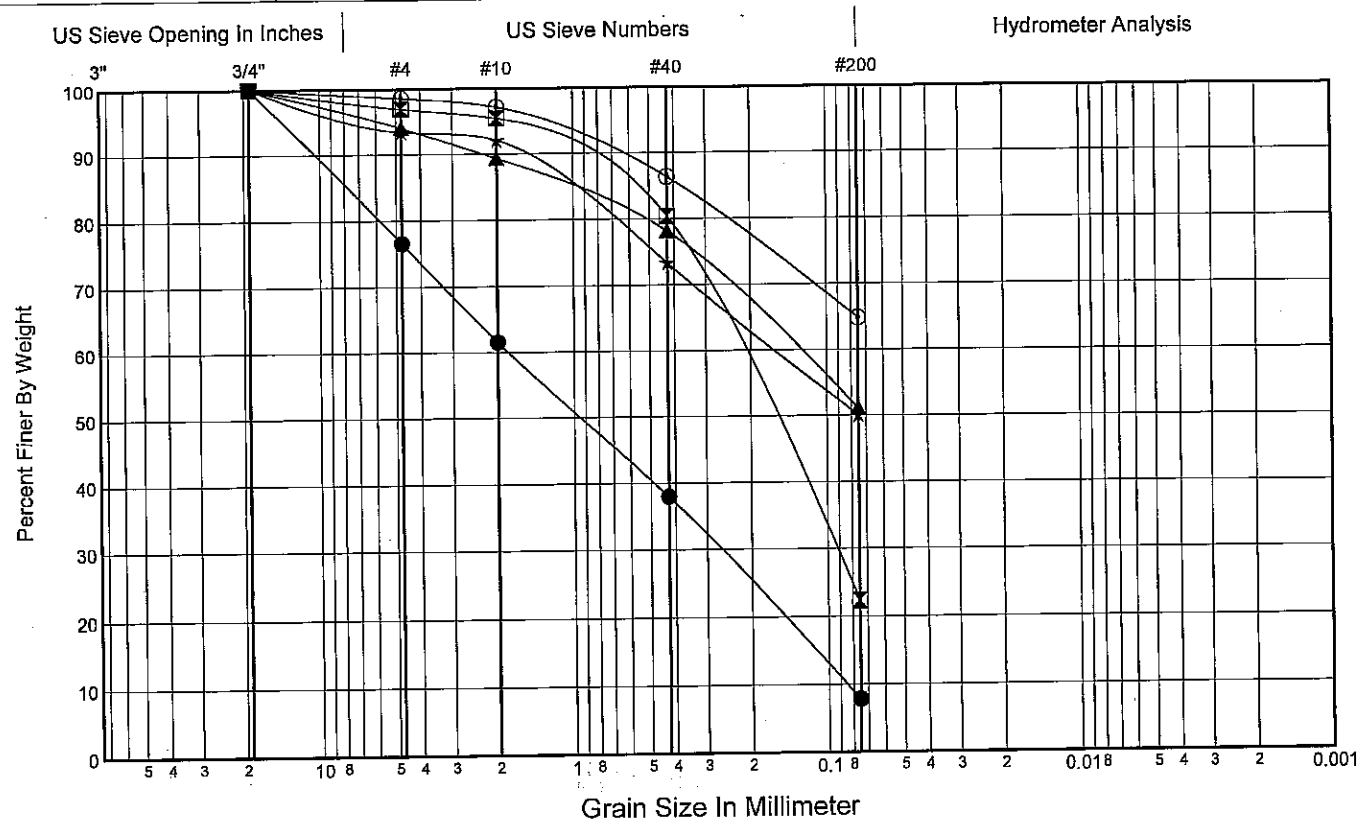
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	4.0	1.22	D-2	SP-SM	See Boring Log	POORLY GRADED SAND with SILT and GRAVEL	12			
⊠	7.0	2.13	D-3	SM	See Boring Log	SILTY SAND	20			
▲	14.0	4.27	D-6	CL	See Boring Log	SANDY LEAN CLAY	17	24	14	10
★	19.0	5.79	D-8	CL	See Boring Log	SANDY LEAN CLAY	17	27	14	13
⊙	29.0	8.84	VS-12	CL	See Boring Log	SANDY LEAN CLAY	23	29	16	13

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	23.5	68.7	7.8	0.5	21.3
⊠	3.1	74.6	22.3		
▲	6.1	42.9	51.1		
★	6.7	43.3	50.0		
⊙	1.5	33.7	64.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	1.814	0.94	0.27	0.15	0.085
⊠	0.231	0.17	0.09		
▲	0.133				
★	0.157				
⊙					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-12-99** Sheet **2** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

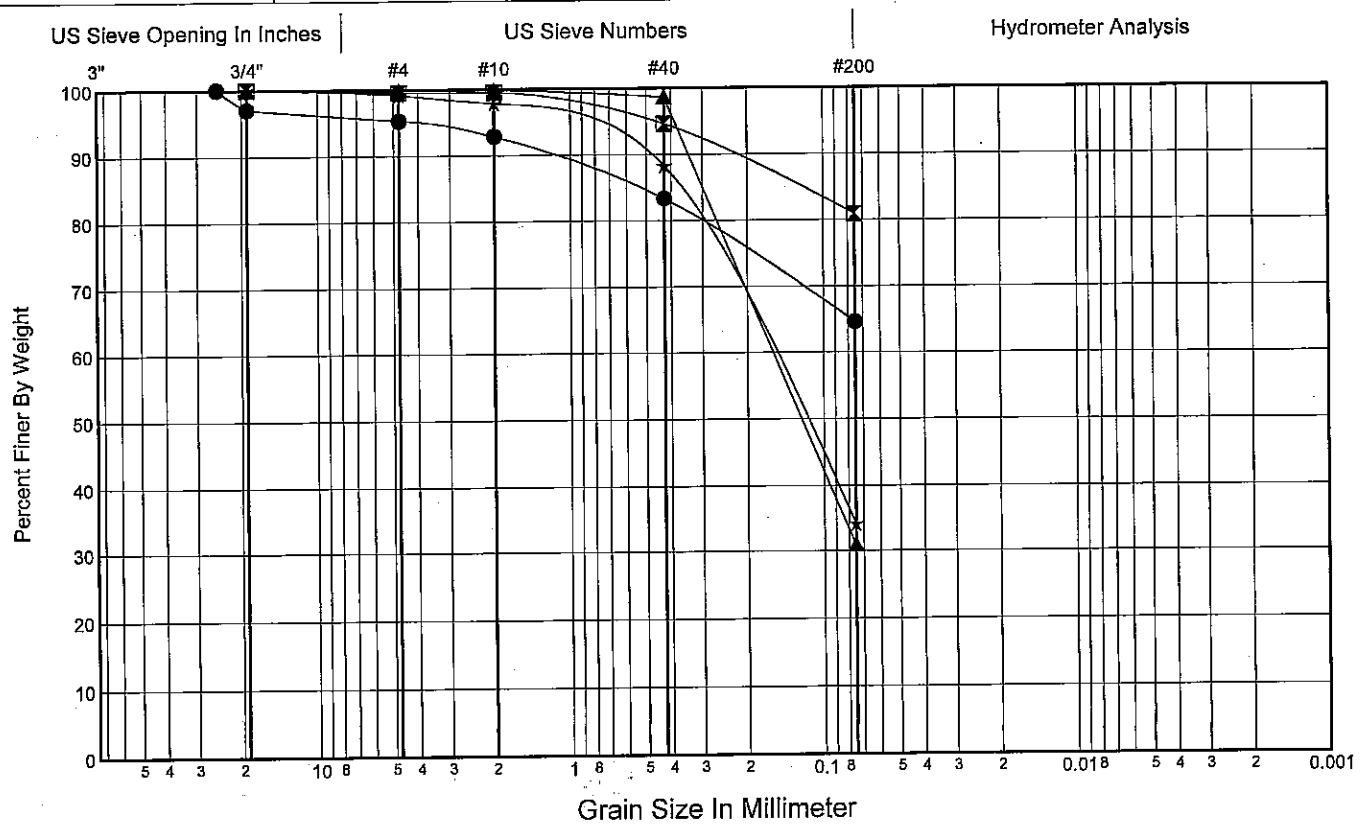
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	32.0	9.75	D-13	CL	See Boring Log	SANDY LEAN CLAY	27	29	15	14
⊠	42.0	12.80	D-17	CL	See Boring Log	LEAN CLAY with SAND	27	27	15	12
▲	54.0	16.46	D-22	SM	See Boring Log	SILTY SAND	23			
★	69.0	21.03	D-25	SM	See Boring Log	SILTY SAND	17			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	4.8	30.7	64.5		
⊠	0.5	18.6	80.9		
▲	0.2	68.9	30.9		
★	0.9	65.0	34.1		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲	0.158	0.12			
★	0.172	0.12			



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-1-01** Sheet **1** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

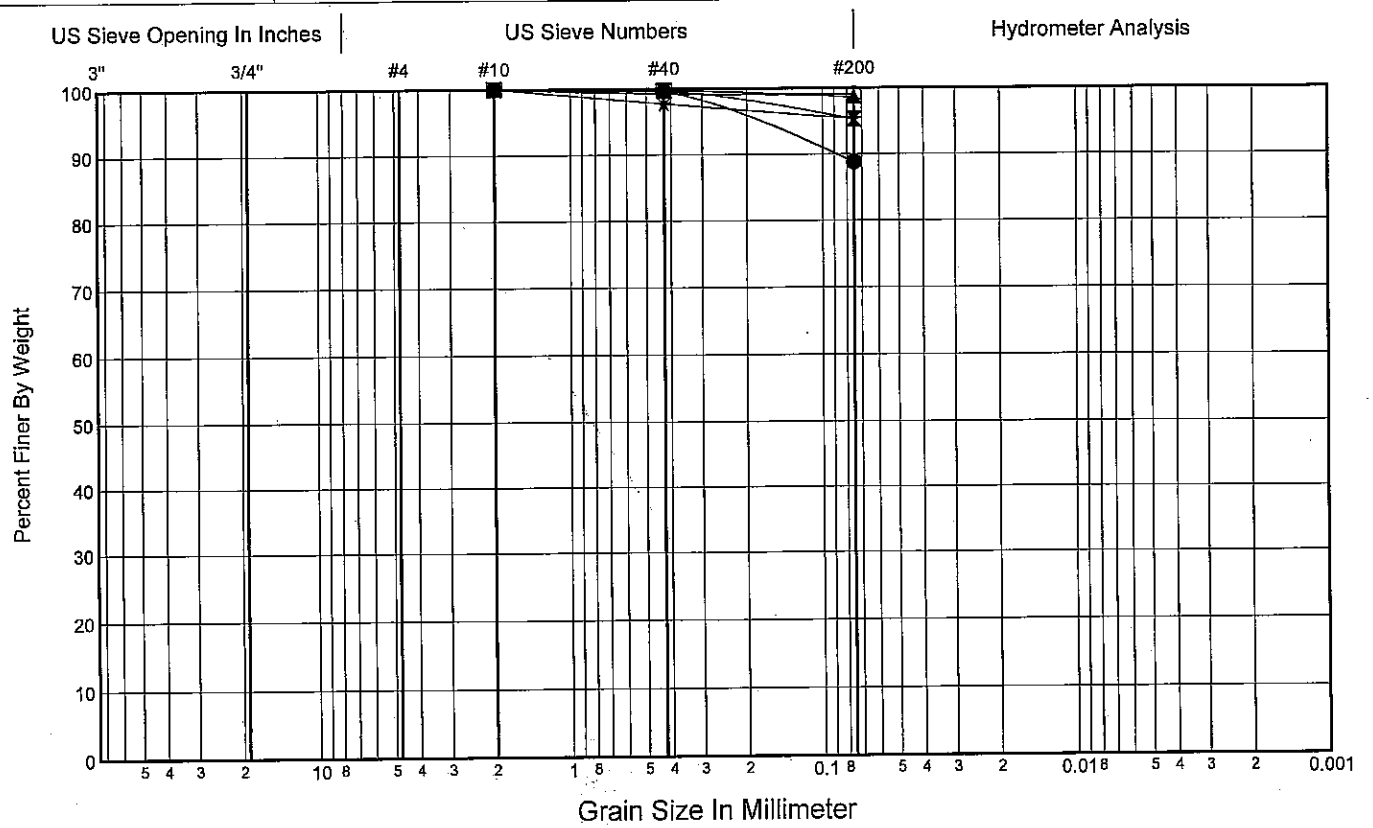
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	1.5	0.46	D-2	CH	See Boring Log	FAT CLAY	28	51	26	25
⊠	5.0	1.52	D-4	CH	See Boring Log	FAT CLAY	47	51	25	26
▲	6.5	1.98	D-5	CH	See Boring Log	FAT CLAY	44	61	24	37
★	8.5	2.59	D-6	CH	See Boring Log	FAT CLAY	49	64	25	39
⊙	11.5	3.51	D-8	CH	See Boring Log	FAT CLAY	75	73	16	57

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	11.3	88.7		
⊠	0.0	4.8	95.2		
▲	0.0	1.5	98.5		
★	0.0	4.7	95.3		
⊙	0.0	1.0	99.0		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					
★					
⊙					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-1-01** Sheet **2** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

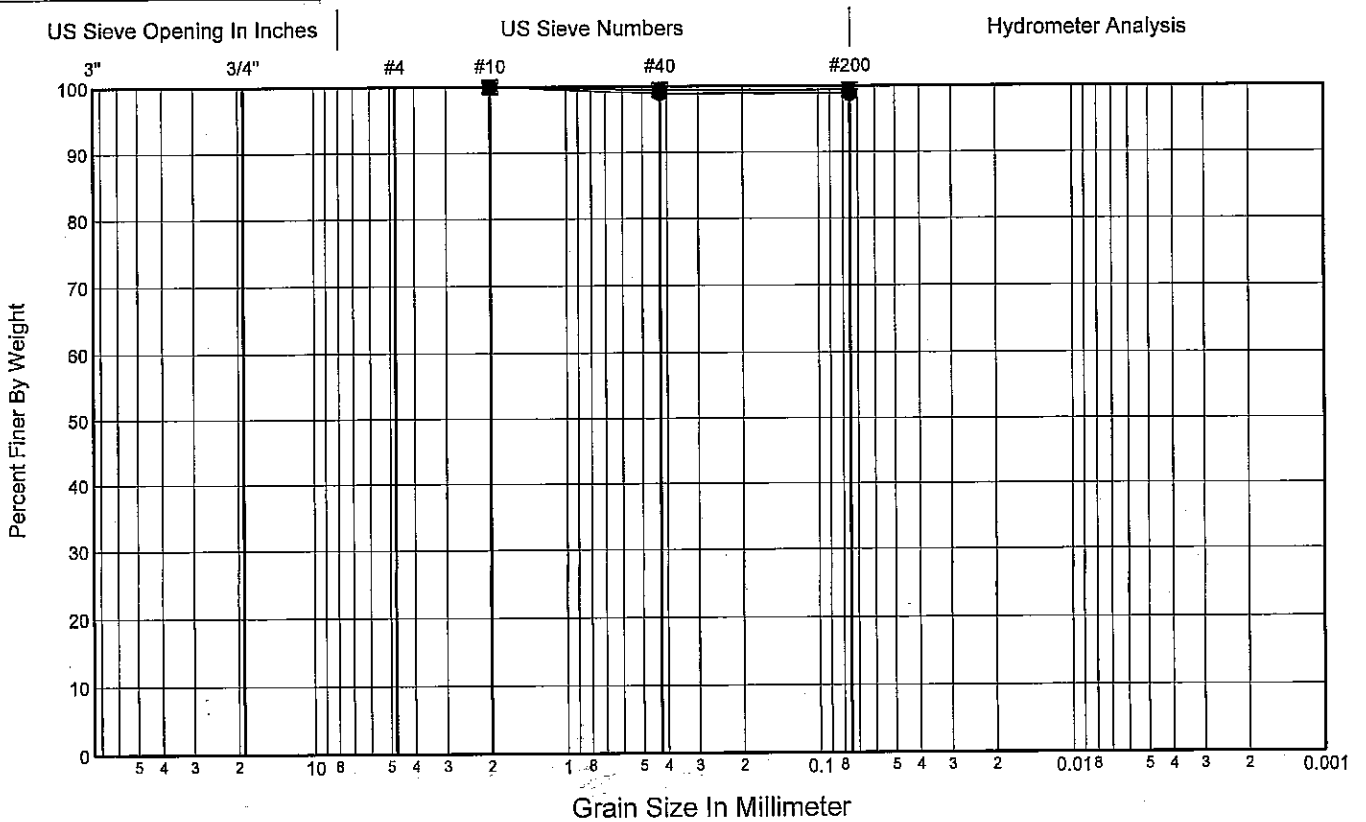
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	18.5	5.64	D-10	CH	See Boring Log	FAT CLAY	78	75	25	50
☒	23.5	7.16	D-11	CH	See Boring Log	FAT CLAY	72	68	9	59

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	1.2	98.8		
☒	0.0	0.7	99.3		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
☒					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-2-01** Sheet **1** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

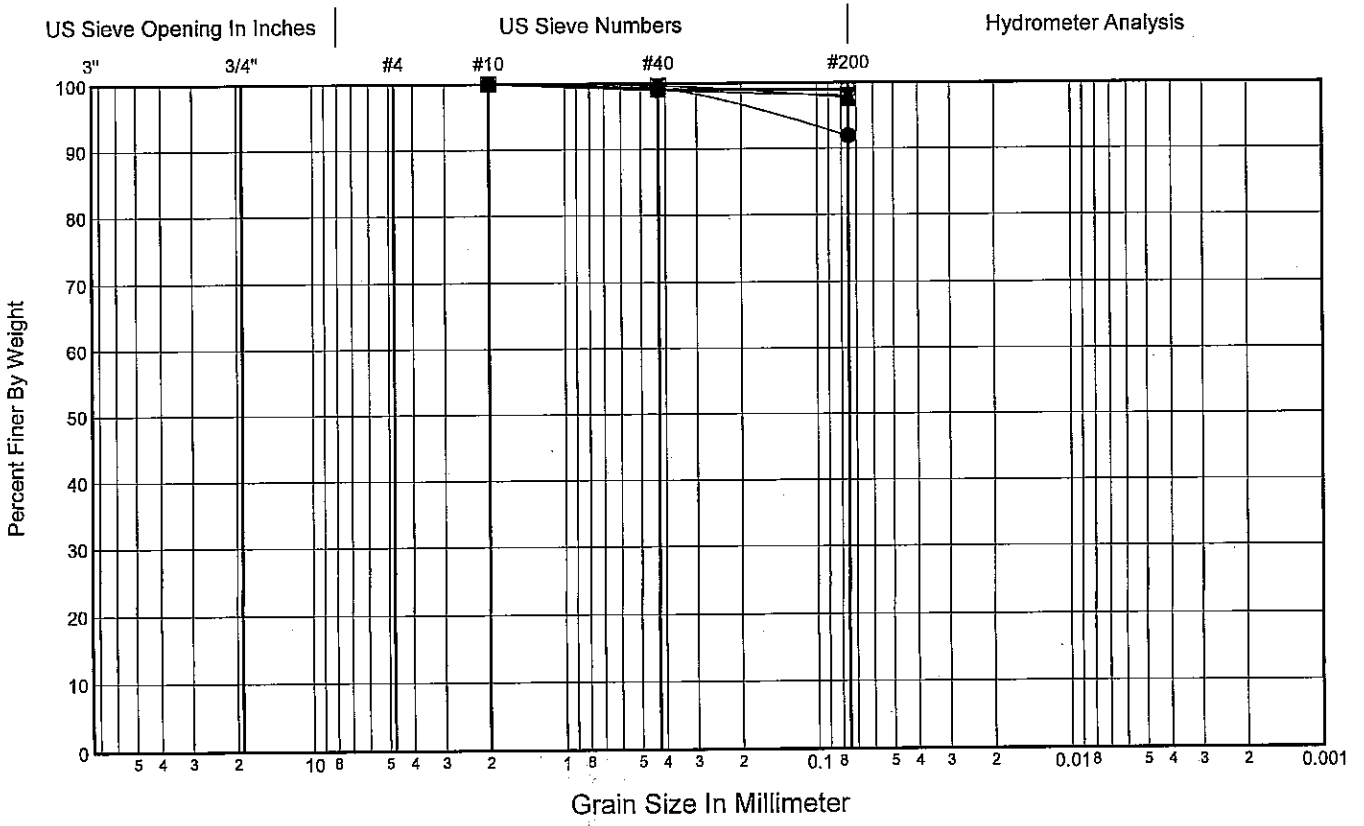
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	1.5	0.46	D-2	MH	See Boring Log	ELASTIC SILT	37	54	30	24
⊠	5.0	1.52	D-3	CL	See Boring Log	LEAN CLAY	47	49	24	25
▲	7.5	2.29	D-4	CH	See Boring Log	FAT CLAY	61	78	28	50
★	11.5	3.51	D-5	CH	See Boring Log	FAT CLAY	74	69	25	44
⊙	14.0	4.27	D-6	CH	See Boring Log	FAT CLAY	77	68	26	42

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	8.1	91.9		
⊠	0.0	2.3	97.7		
▲	0.0	2.0	98.0		
★	0.0	1.0	99.0		
⊙	0.0	1.2	98.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					
★					
⊙					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-2-01** Sheet **2** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

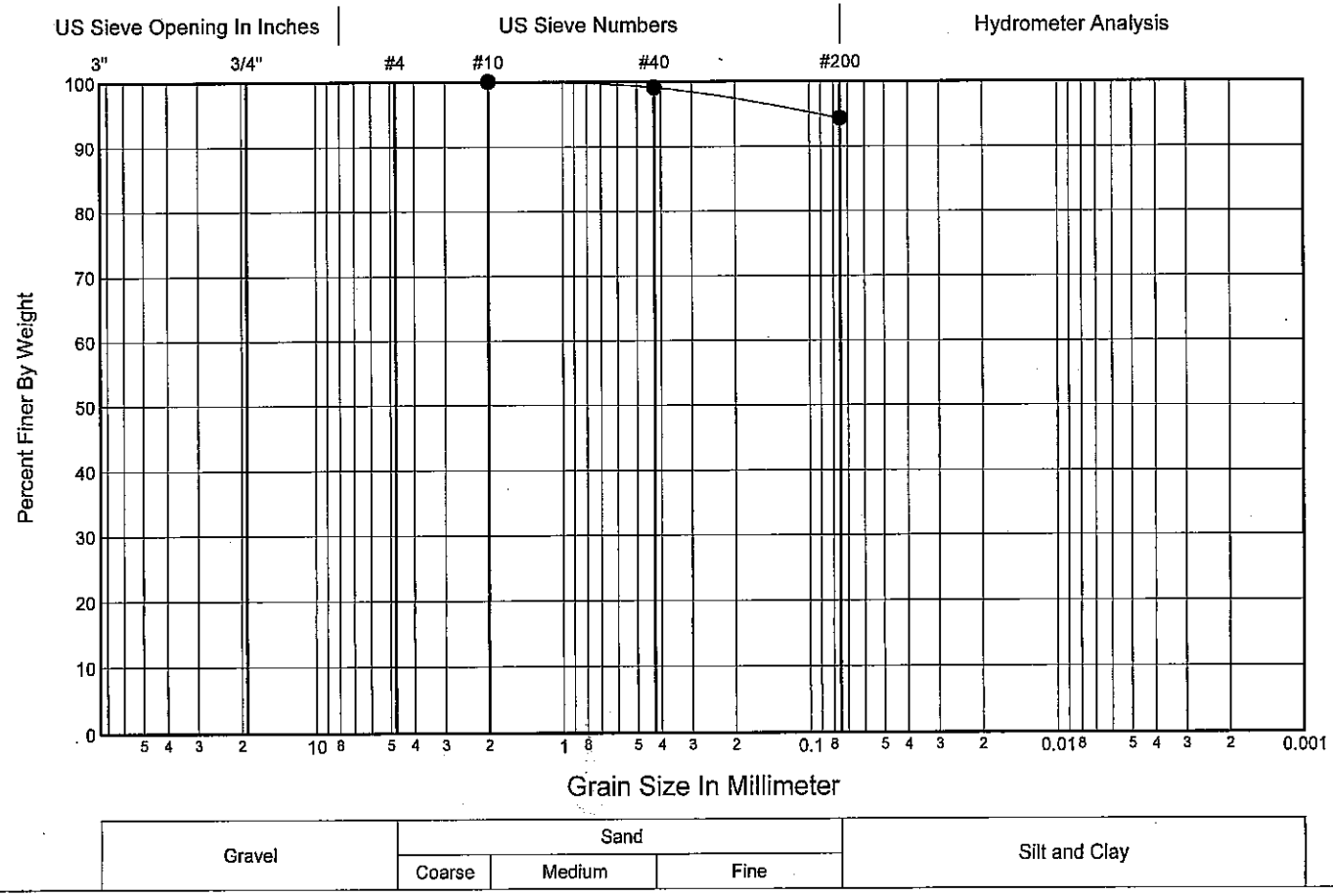
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	29.0	8.84	D-9	CL	See Boring Log	LEAN CLAY	73	34	19	15

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	5.7	94.3		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-3-01** Sheet **1** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

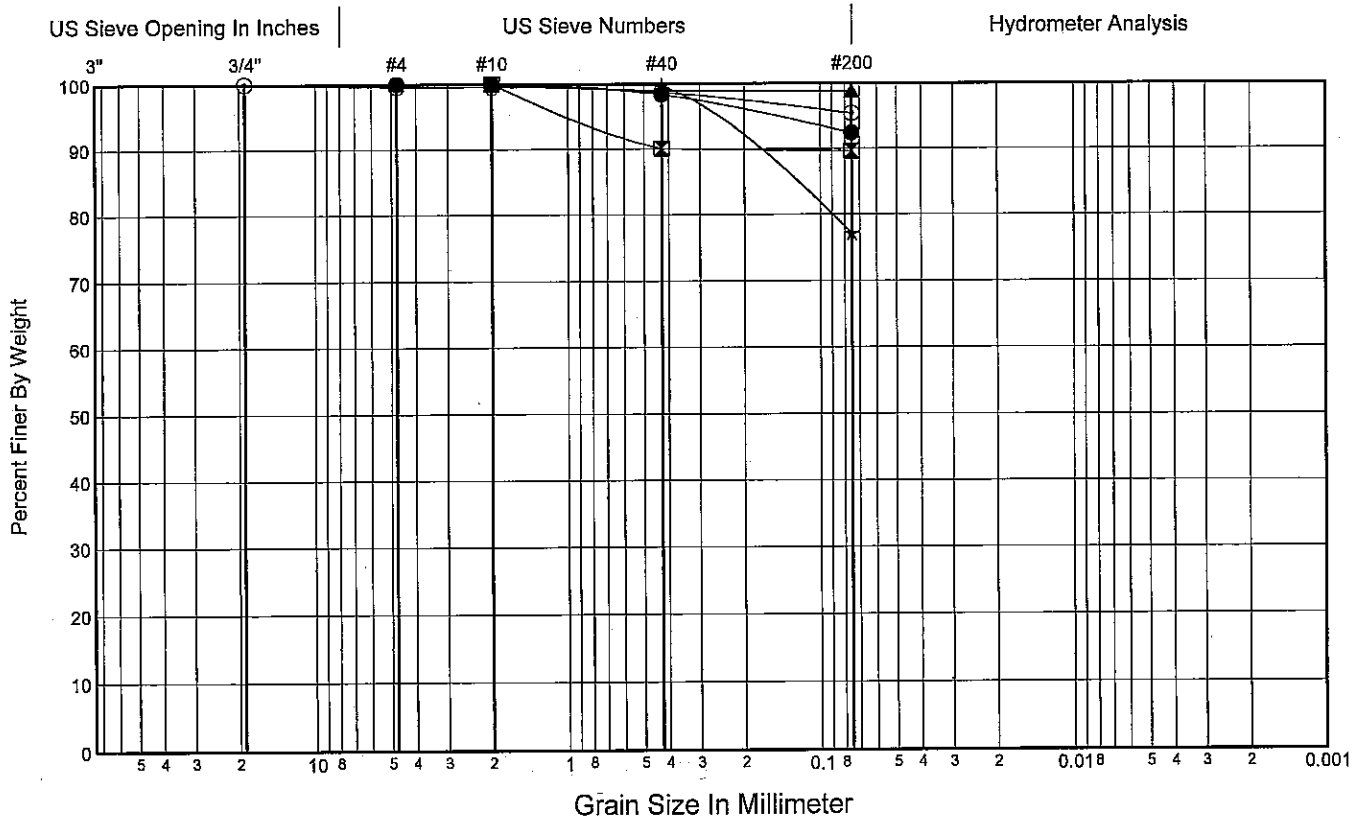
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	0.0	0.00	D-1	CH	See Boring Log	FAT CLAY	48	69	33	36
⊠	6.0	1.83	D-4	CH	See Boring Log	FAT CLAY	62	65	26	39
▲	13.0	3.96	D-7	CH	See Boring Log	FAT CLAY	62	65	25	40
★	19.0	5.79	D-8	ML	See Boring Log	SILT with SAND	32	22	NP	22
⊙	38.0	11.58	D-14	CH	See Boring Log	FAT CLAY	35	59	21	38

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	7.7	92.3		
⊠	0.0	10.4	89.6		
▲	0.0	1.3	98.7		
★	0.0	22.9	77.1		
⊙	0.4	4.2	95.3		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					
★					
⊙					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-3-01** Sheet **2** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

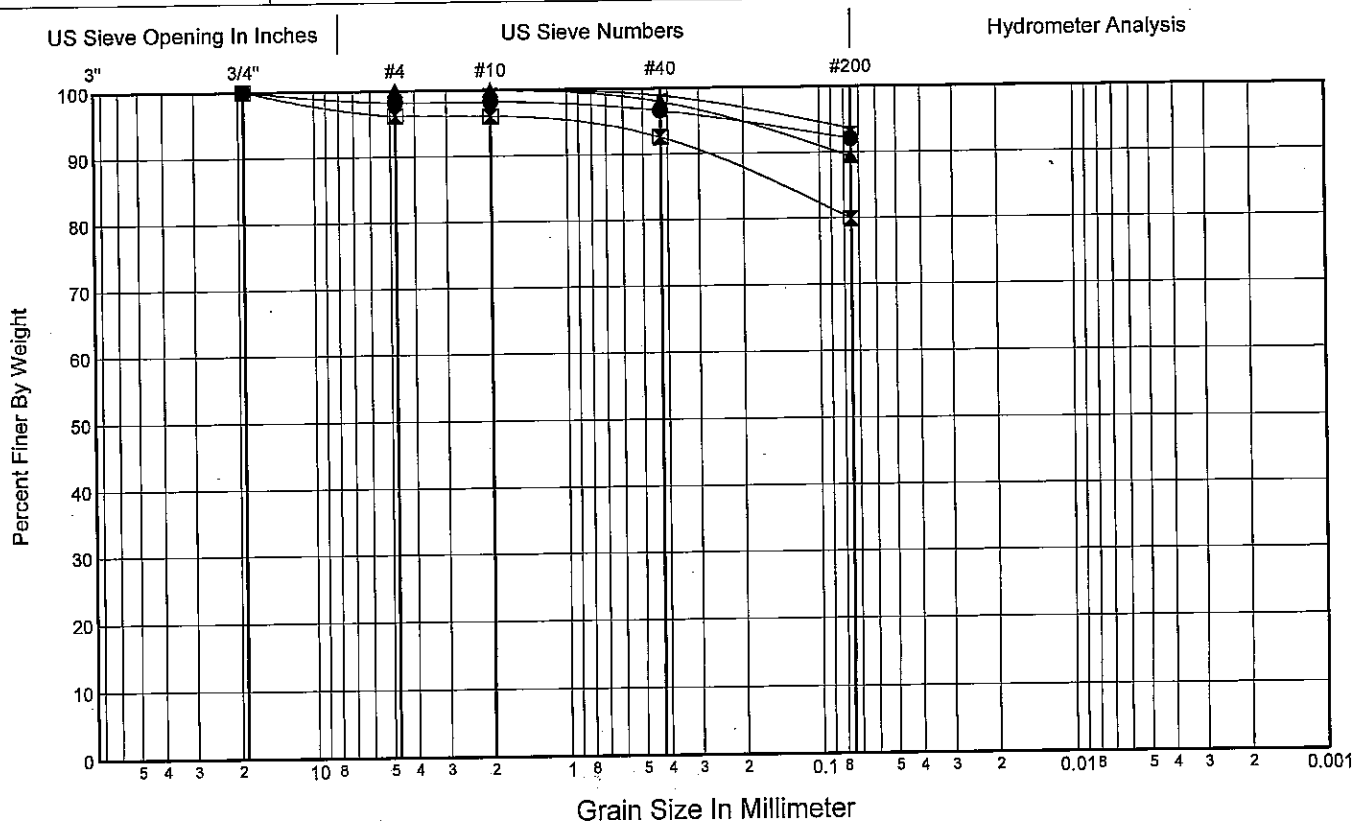
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	59.0	17.98	D-18	CL	See Boring Log	LEAN CLAY	37	42	18	24
⊠	79.0	24.08	D-22	CL	See Boring Log	LEAN CLAY with SAND	31	34	18	16
▲	99.0	30.18	D-26	CL	See Boring Log	LEAN CLAY	31	44	16	28
★	119.0	36.27	D-30	CL	See Boring Log	LEAN CLAY	30	29	19	10

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	1.8	6.2	92.0		
⊠	3.9	16.3	79.9		
▲	0.0	10.7	89.3		
★	0.0	6.5	93.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					
★					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-4-01** Sheet **1** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

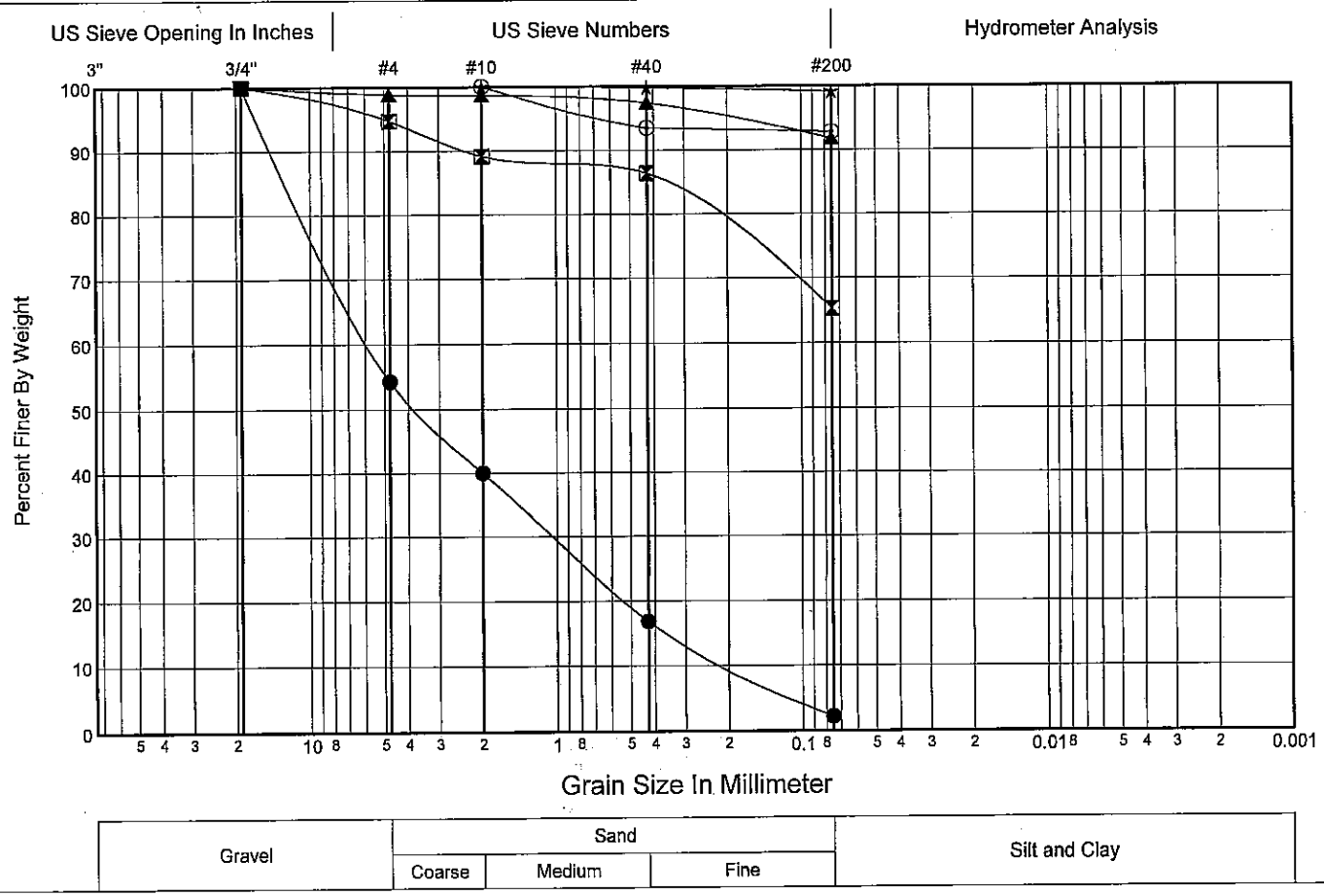
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	0.0	0.00	D-1	SP	See Boring Log	POORLY GRADED SAND with GRAVEL	9			
⊠	1.5	0.46	D2	CL	See Boring Log	SANDY LEAN CLAY	27	43	24	19
▲	3.0	0.91	D-3	CH	See Boring Log	FAT CLAY	45	57	28	29
★	7.0	2.13	D-5	CL	See Boring Log	LEAN CLAY	54	23	14	9
⊙	8.5	2.59	D-6	CH	See Boring Log	FAT CLAY	64	63	26	37

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	45.8	52.1	2.1	1.0	29.7
⊠	5.3	29.4	65.3		
▲	1.2	7.1	91.7		
★	0.0	0.9	99.1		
⊙	0.0	7.2	92.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	5.657	3.68	1.03	0.53	0.190
⊠					
▲					
★					
⊙					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-4-01** Sheet **2** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

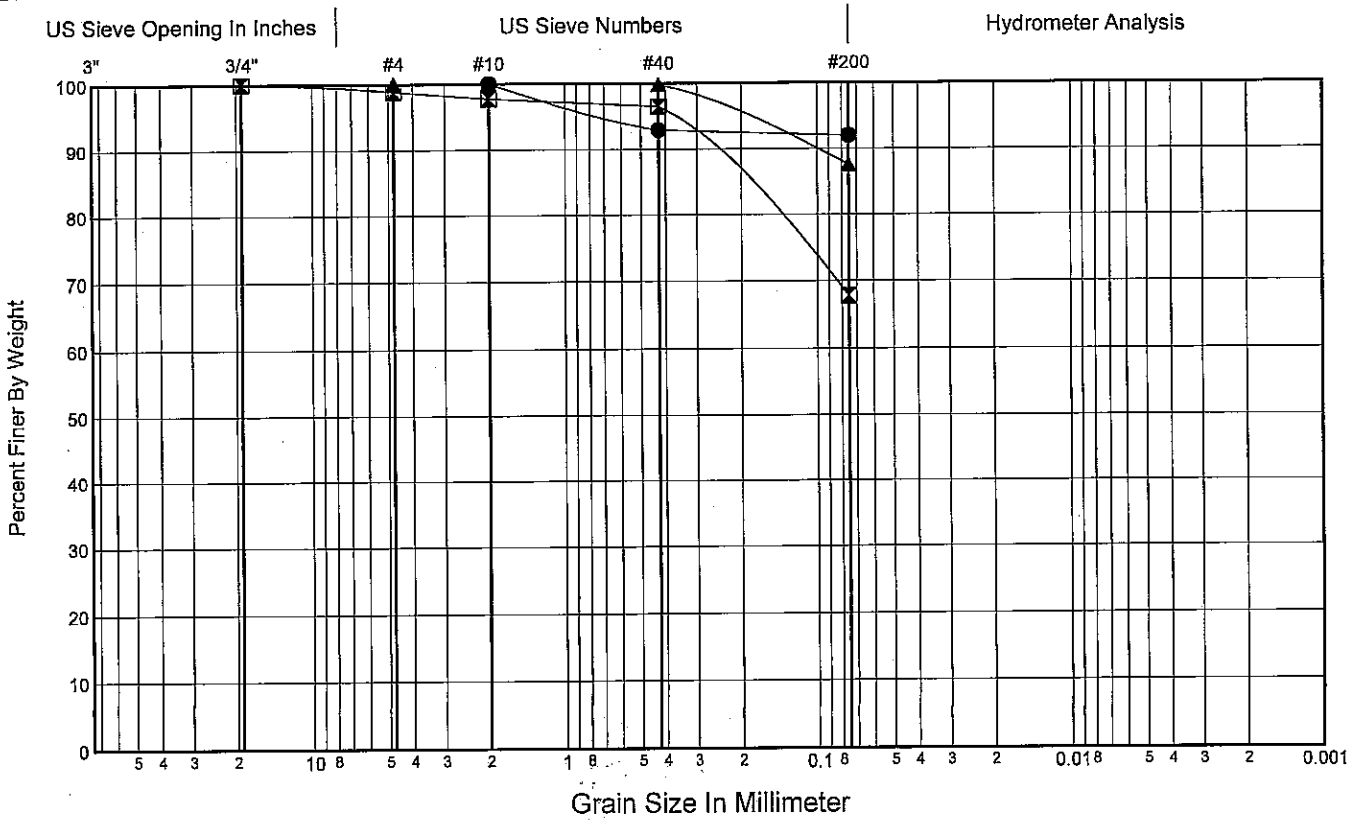
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	10.5	3.20	D-7	CH	See Boring Log	FAT CLAY	64	68	26	42
⊠	17.5	5.33	D-10	ML	See Boring Log	SANDY SILT	28	21	NP	21
▲	22.5	6.86	D-11	CL	See Boring Log	LEAN CLAY	31	28	16	12

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	8.1	91.9		
⊠	1.2	31.0	67.8		
▲	0.0	12.5	87.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-5-01** Sheet **1** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

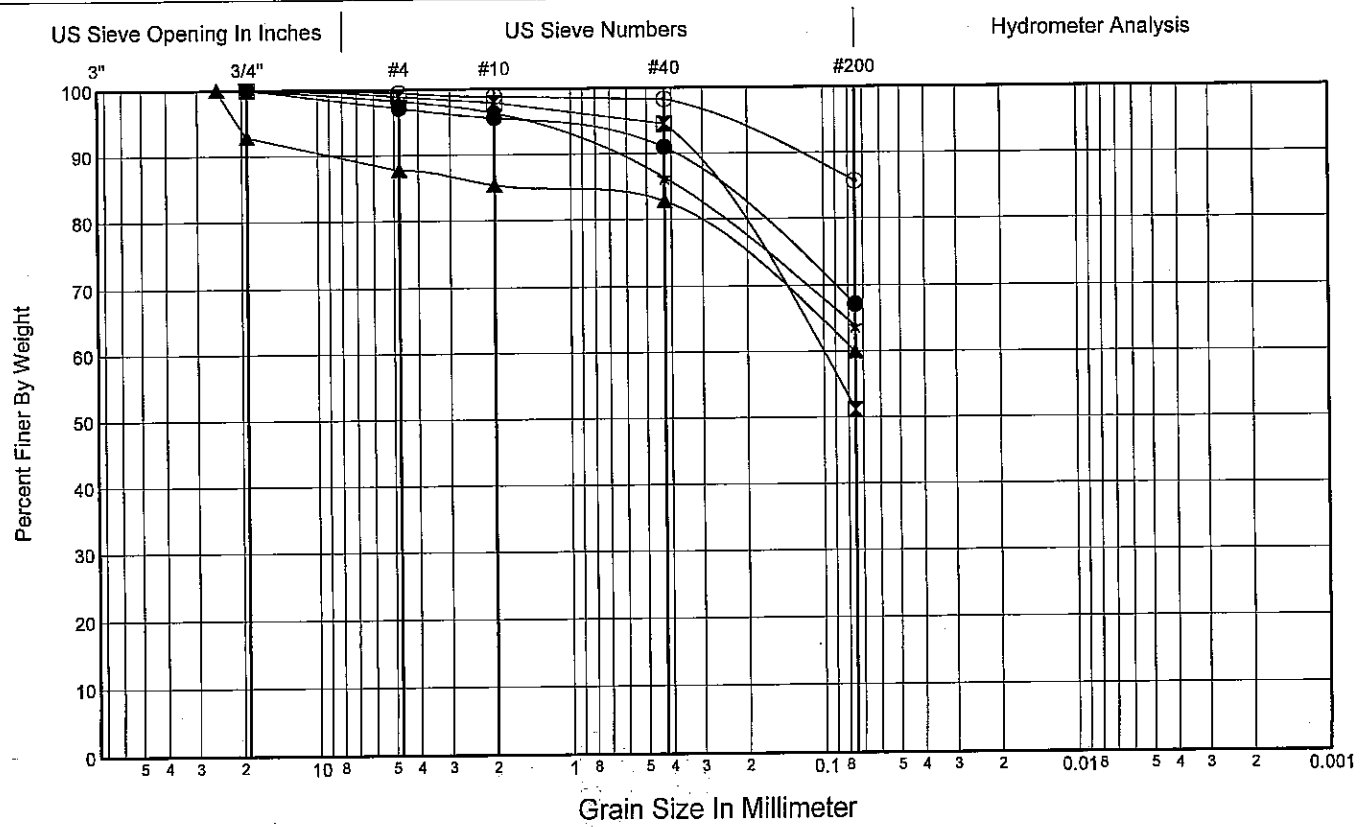
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	0.0	0.00	D-1	ML	See Boring Log	SANDY SILT	32	33	NP	33
⊠	3.0	0.91	D-3	ML	See Boring Log	SANDY SILT	21	21	NP	21
▲	8.0	2.44	D-5	ML	See Boring Log	SANDY SILT	14	21	NP	21
★	13.0	3.96	D-6	CL	See Boring Log	SANDY LEAN CLAY	18	26	15	11
⊙	33.0	10.06	D-9	CL	See Boring Log	LEAN CLAY	24	33	16	17

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	2.9	30.0	67.1		
⊠	1.2	47.8	51.1		
▲	12.3	27.8	59.9		
★	1.8	34.4	63.8		
⊙	0.6	13.8	85.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠	0.107				
▲	0.076				
★					
⊙					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-5-01** Sheet **2** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

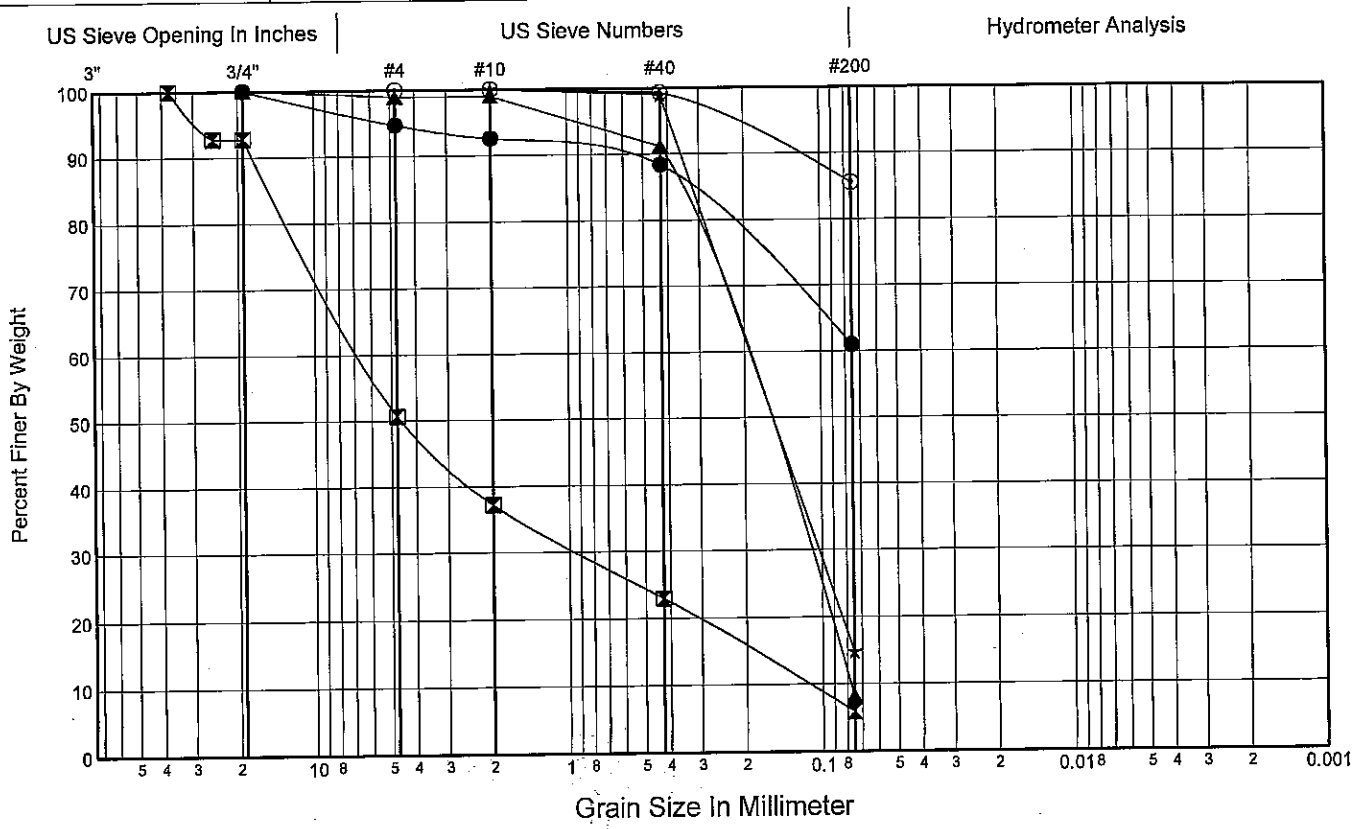
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	53.0	16.15	D-12	CL	See Boring Log	SANDY LEAN CLAY	20	24	14	10
⊠	68.0	20.73	D-15	GW-GM	See Boring Log	WELL-GRADED GRAVEL with SILT and SAND	7			
▲	73.0	22.25	D-16	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	21			
★	78.0	23.77	D-17	SM	See Boring Log	SILTY SAND	21			
⊙	93.0	28.35	D-20	ML	See Boring Log	SILT	17	27	NP	27

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	5.4	33.7	61.0		
⊠	49.3	44.8	5.8	1.1	56.5
▲	1.1	90.8	8.1	0.8	2.8
★	0.0	85.2	14.8		
⊙	0.0	14.5	85.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠	6.463	4.55	0.92	0.32	0.114
▲	0.222	0.18	0.12	0.10	0.078
★	0.190	0.15	0.10	0.08	
⊙					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-5-01** Sheet **3** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

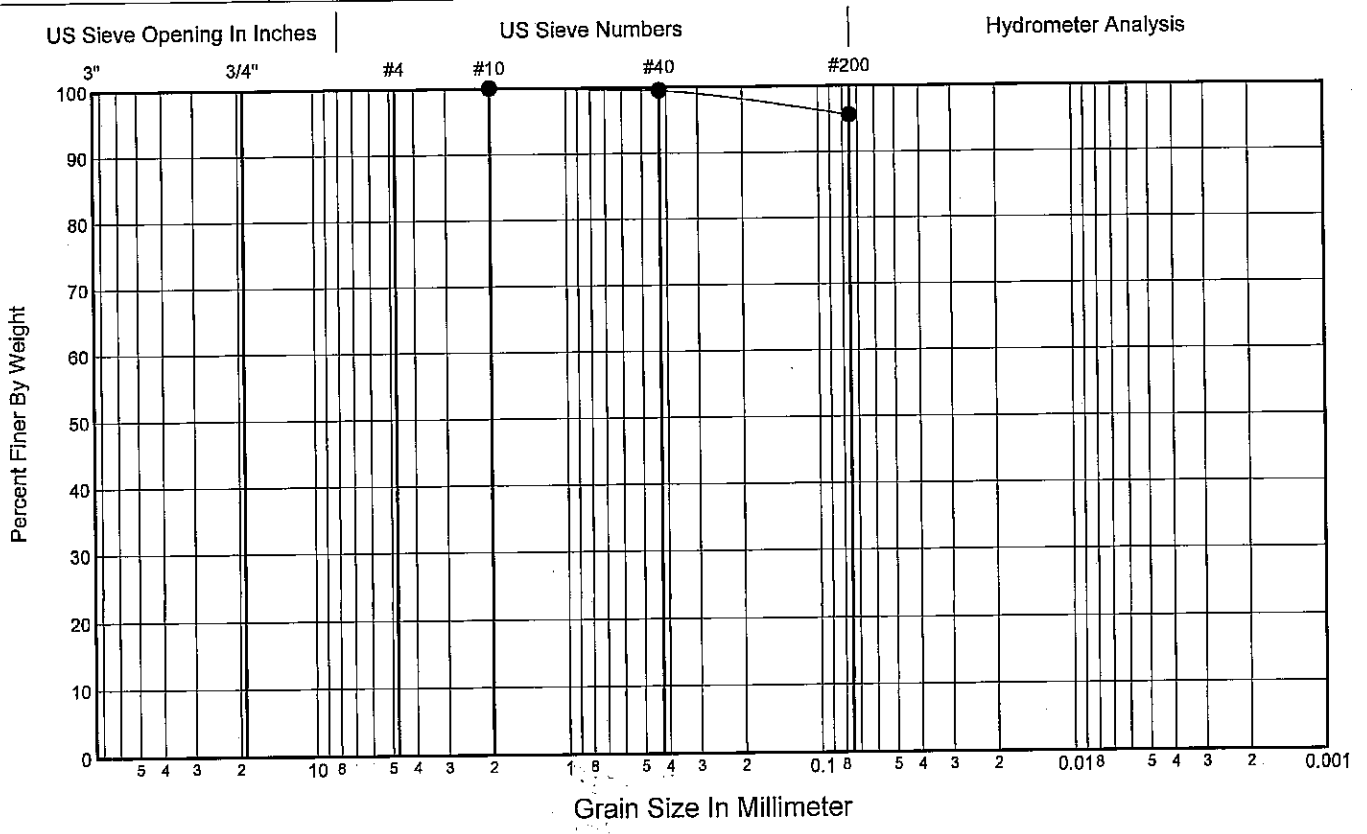
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	98.0	29.87	D-21	CL	See Boring Log	LEAN CLAY	21	34	20	14

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	4.4	95.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-6-01** Sheet **1** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

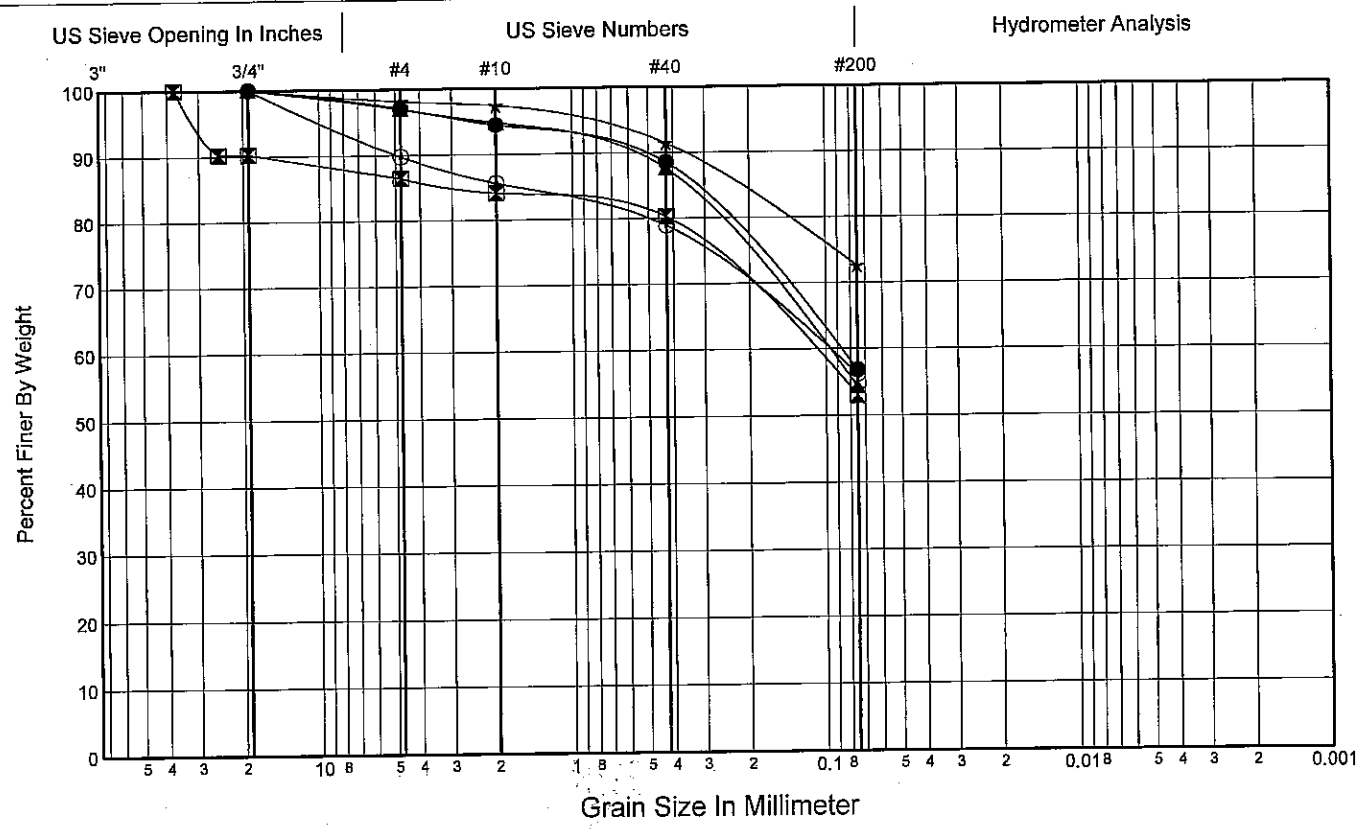
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	2.5	0.76	D-1	CL	See Boring Log	SANDY LEAN CLAY	19	25	16	9
⊠	7.5	2.29	D-2	CL	See Boring Log	SANDY LEAN CLAY	27	26	15	11
▲	12.5	3.81	D-3	ML	See Boring Log	SANDY SILT	15	22	20	2
★	17.5	5.33	D-4	CL	See Boring Log	LEAN CLAY with SAND	32	31	16	15
⊙	32.5	9.91	D-6	CL-ML	See Boring Log	SANDY SILTY CLAY	22	19	15	4

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	3.0	40.2	56.8		
⊠	13.6	33.4	53.1		
▲	3.1	42.6	54.3		
★	1.9	25.6	72.5		
⊙	10.3	33.5	56.2		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.089				
⊠	0.117				
▲	0.101				
★					
⊙	0.100				



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-6-01** Sheet **2** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

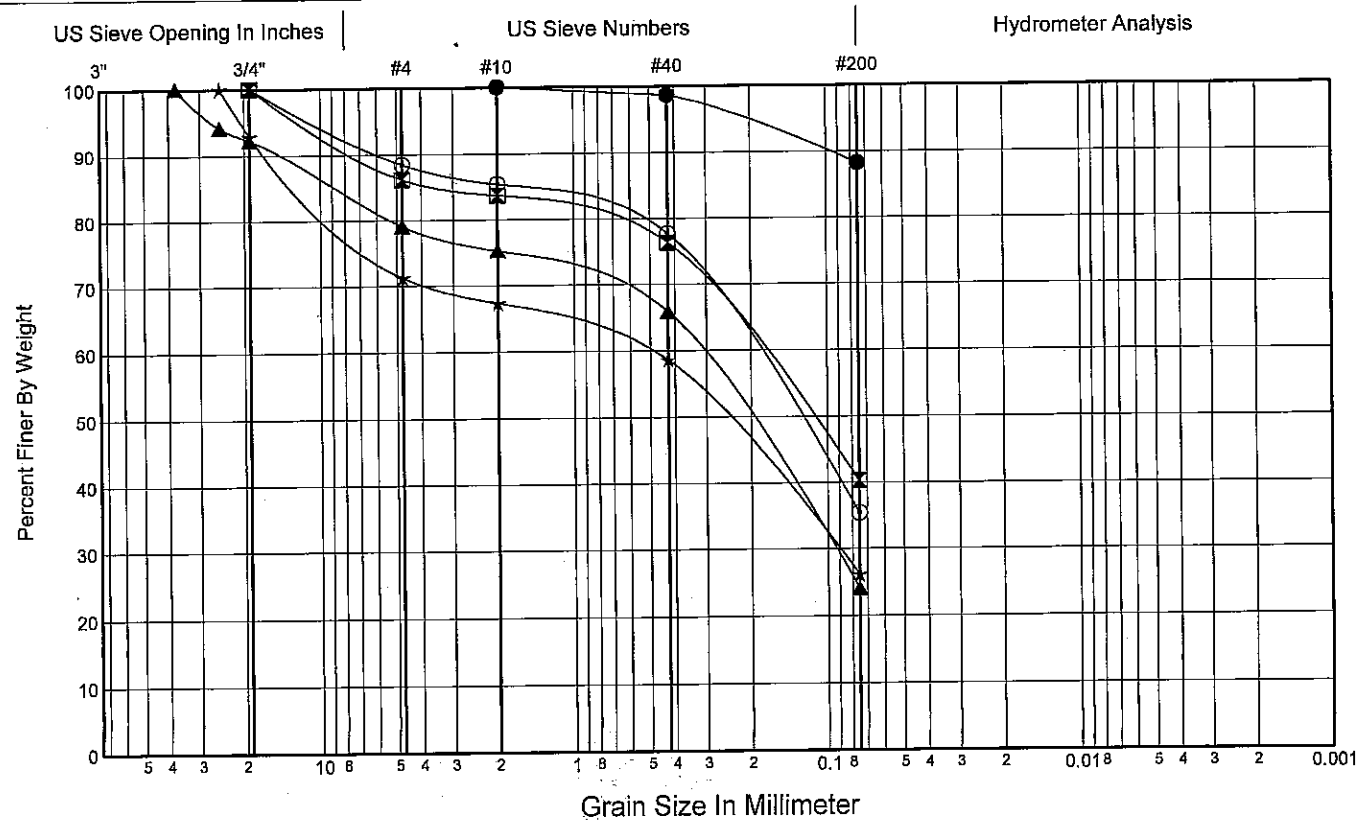
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	42.5	12.95	D-7	CL	See Boring Log	LEAN CLAY	39	30	15	15
⊠	47.5	14.48	D-8	SM	See Boring Log	SILTY SAND	11			
▲	57.5	17.53	D-10	SM	See Boring Log	SILTY SAND with GRAVEL	11			
★	62.5	19.05	D-11	SM	See Boring Log	SILTY SAND with GRAVEL	10			
⊙	72.5	22.10	D-13	SM	See Boring Log	SILTY SAND	10			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	11.8	88.2		
⊠	13.9	45.8	40.3		
▲	21.0	55.0	24.1		
★	28.8	45.1	26.1		
⊙	11.6	53.0	35.4		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠	0.194	0.12			
▲	0.333	0.22	0.10		
★	0.545	0.27	0.09		
⊙	0.206	0.14			



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-6-01** Sheet **3** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

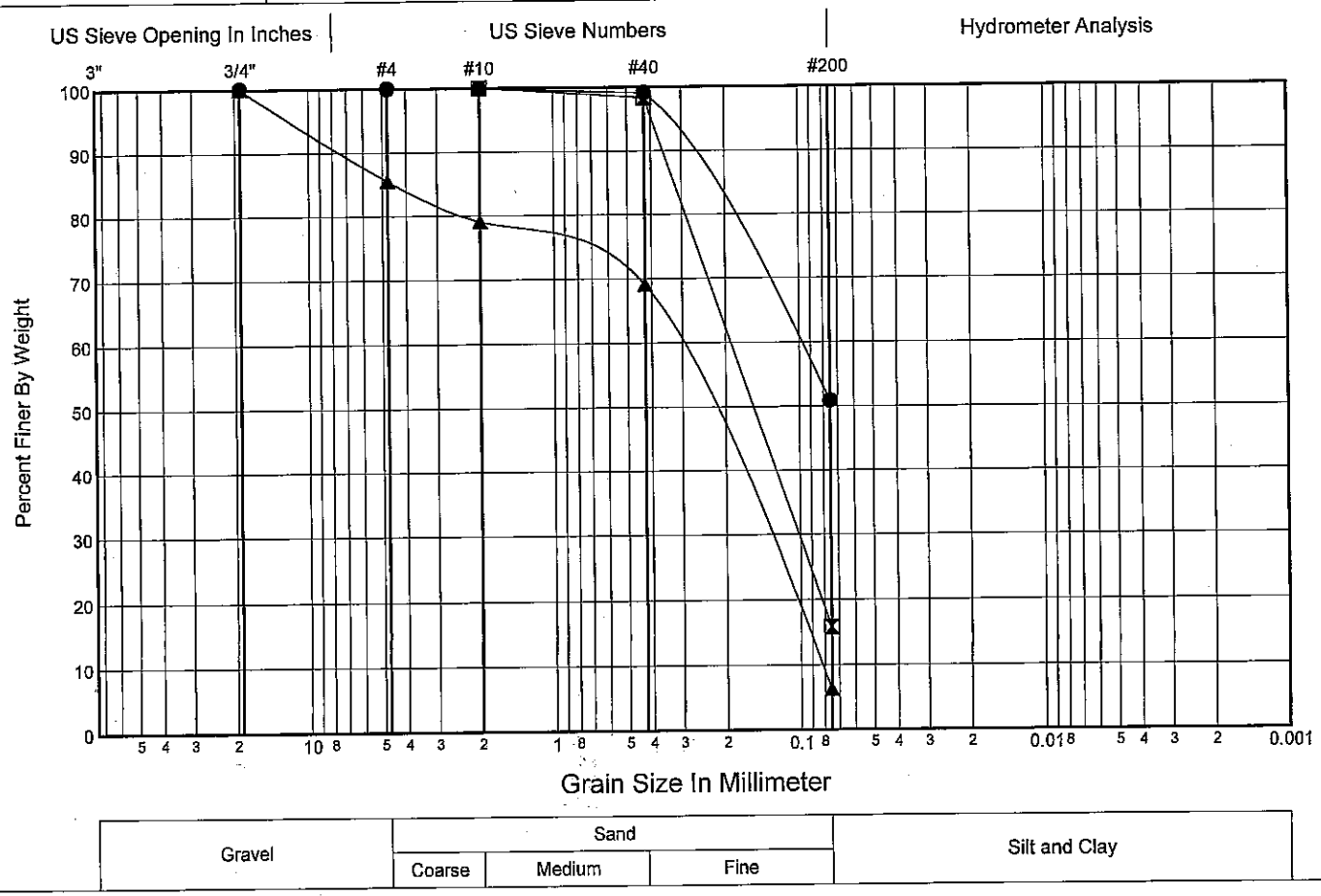
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	82.5	25.15	D-15	ML	See Boring Log	SANDY SILT	23			
⊠	87.5	26.67	D-16	SM	See Boring Log	SILTY SAND	24			
▲	92.5	28.19	D-17	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	16			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.1	49.0	50.9		
⊠	0.0	84.2	15.8		
▲	14.6	79.3	6.1	0.8	4.0

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.104				
⊠	0.190	0.15	0.10	0.08	
▲	0.331	0.25	0.14	0.11	0.083



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-7-01** Sheet **1** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

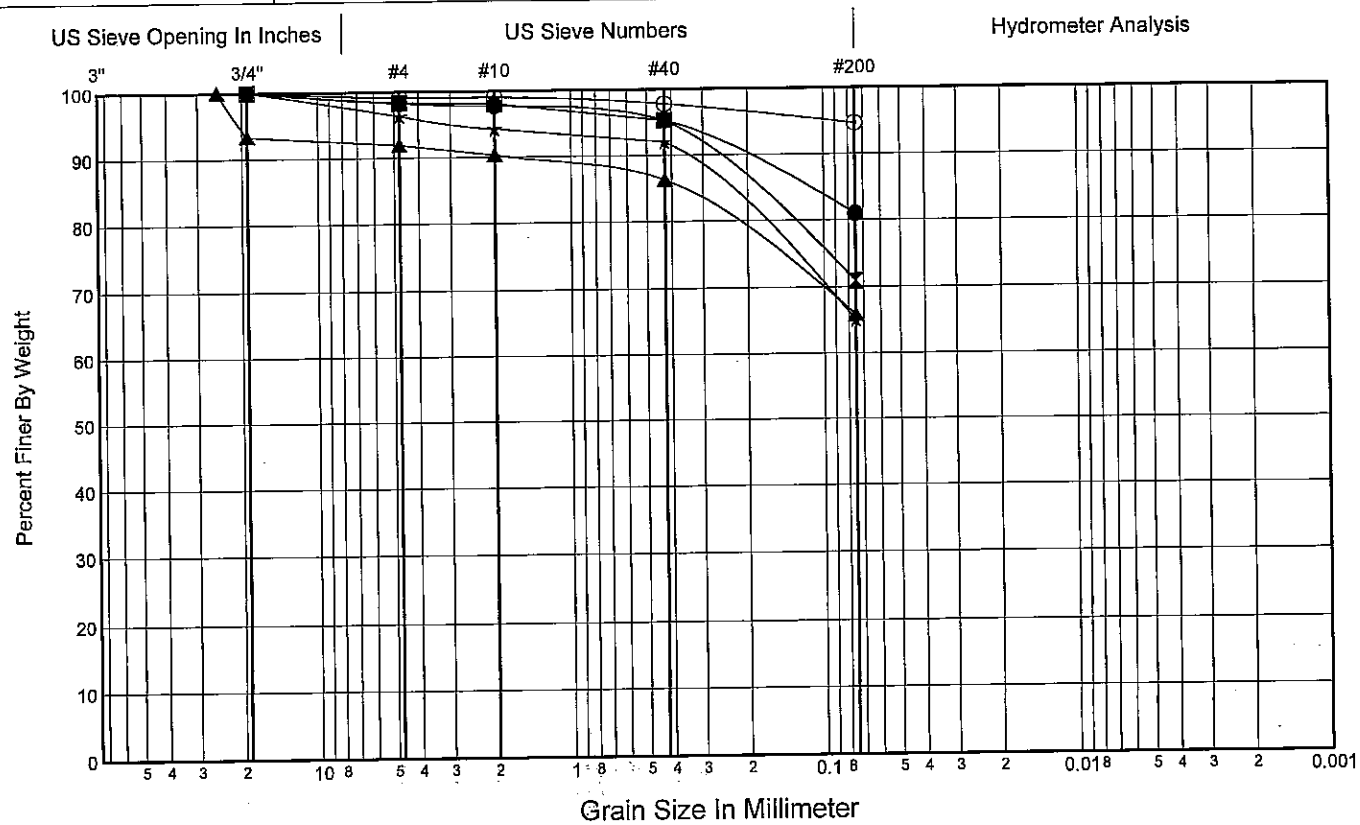
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	4.0	1.22	D-1	CL	See Boring Log	LEAN CLAY with SAND	23	41	22	19
⊠	16.0	4.88	D-4	CL	See Boring Log	LEAN CLAY with SAND	30	37	17	20
▲	19.0	5.79	U-5	CL	See Boring Log	SANDY LEAN CLAY	25	24	14	10
★	21.0	6.40	D-6	CH	See Boring Log	SANDY FAT CLAY	25	62	26	36
⊙	29.0	8.84	D-8	CH	See Boring Log	FAT CLAY	41	58	22	36

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	1.8	17.3	80.9		
⊠	1.7	27.5	70.8		
▲	8.1	26.0	65.9		
★	3.7	31.2	65.1		
⊙	0.9	4.5	94.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					
★					
⊙					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-7-01** Sheet **2** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

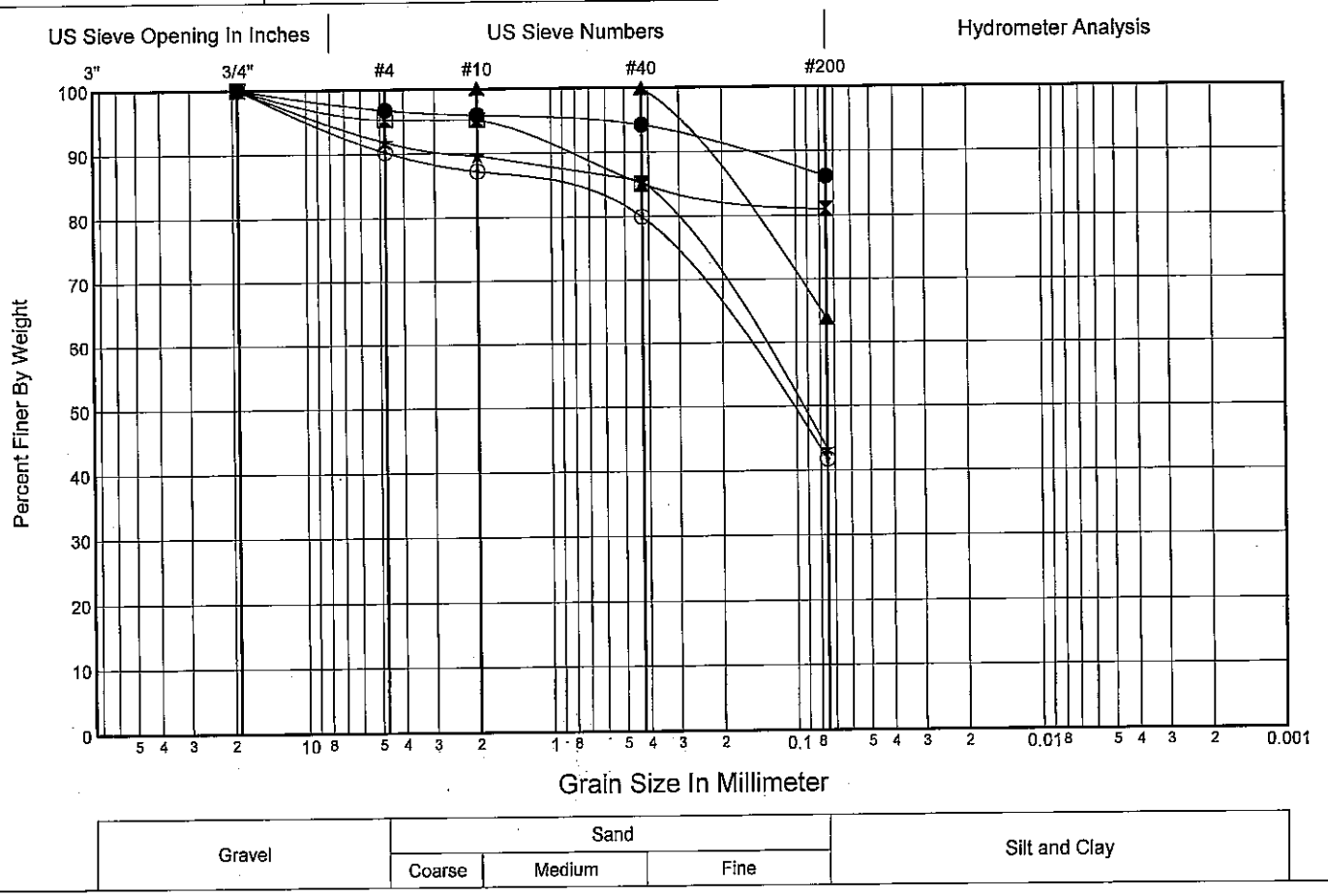
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	34.2	10.42	U-9A	CL	See Boring Log	LEAN CLAY	39	42	18	24
⊠	36.0	10.97	D-10	CH	See Boring Log	FAT CLAY with SAND	55	56	19	37
▲	44.0	13.41	D-12	ML	See Boring Log	SANDY SILT	19	18	NP	18
★	49.0	14.94	D-13	SM	See Boring Log	SILTY SAND	11			
⊙	54.0	16.46	D-14	SM	See Boring Log	SILTY SAND	10			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	3.3	10.7	86.0		
⊠	4.7	14.3	81.0		
▲	0.0	36.3	63.7		
★	8.2	48.5	43.3		
⊙	9.8	48.4	41.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					
★	0.149	0.10			
⊙	0.172	0.11			



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-7-01** Sheet **3** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

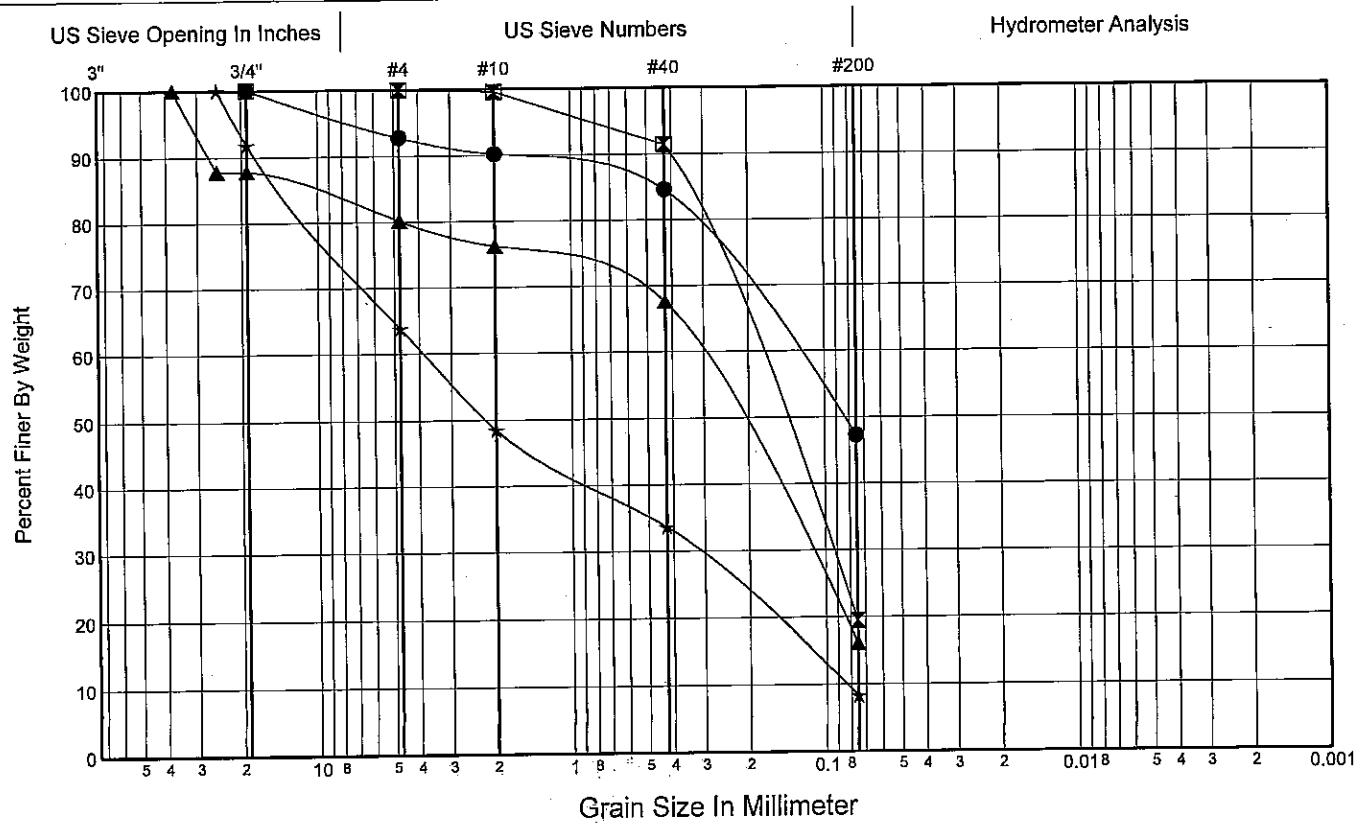
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	59.0	17.98	D-15	SM	See Boring Log	SILTY SAND	9			
⊠	74.0	22.56	D-18	SM	See Boring Log	SILTY SAND	20			
▲	79.0	24.08	D-19	SM	See Boring Log	SILTY SAND with GRAVEL	17			
★	84.0	25.60	D-20	SP-SM	See Boring Log	POORLY GRADED SAND with SILT and GRAVEL	9			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	7.3	45.5	47.3		
⊠	0.1	80.4	19.4		
▲	19.9	64.0	16.1		
★	36.2	55.6	8.2	0.3	45.3

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.136	0.09			
⊠	0.199	0.16	0.10	0.08	
▲	0.329	0.24	0.12	0.09	
★	3.833	2.18	0.33	0.17	0.085



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-8-01** Sheet **1** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

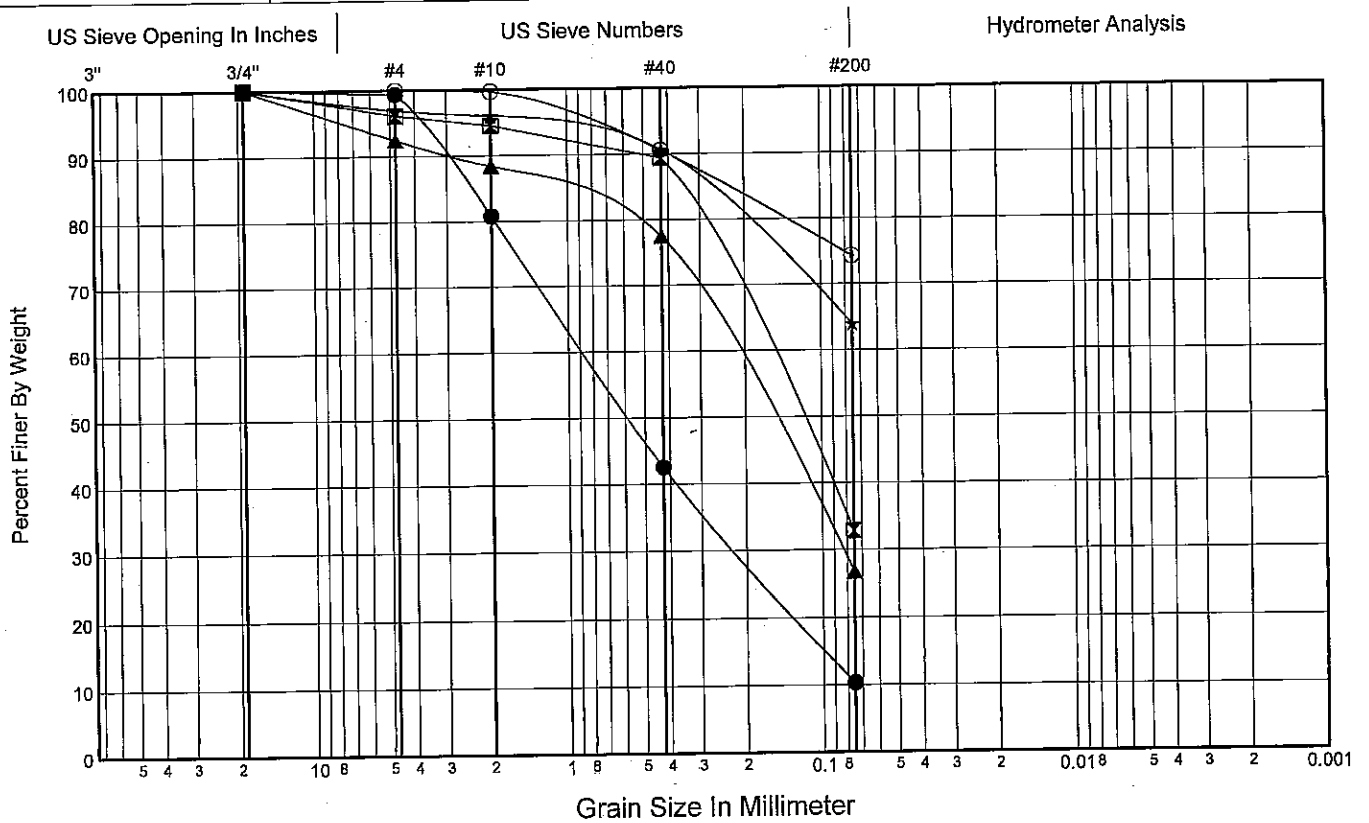
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	4.5	1.37	D-1	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	22			
⊠	9.5	2.90	D-2	SM	See Boring Log	SILTY SAND	28			
▲	15.5	4.72	D-3	SM	See Boring Log	SILTY SAND	21			
★	19.5	5.94	D-4	CL	See Boring Log	SANDY LEAN CLAY	21	27	16	11
⊙	24.5	7.47	D-5	CL	See Boring Log	LEAN CLAY with SAND	40	31	17	14

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.7	89.0	10.3	0.7	11.7
⊠	3.9	63.3	32.8		
▲	7.6	65.7	26.7		
★	3.1	33.0	63.9		
⊙	0.1	25.6	74.3		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.863	0.58	0.22	0.13	
⊠	0.173	0.13			
▲	0.234	0.17	0.08		
★					
⊙					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-8-01** Sheet **2** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

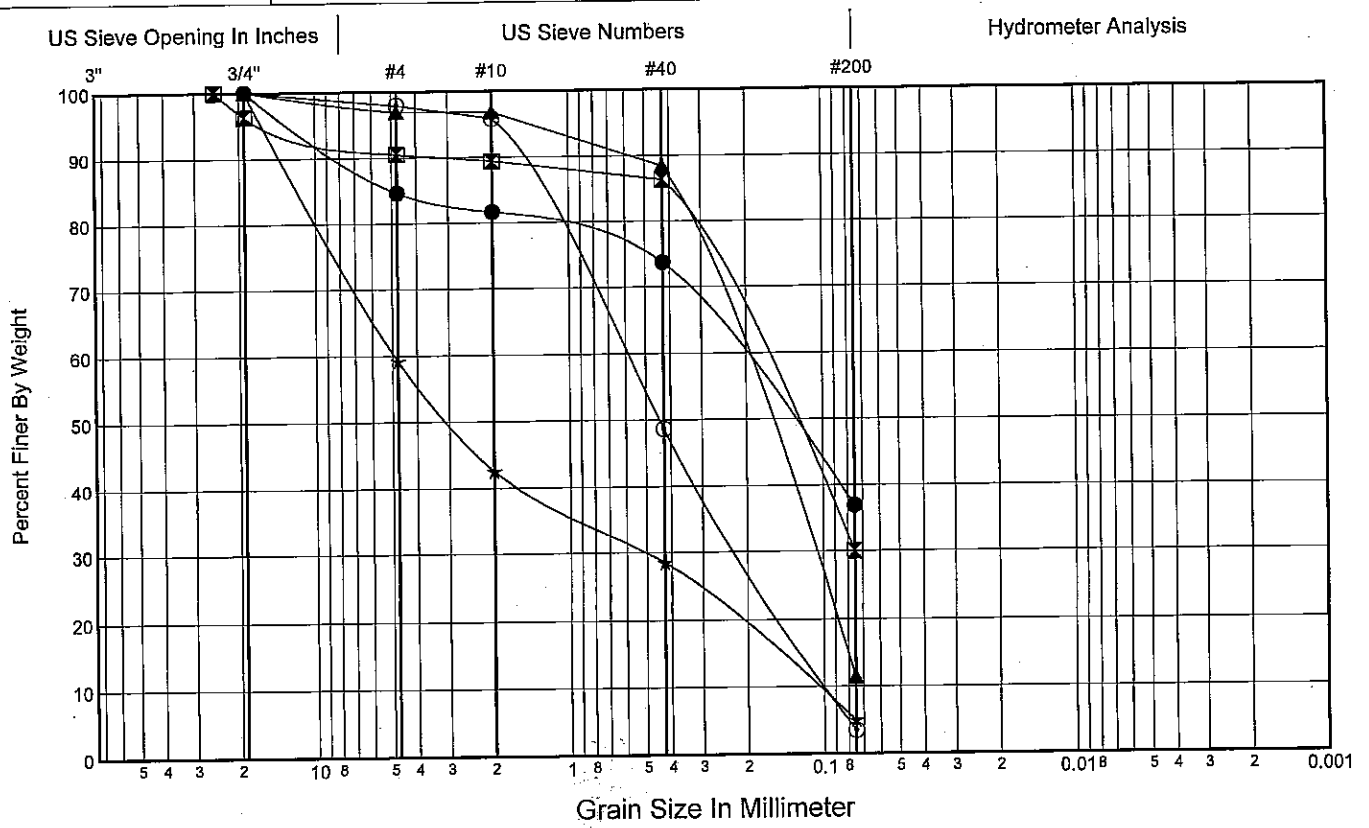
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	39.5	12.04	D-7	SM	See Boring Log	SILTY SAND with GRAVEL	10			
⊠	43.5	13.26	D-8	SM	See Boring Log	SILTY SAND	17			
▲	48.5	14.78	D-9	SP-SM	See Boring Log	POORLY GRADED SAND with SILT	18			
★	58.5	17.83	D-11	SP	See Boring Log	POORLY GRADED SAND with GRAVEL	9			
⊙	63.5	19.35	D-12	SP	See Boring Log	POORLY GRADED SAND	20			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	15.4	47.7	36.9		
⊠	9.6	60.5	30.0		
▲	3.1	85.5	11.4	0.8	3.1
★	40.8	54.2	5.0	0.5	44.9
⊙	2.1	94.5	3.4	0.7	6.4

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.223	0.14			
⊠	0.189	0.14	0.08		
▲	0.224	0.18	0.11	0.09	
★	4.885	2.95	0.50	0.23	0.109
⊙	0.617	0.44	0.21	0.14	0.096



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-8-01** Sheet **3** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

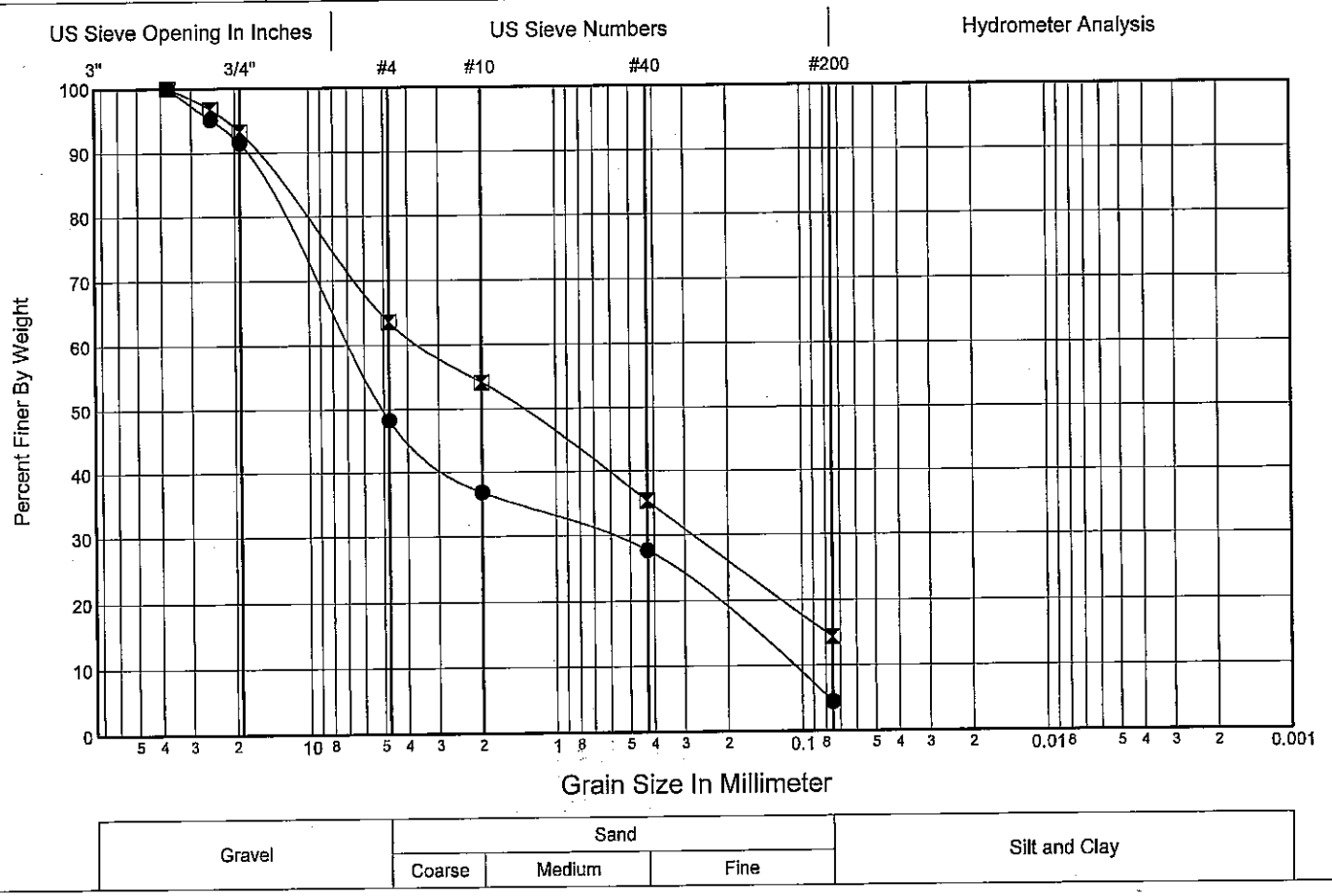
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	68.5	20.88	D-13	GP	See Boring Log	POORLY GRADED GRAVEL with SAND	9			
⊠	73.5	22.40	D-14	SM	See Boring Log	SILTY SAND with GRAVEL	11			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	51.8	43.7	4.5	0.5	61.2
⊠	36.4	49.2	14.4		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	6.926	5.03	0.63	0.24	0.113
⊠	3.423	1.42	0.27	0.12	



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-9-01** Sheet **1** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

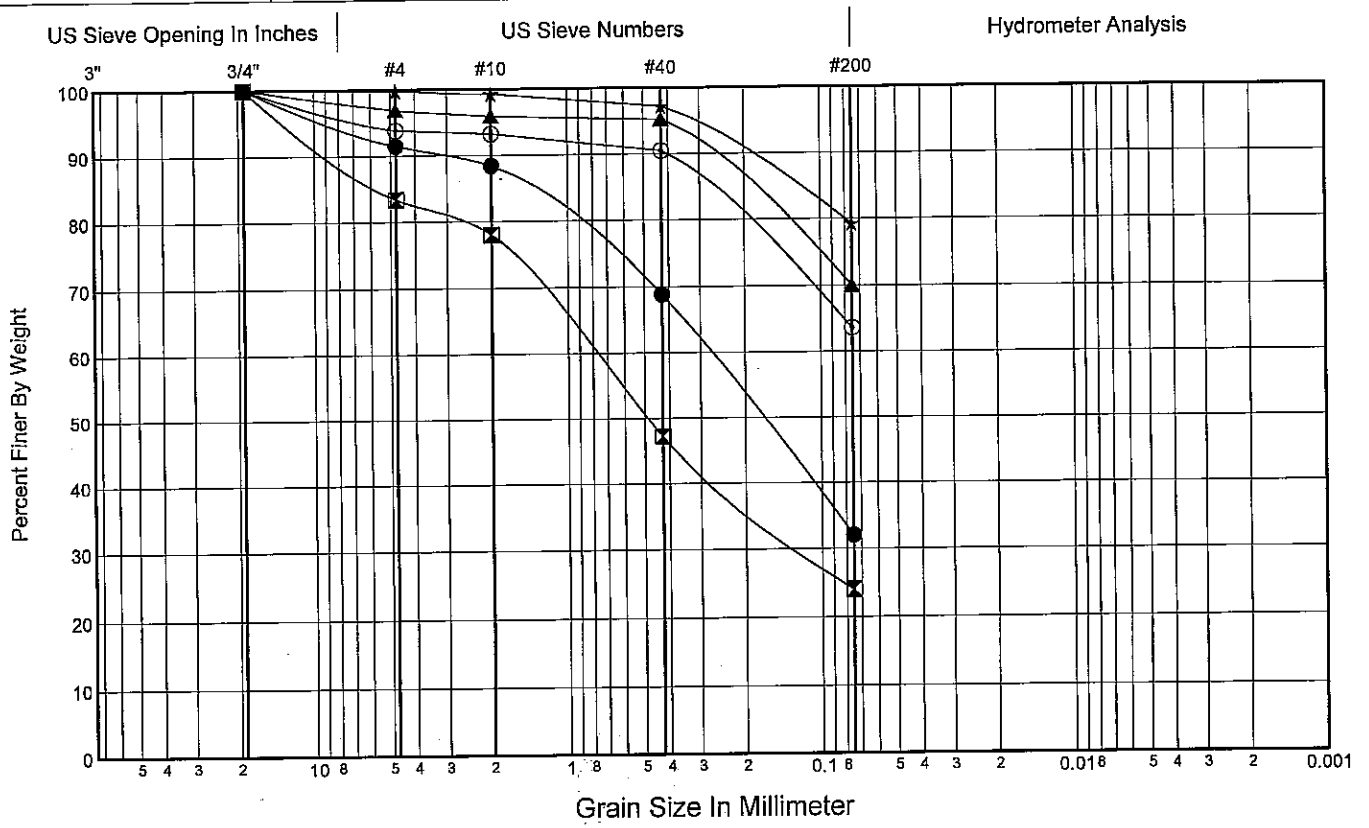
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	0.0	0.00	D-1	SM	See Boring Log	SILTY SAND	50			
⊠	1.5	0.46	D-2	SM	See Boring Log	SILTY SAND with GRAVEL	23			
▲	4.0	1.22	D-3	CL	See Boring Log	LEAN CLAY with SAND	23	31	18	13
★	5.5	1.68	D-4	CL	See Boring Log	LEAN CLAY with SAND	19	37	18	19
⊙	9.0	2.74	D-5	CL	See Boring Log	SANDY LEAN CLAY	21	26	16	10

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	8.6	59.4	32.0		
⊠	16.7	59.3	24.0		
▲	3.2	26.8	70.0		
★	0.3	20.5	79.2		
⊙	6.2	30.2	63.6		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	0.280	0.17			
⊠	0.810	0.49	0.12		
▲					
★					
⊙					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-9-01** Sheet **2** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

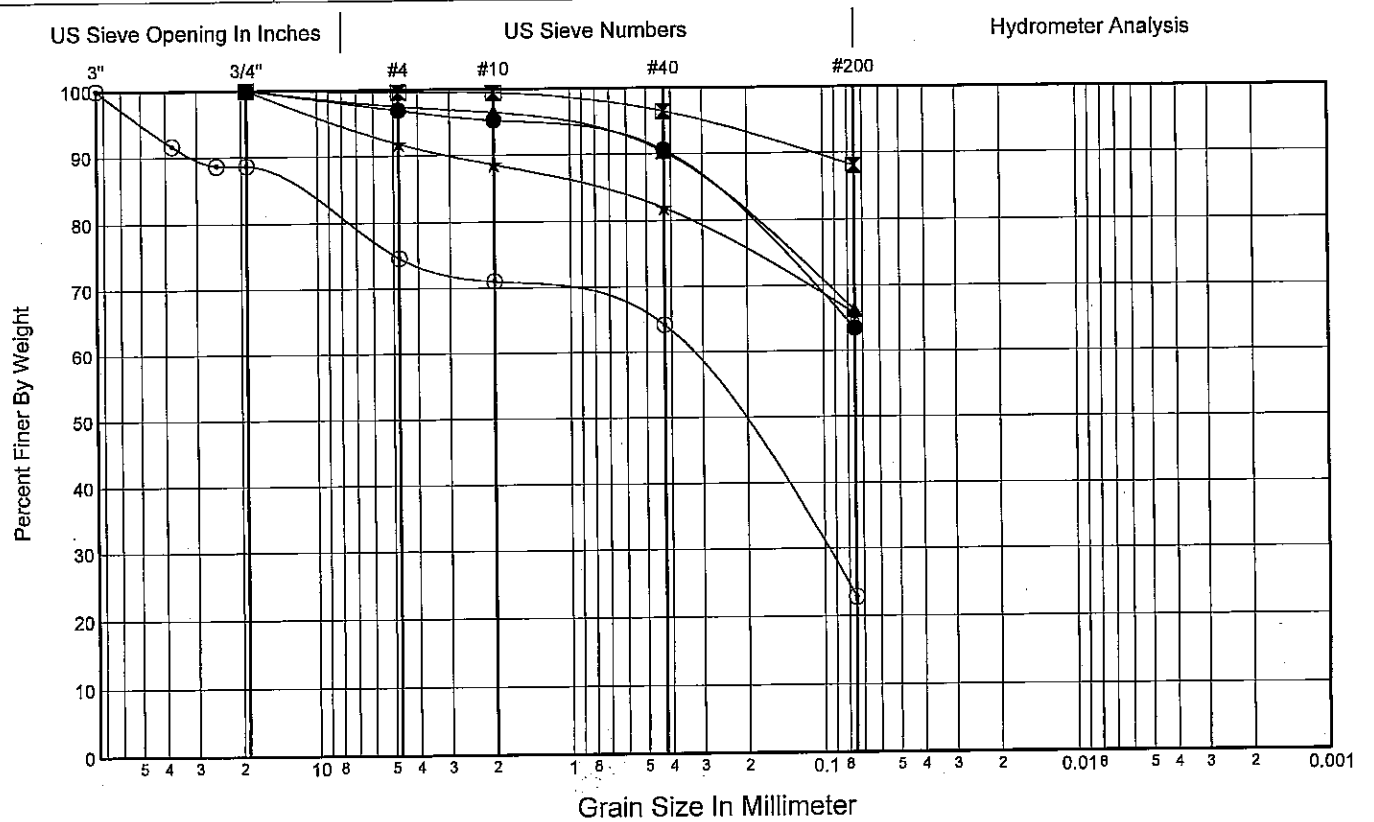
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	19.0	5.79	D-7	CL	See Boring Log	SANDY LEAN CLAY	24	24	14	10
⊠	24.0	7.32	D-8	CL	See Boring Log	LEAN CLAY	31	37	18	19
▲	31.0	9.45	D-10	CL	See Boring Log	SANDY LEAN CLAY	24	23	14	9
★	39.0	11.89	D-13	CL-ML	See Boring Log	SANDY SILTY CLAY	29	21	15	6
⊙	54.0	16.46	D-16	SM	See Boring Log	SILTY SAND with GRAVEL	9	14	NP	14

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	3.2	33.4	63.4		
⊠	0.4	11.6	88.0		
▲	2.6	31.2	66.2		
★	8.3	26.0	65.7		
⊙	25.4	51.8	22.8		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					
★					
⊙	0.357	0.23	0.10		



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-9-01** Sheet **3** of **3**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

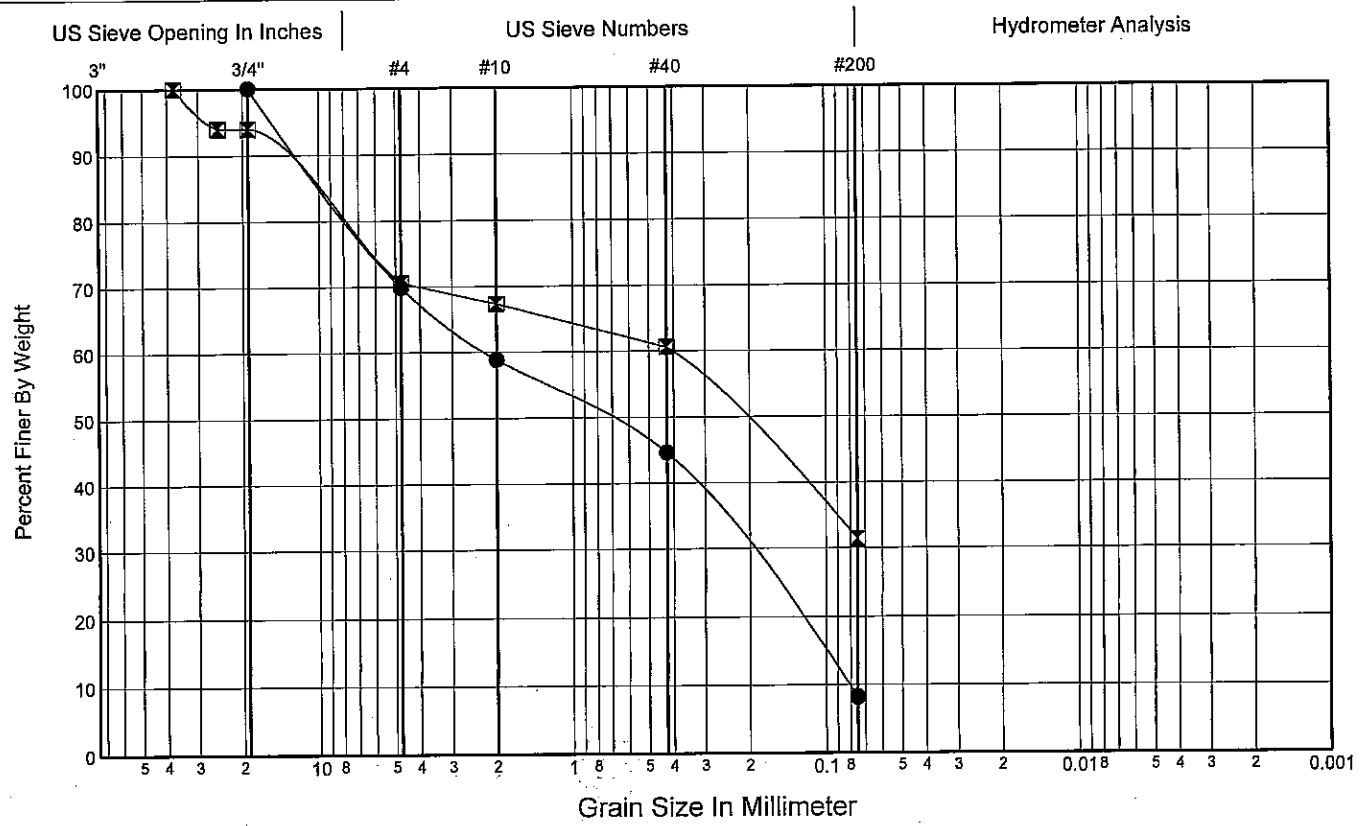
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	64.0	19.51	D-18	SP-SM	See Boring Log	POORLY GRADED SAND with SILT and GRAVEL	11			
⊠	79.0	24.08	D-21	SM	See Boring Log	SILTY SAND with GRAVEL	12			

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	30.1	61.7	8.2	0.3	26.9
⊠	29.4	39.2	31.4		

GRADATION VALUES

	D60	D50	D30	D20	D10
●	2.196	0.76	0.21	0.13	0.082
⊠	0.410	0.23			



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-10-02** Sheet **1** of **1**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

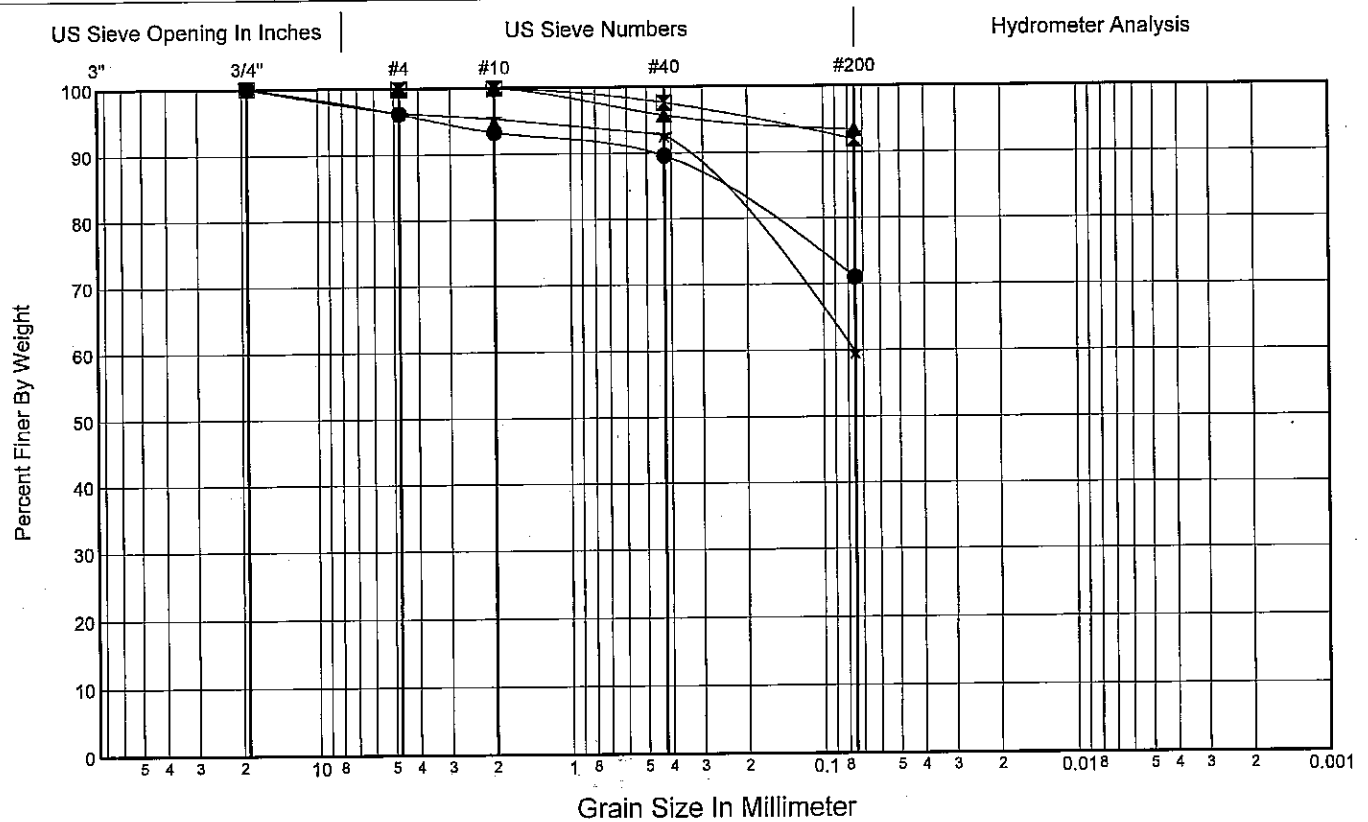
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	5.0	1.52	D-2	CL	See Boring Log	LEAN CLAY with SAND	21	31	17	14
⊠	8.5	2.59	D-3	CH	See Boring Log	FAT CLAY	35	56	25	31
▲	13.5	4.11	D-5	CH	See Boring Log	FAT CLAY	55	62	28	34
★	23.5	7.16	D-7	CL	See Boring Log	SANDY LEAN CLAY	28	27	16	11

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	3.9	25.1	71.0		
⊠	0.2	8.0	91.9		
▲	0.0	6.7	93.3		
★	3.8	36.5	59.7		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					
★	0.076				



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-11-02** Sheet **1** of **1**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

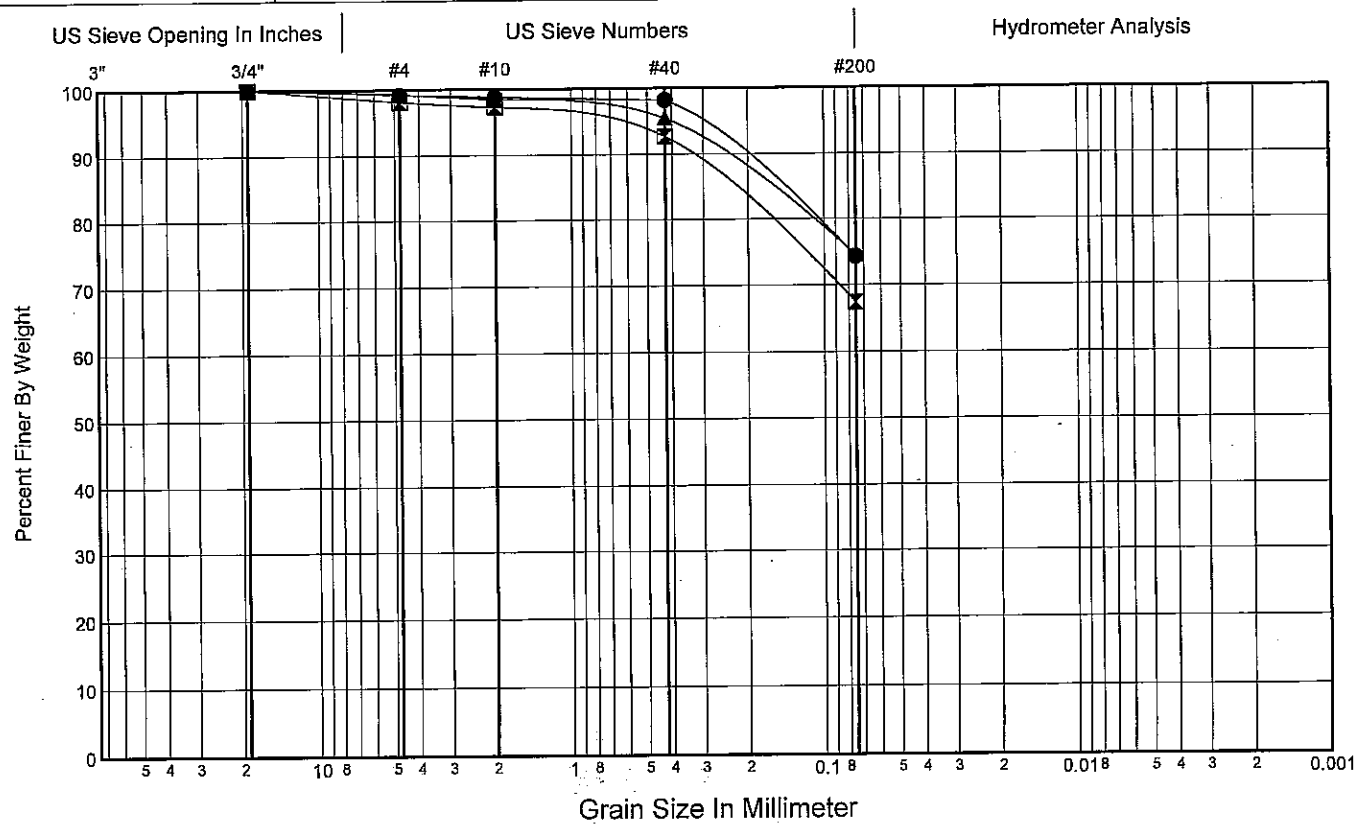
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	3.5	1.07	D-1	CL	See Boring Log	LEAN CLAY with SAND	27	32	21	11
⊠	8.5	2.59	D-3	CL	See Boring Log	SANDY LEAN CLAY	28	28	17	11
▲	13.5	4.11	D-5	CL	See Boring Log	LEAN CLAY with SAND	28	28	16	12

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.9	24.8	74.3		
⊠	1.9	30.7	67.4		
▲	0.8	24.7	74.5		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠					
▲					



Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-12-01** Sheet **1** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

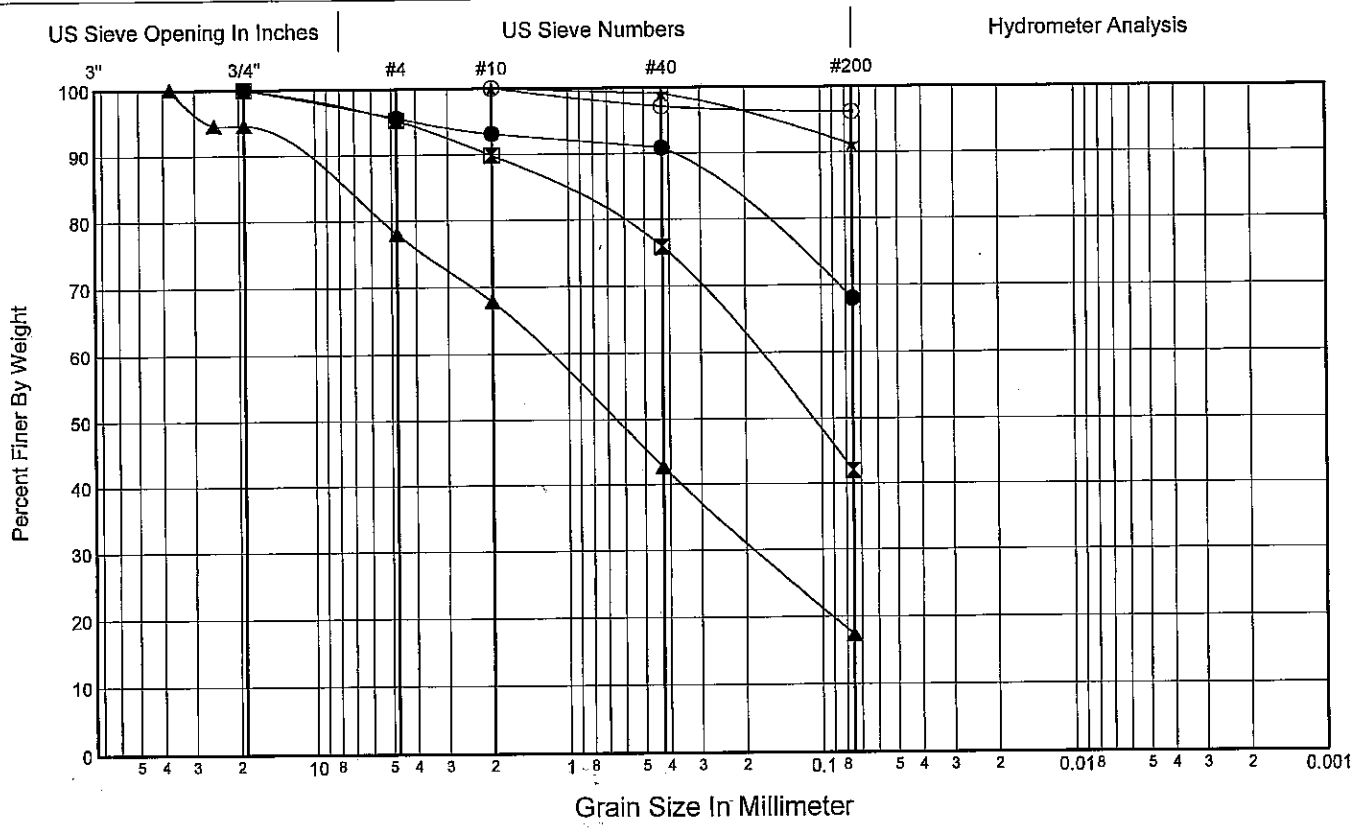
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	0.0	0.00	D-1	CL	See Boring Log	SANDY LEAN CLAY and root hairs	34	35	23	12
⊠	1.5	0.46	D-2	SC-SM	See Boring Log	SILTY, CLAYEY SAND	15	23	16	7
▲	4.5	1.37	D-4	SM	See Boring Log	SILTY SAND with GRAVEL and organics	15			
★	8.0	2.44	D-5	CH	See Boring Log	FAT CLAY	62	51	27	24
⊙	13.0	3.96	D-6	CH	See Boring Log	FAT CLAY	45	65	27	38

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	4.4	27.6	68.0		
⊠	4.8	53.3	42.0		
▲	22.0	60.7	17.3		
★	0.0	8.8	91.2		
⊙	0.0	3.9	96.1		

GRADATION VALUES

	D60	D50	D30	D20	D10
●					
⊠	0.189	0.11			
▲	1.237	0.67	0.18	0.09	
★					
⊙					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

Job No. **0L-3500** Date **June 11, 2002**

Hole No. **TH-12-01** Sheet **2** of **2**

Project **I-5 to International Boundary**

Laboratory Summary

Washington State Department of Transportation

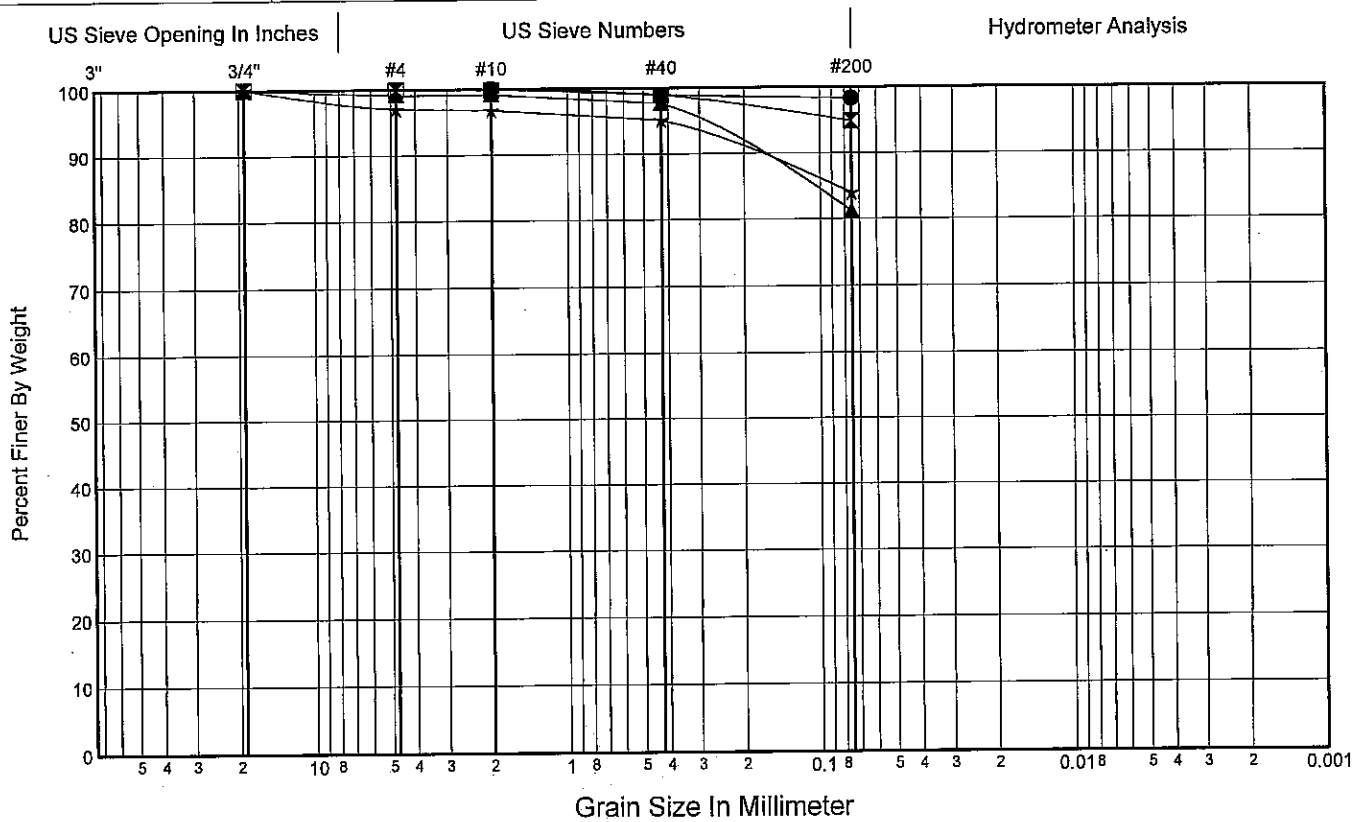
	Depth (ft)	Depth (m)	Sample No.	USCS	Color	Description	MC%	LL	PL	PI
●	18.0	5.49	D-7	CH	See Boring Log	FAT CLAY	66	62	23	39
⊠	38.0	11.58	D-11	CL	See Boring Log	LEAN CLAY	32	46	19	27
▲	58.0	17.68	D-13	CL	See Boring Log	LEAN CLAY with SAND	32	43	18	25
★	88.0	26.82	D-16	CL	See Boring Log	LEAN CLAY with SAND	26	38	18	20

GRADATION FRACTIONS

	%Gravel	%Sand	%Fines	Cc	Cu
●	0.0	1.8	98.2		
⊠	0.1	5.1	94.8		
▲	0.9	18.0	81.1		
★	3.0	13.1	83.9		

GRADATION VALUES

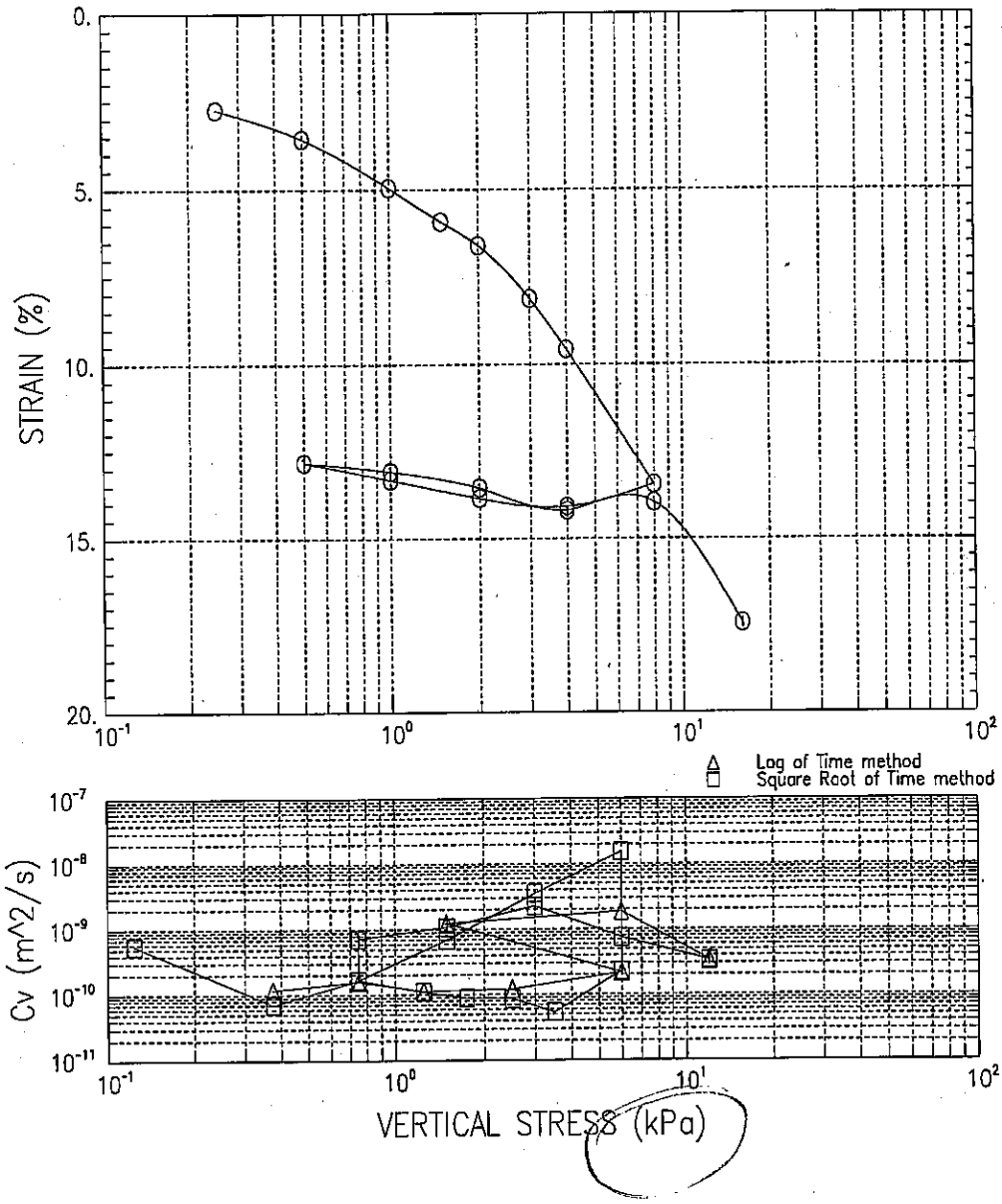
	D60	D50	D30	D20	D10
●					
⊠					
▲					
★					



Gravel	Sand			Silt and Clay
	Coarse	Medium	Fine	

CONSOLIDATION TEST

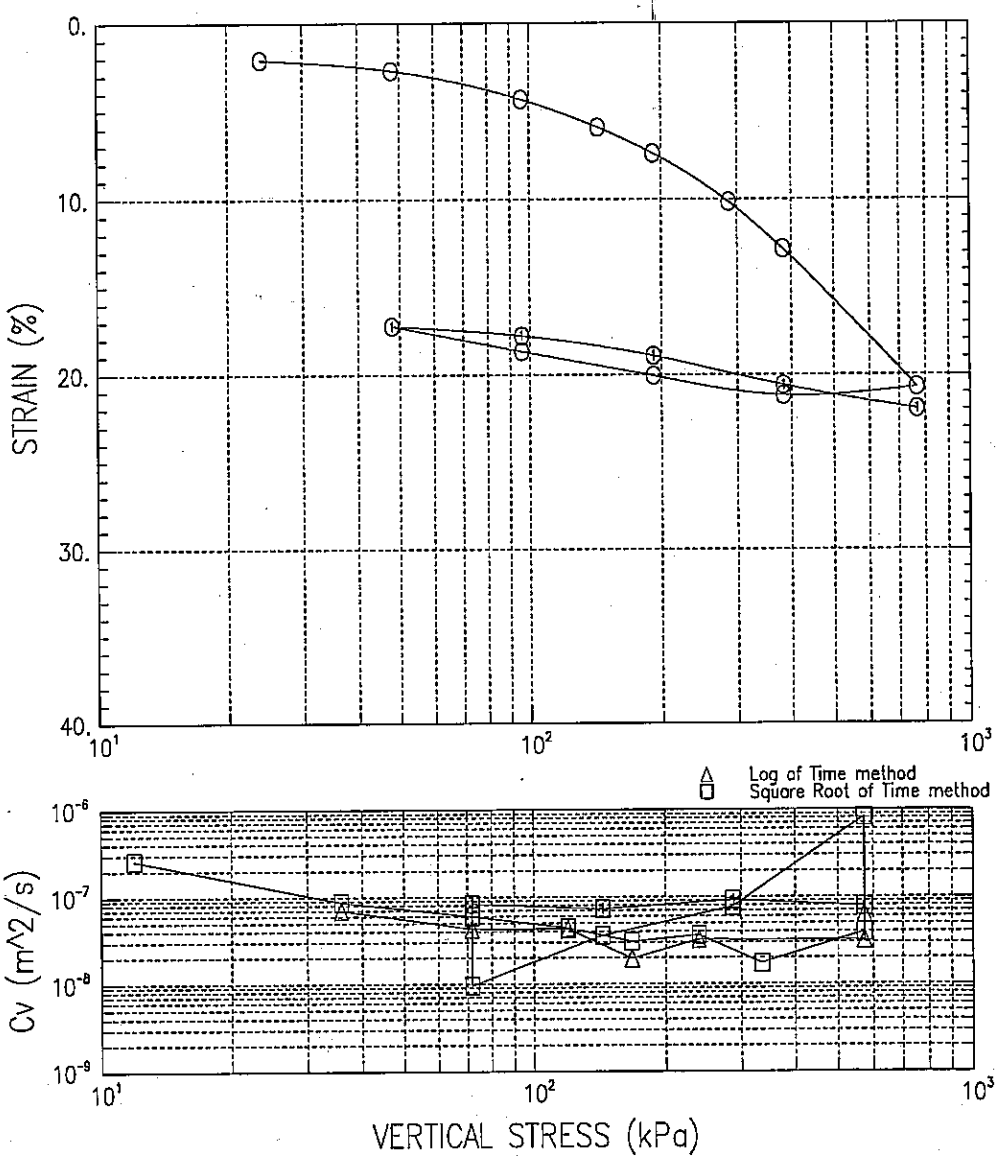
SUMMARY REPORT



Washington State D.O.T.
Project Name : I-5 TO INTERNATIONAL BOR
Project No : OL-3500 Boring No : H-4-99 Sample No : U-12/D
Test Date : 7/22/99 Test No : 298912D Depth : 44-44.3 FT
Description : GRAY MOIST SILT
Remarks :

CONSOLIDATION TEST

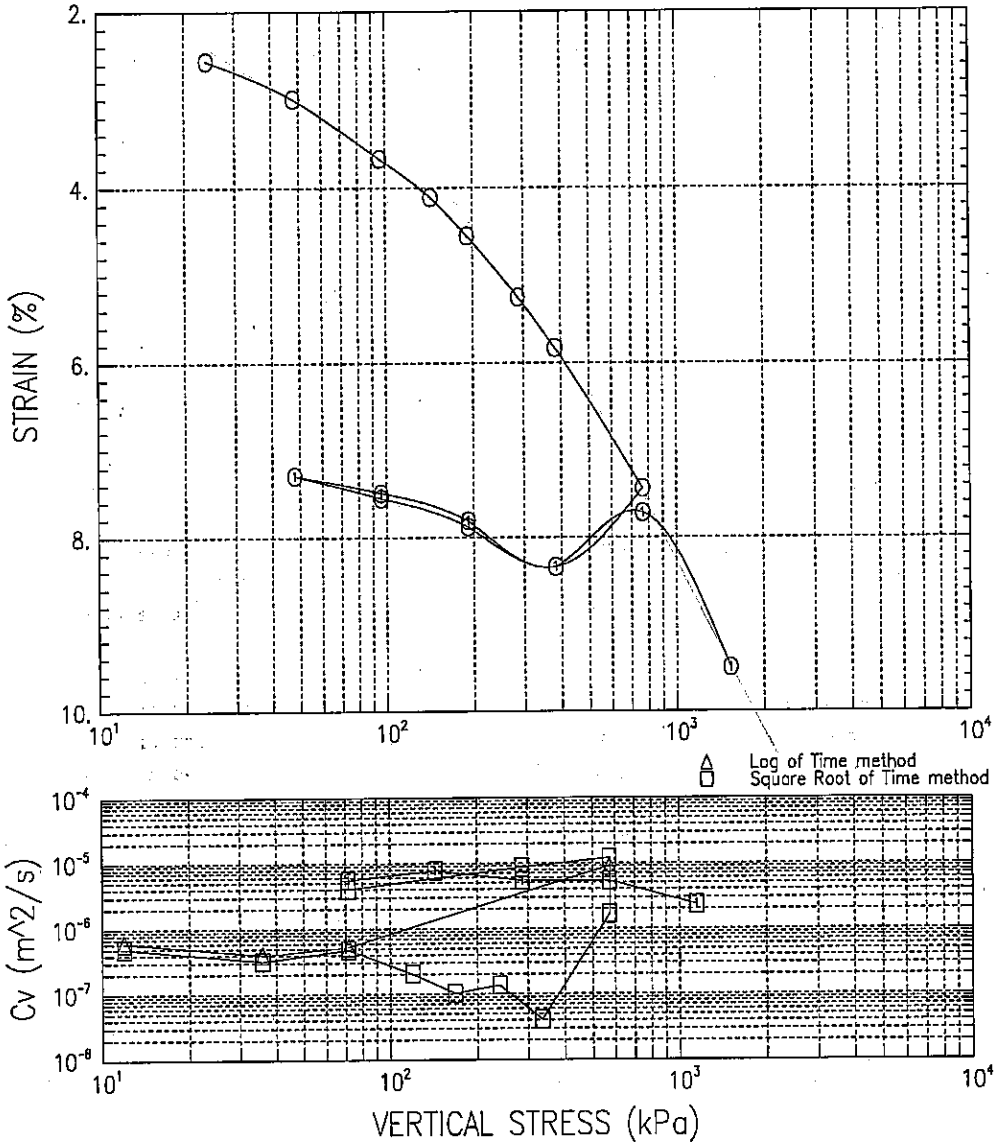
SUMMARY REPORT



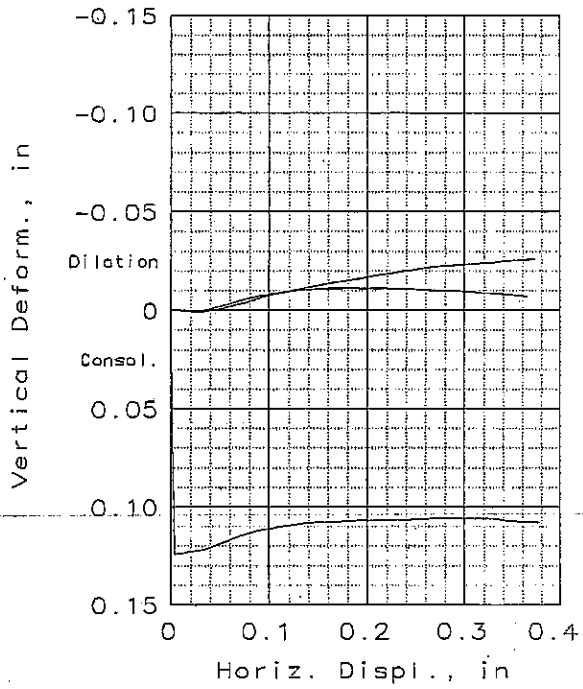
Washington State D.O.T.
Project Name : I-5 TO INTERNATIONAL BOR
Project No : OL-3500 Boring No : H-4-99 Sample No : U-12/F
Test Date : 7/20/99 Test No : 298912F Depth : 44.7-45 FT
Description : GRAY MOIST SILT
Remarks :

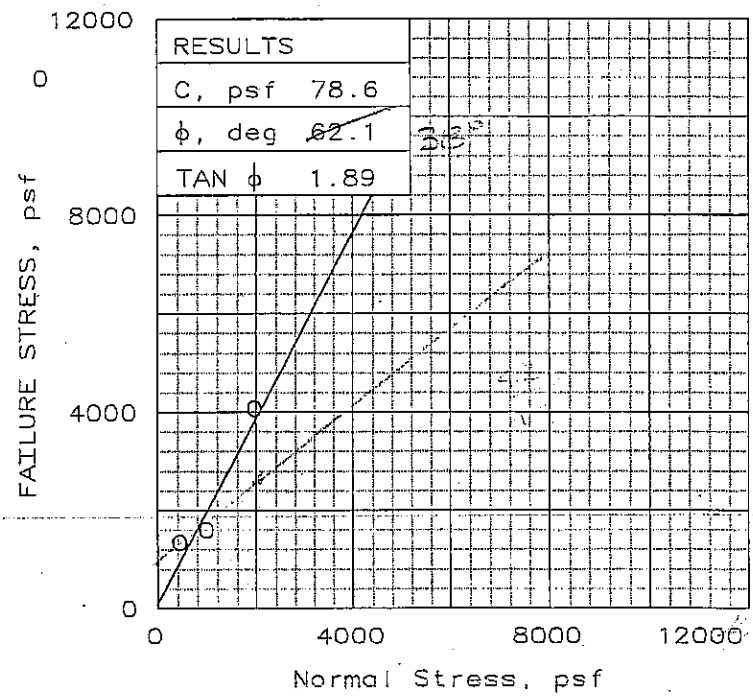
CONSOLIDATION TEST

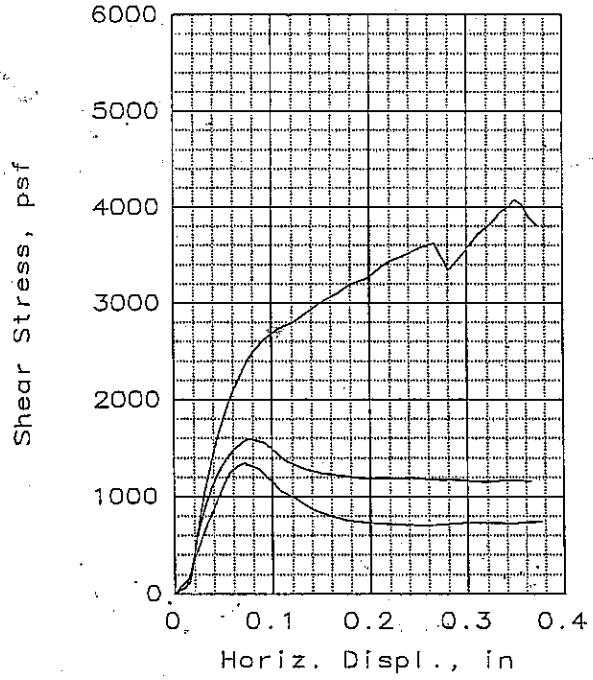
SUMMARY REPORT



Washington State D.O.T.
Project Name : I-5 TO INTERNATIONAL BOR
Project No : OL-3500 Boring No : H-4-99 Sample No : U-14/A
Test Date : 7/24/99 Test No : 298914A Depth : 48-48.3 FT
Description : GRAY MOIST SILT
Remarks :







SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	12.7	12.7	12.7
	DRY DENSITY, pcf	126.6	124.2	127.2
	SATURATION, %	109.5	101.2	111.9
	VOID RATIO	0.307	0.332	0.300
	DIAMETER, in	1.91	1.91	1.91
	HEIGHT, in	0.77	0.78	0.78
AT TEST	WATER CONTENT, %	16.6	16.7	16.7
	DRY DENSITY, pcf	122.3	123.3	126.2
	SATURATION, %	124.5	129.6	142.1
	VOID RATIO	0.352	0.341	0.311
	DIAMETER, in	1.91	1.91	1.91
	HEIGHT, in	0.80	0.79	0.79
NORMAL STRESS, psf		513	1050	2025
FAILURE STRESS, psf		1347	1598	4071
DISPLACEMENT, in		0.07	0.08	0.35
ULTIMATE STRESS, psf		1317	1558	3624
DISPLACEMENT, in		0.07	0.07	0.27
Strain rate, %/min		0.00	0.00	0.00

SAMPLE TYPE: WSDOT TUBE
DESCRIPTION: DK GRAY MOIST
CLAYEY SAND
LL= 24 PL= 14 PI= 10
SPECIFIC GRAVITY= 2.65
REMARKS:

Fig. No.: 1

CLIENT: DON CHADBOURNE

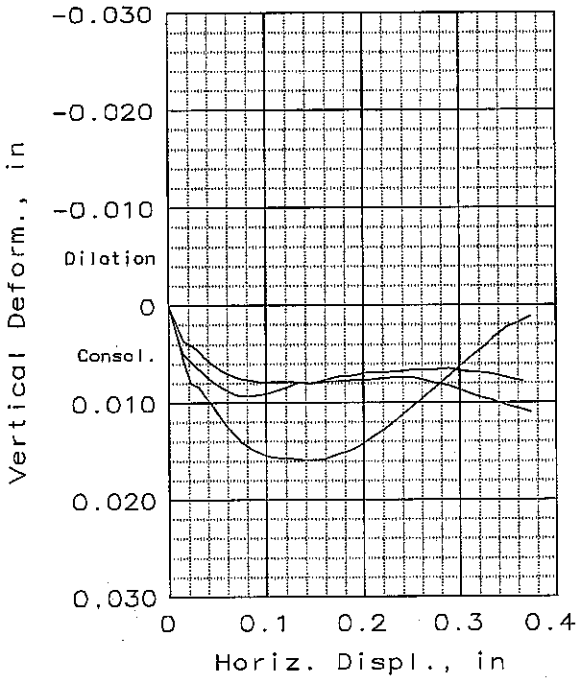
PROJECT: I-5 TO INTERNATIONAL BORDER

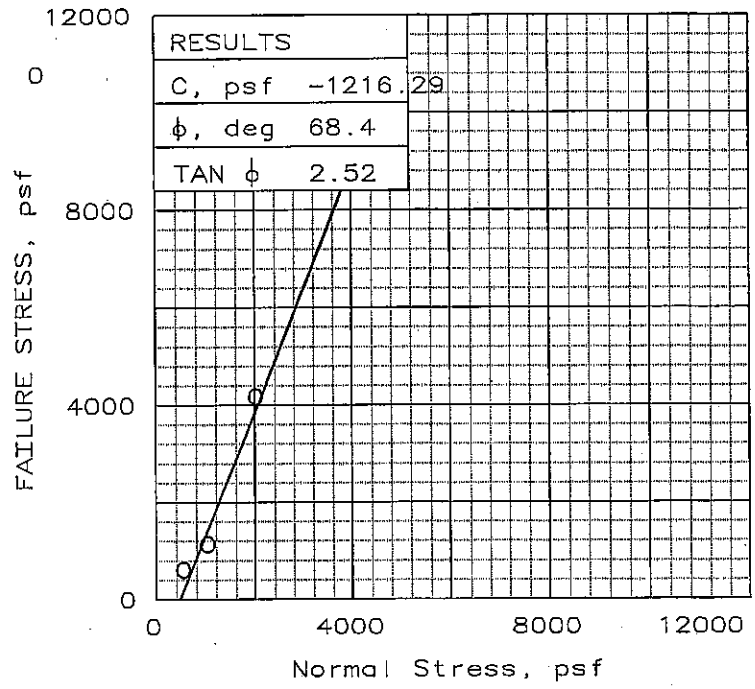
SAMPLE LOCATION: SR-543 H-4-99

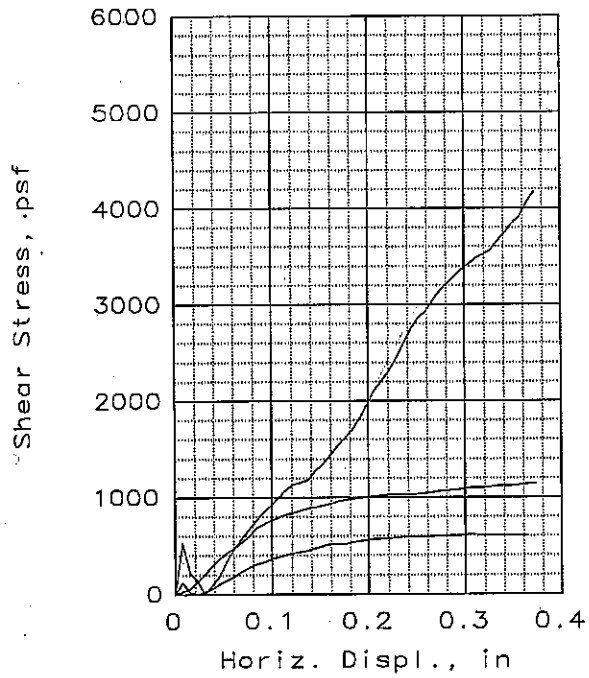
PROJ. NO.: OL-3500 DATE: 8/2/99

DIRECT SHEAR TEST REPORT

WASHINGTON STATE DOT







SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	12.7	12.7	12.7
	DRY DENSITY, pcf	126.6	124.2	127.2
	SATURATION, %	109.5	101.2	111.9
	VOID RATIO	0.307	0.332	0.300
	DIAMETER, in	1.91	1.91	1.91
	HEIGHT, in	0.77	0.78	0.78
AT TEST	WATER CONTENT, %	16.6	16.7	16.7
	DRY DENSITY, pcf	122.3	123.3	126.2
	SATURATION, %	124.5	129.6	142.1
	VOID RATIO	0.352	0.341	0.311
	DIAMETER, in	1.91	1.91	1.91
	HEIGHT, in	0.80	0.79	0.79
NORMAL STRESS, psf		613	1101	2081
FAILURE STRESS, psf		613	1141	4176
DISPLACEMENT, in		0.31	0.37	0.37
ULTIMATE STRESS, psf		588	1025	3478
DISPLACEMENT, in		0.24	0.24	0.31
Strain rate, %/min		0.00	0.00	0.00

SAMPLE TYPE: WSDOT TUBE
DESCRIPTION: DK GRAY MOIST
CLAYEY SAND
LL= 24 PL= 14 PI= 10
SPECIFIC GRAVITY= 2.65
REMARKS:

CLIENT: DON CHADBOURNE

PROJECT: I-5 TO INTERNATIONAL BORDER

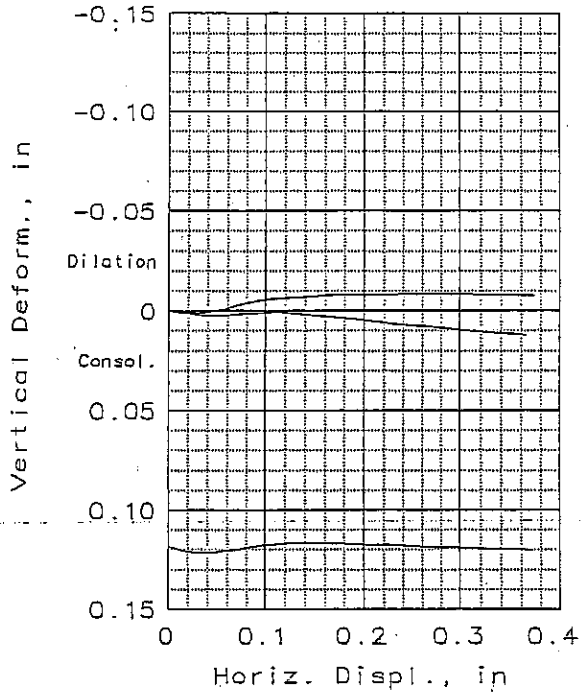
SAMPLE LOCATION: SR-543 H-4-99

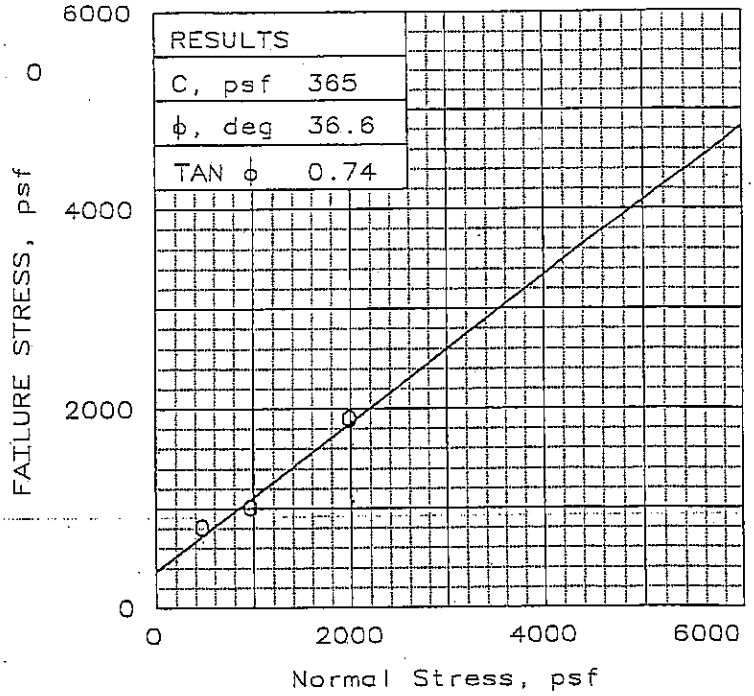
PROJ. NO.: OL-3500 DATE: 8/2/99

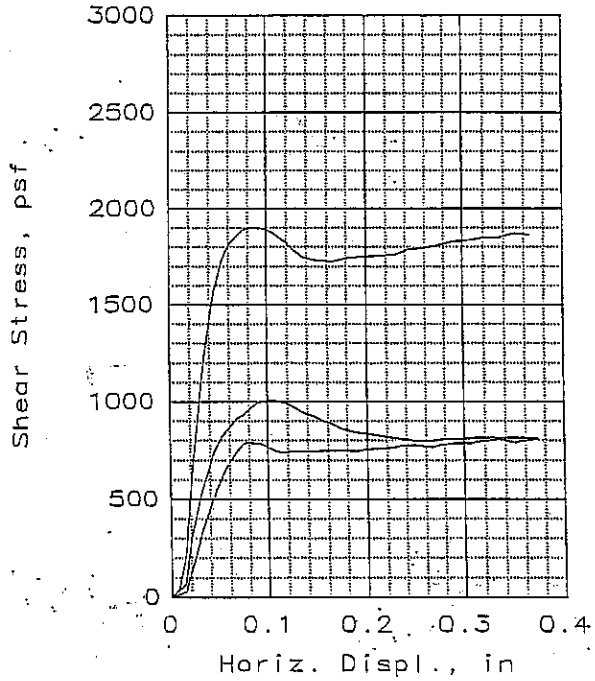
DIRECT SHEAR TEST REPORT

WASHINGTON STATE DOT

Fig. No.: 2







	SAMPLE NO.:	1	2	3
INITIAL	WATER CONTENT, %	16.7	16.7	16.7
	DRY DENSITY, pcf	117.8	118.7	119.1
	SATURATION, %	109.4	112.4	113.8
	VOID RATIO	0.405	0.394	0.389
	DIAMETER, in	1.91	1.91	1.91
	HEIGHT, in	0.77	0.77	0.75
AT TEST	WATER CONTENT, %	19.5	18.6	15.4
	DRY DENSITY, pcf	119.1	117.4	117.0
	SATURATION, %	132.8	120.4	98.5
	VOID RATIO	0.389	0.409	0.414
	DIAMETER, in	1.91	1.91	1.91
	HEIGHT, in	0.76	0.77	0.76
NORMAL STRESS, psf		508	1000	2020
FAILURE STRESS, psf		809	1010	1900
DISPLACEMENT, in		0.37	0.11	0.08
ULTIMATE STRESS, psf		784	1010	1900
DISPLACEMENT, in		0.09	0.11	0.08
Strain rate, %/min		0.00	0.02	

SAMPLE TYPE: WSDOT Tube
DESCRIPTION: Gray Moist Clay

LL = 27 PL = 14 PI = 13
SPECIFIC GRAVITY= 2.65
REMARKS:

Fig. No.: _____

CLIENT: Don Chadbourne

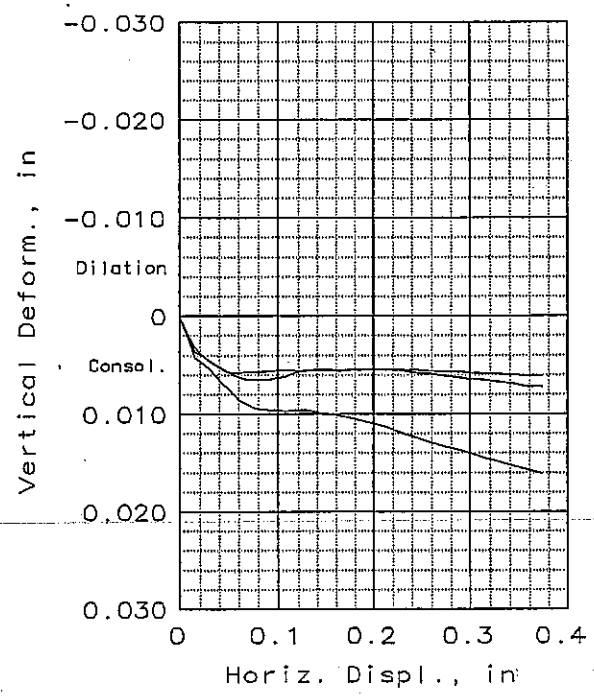
PROJECT: SR 543 I-5 To International Border

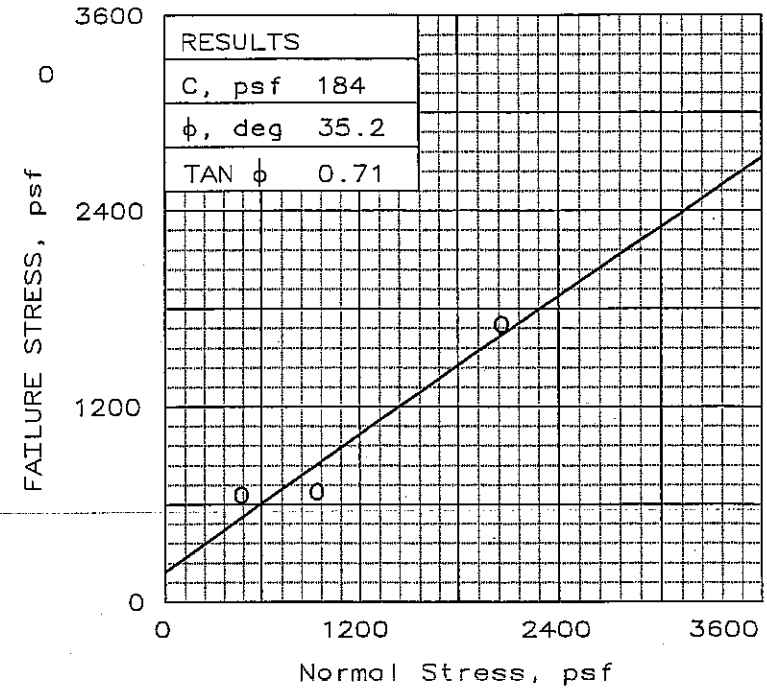
SAMPLE LOCATION: H-4-99, U-4C (Peak)

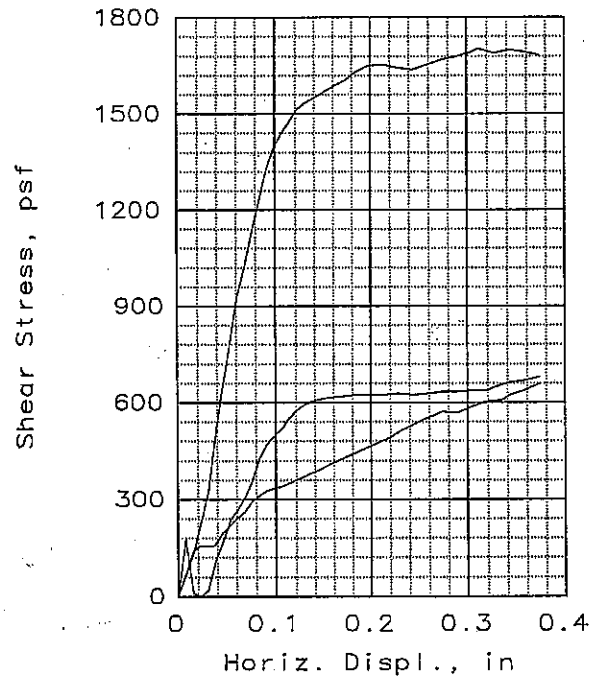
PROJ. NO.: OL-3500 DATE: 7/27/99

DIRECT SHEAR TEST REPORT

WASHINGTON STATE DOT







SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	16.7	16.7	16.7
	DRY DENSITY, pcf	117.8	118.7	119.1
	SATURATION, %	109.4	112.4	113.8
	VOID RATIO	0.405	0.394	0.389
	DIAMETER, in	1.91	1.91	1.91
	HEIGHT, in	0.77	0.77	0.75
AT TEST	WATER CONTENT, %	19.5	18.6	15.4
	DRY DENSITY, pcf	118.9	117.4	117.0
	SATURATION, %	132.0	120.4	98.5
	VOID RATIO	0.391	0.409	0.414
	DIAMETER, in	1.91	1.91	1.91
	HEIGHT, in	0.76	0.77	0.76
NORMAL STRESS, psf		493	955	2081
FAILURE STRESS, psf		658	678	1704
DISPLACEMENT, in		0.37	0.37	0.31
ULTIMATE STRESS, psf		312	623	1648
DISPLACEMENT, in		0.08	0.18	0.20
Strain rate, %/min		0.00	0.00	0.00

SAMPLE TYPE: WSDOT TUBE
DESCRIPTION: GRAY MOIST CLAY

LL= 27 PL= 14 PI= 13
SPECIFIC GRAVITY= 2.65
REMARKS: 2ND PASS

Fig. No.: 2

CLIENT: DON CHADBOURNE

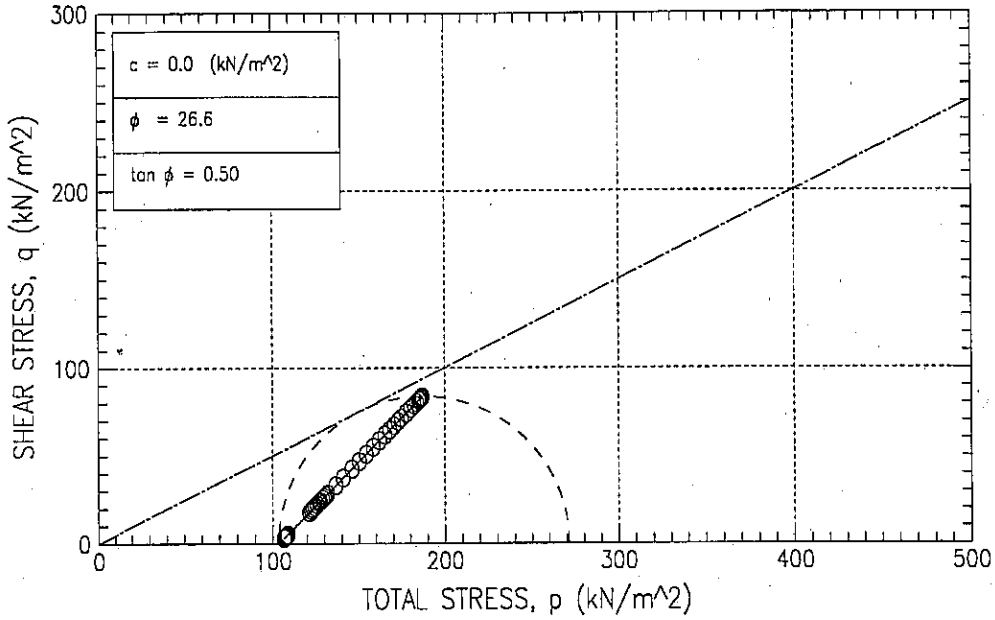
PROJECT: SR-543 I-5 TO INTERNATIONAL BORDER
SAMPLE LOCATION: H-4-99, U-4C (Residual)

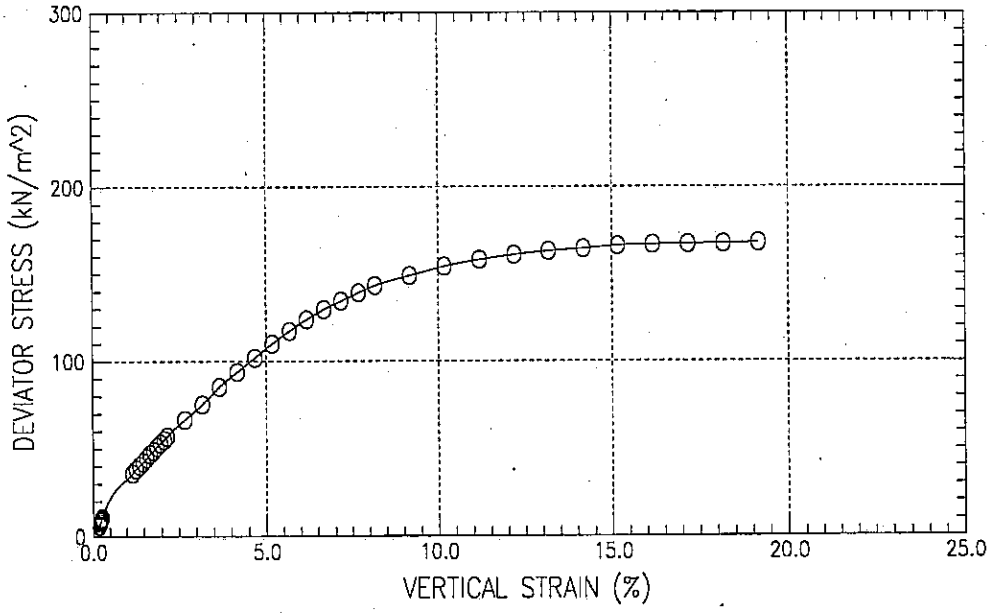
PROJ. NO.: OL-3500 DATE: 7/27/99

DIRECT SHEAR TEST REPORT

WASHINGTON STATE DOT

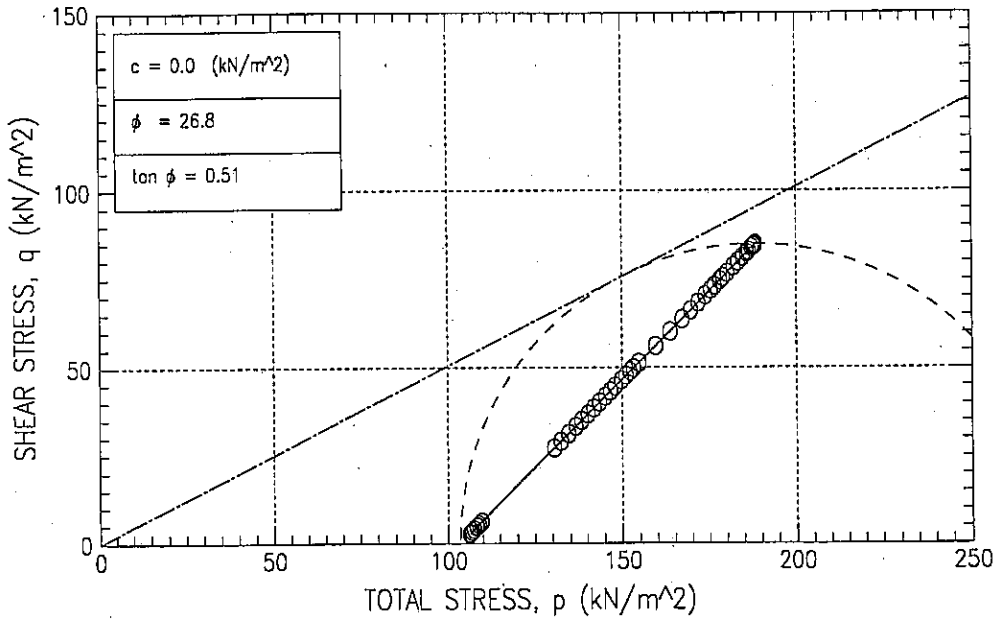
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

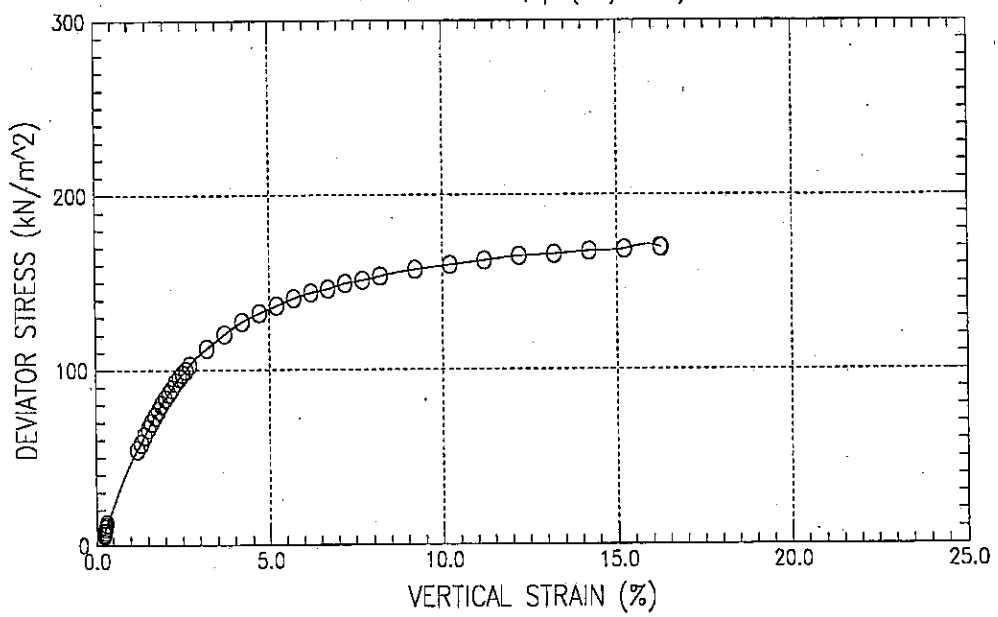




Washington State D.O.T.
Project Name : I5 TO INTERNATIONAL BORD
Project No : OL-3500 Boring No : H-4-99 Sample No : U-4/B
Test Date : 6/23/99 Test No : 29894B Depth : 14.3-14.7
Description : WET GRAY CLAY
Remarks :

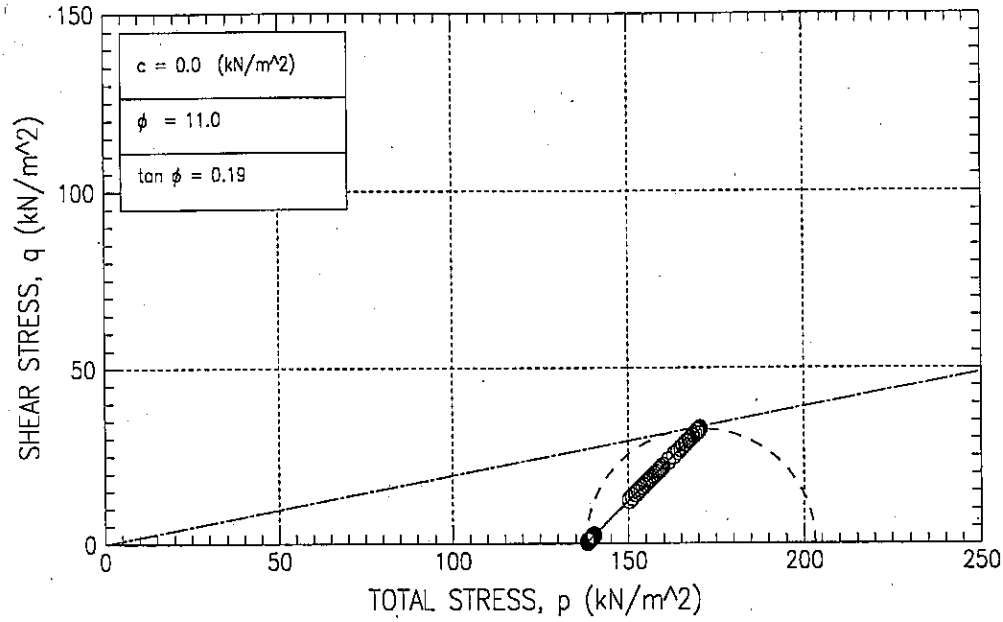
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

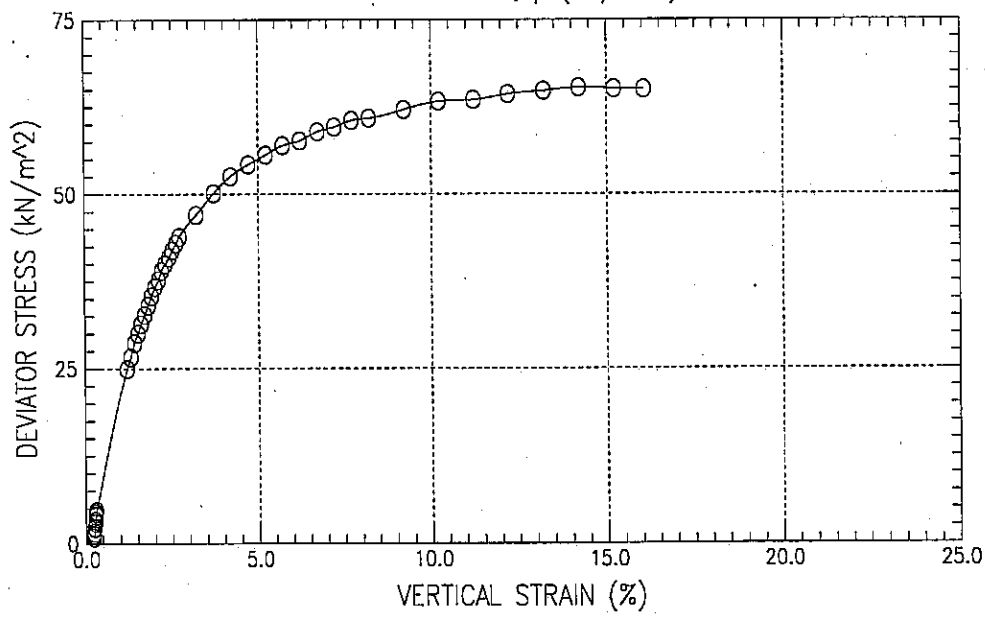




Washington State D.O.T.
Project Name : I5 TO INTERNATIONAL BORD
Project No : OL-3500 Boring No : H-4-99 Sample No : U-4/D
Test Date : 6/28/99 Test No : 2989-4D Depth : 15-15.3 FT
Description : MOIST DK GRAY CLAY W/GRAVEL & SAND
Remarks :

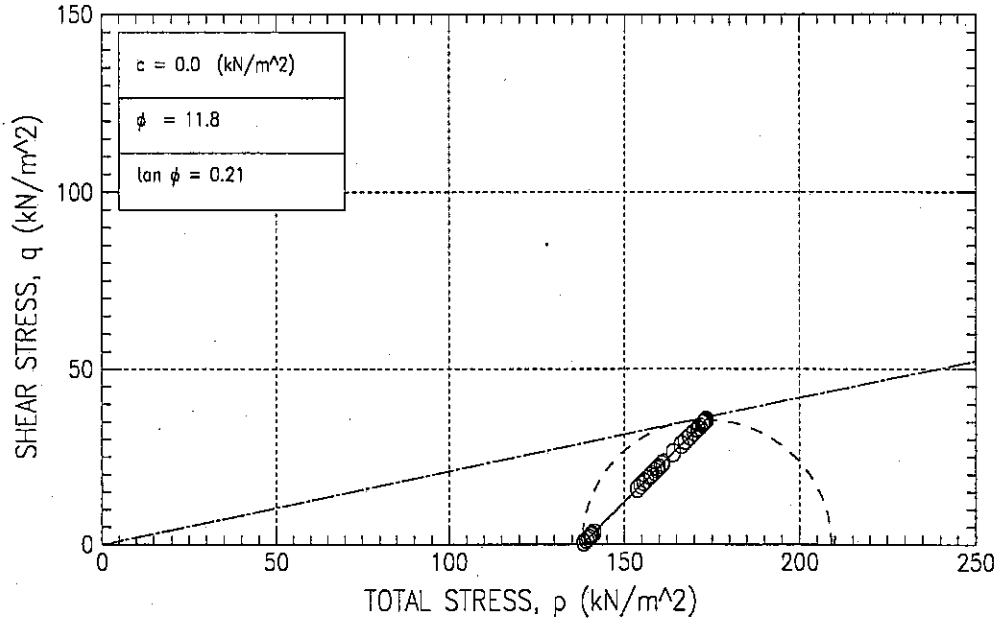
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

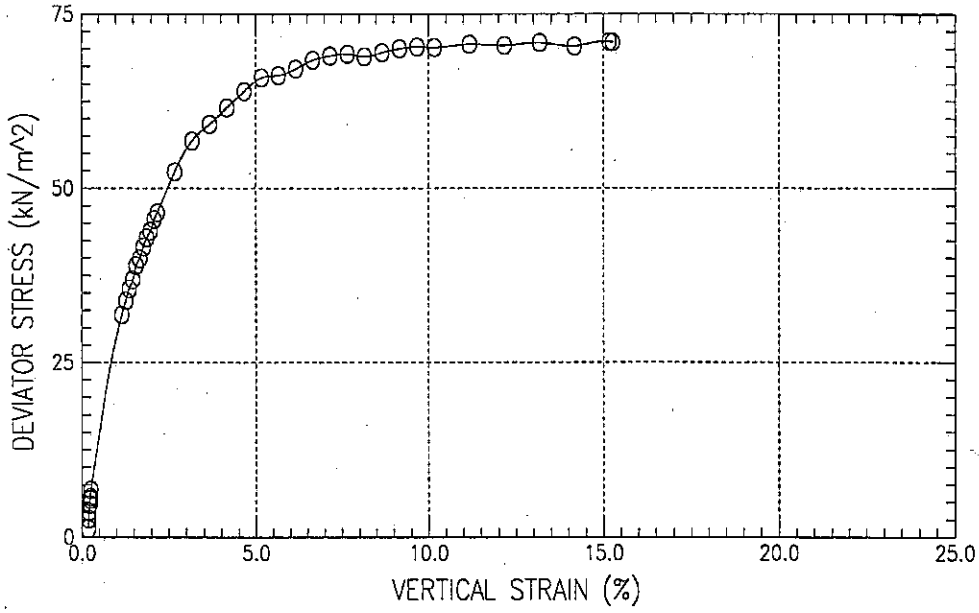




Washington State D.O.T.
Project Name : I5 TO INTERNATIONAL BORD
Project No : OL-3500 Boring No : H-4--99 Sample No : U-6/E
Test Date : 6/28/99 Test No : 2989-6E Depth : 25.3-25.7
Description : MOIST DK GRAY CLAY W/GRAVEL & SAND
Remarks :

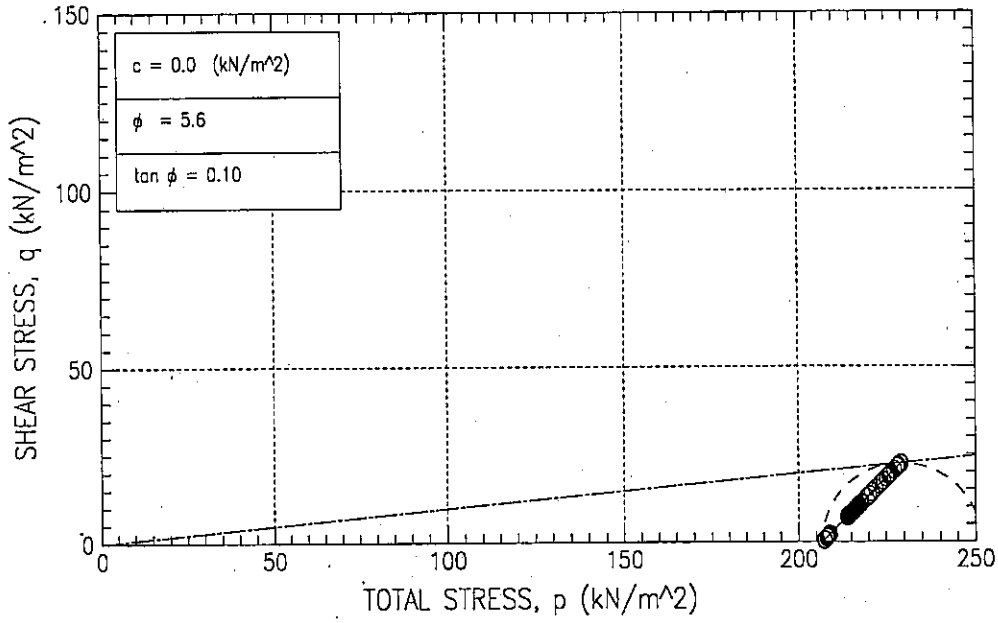
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

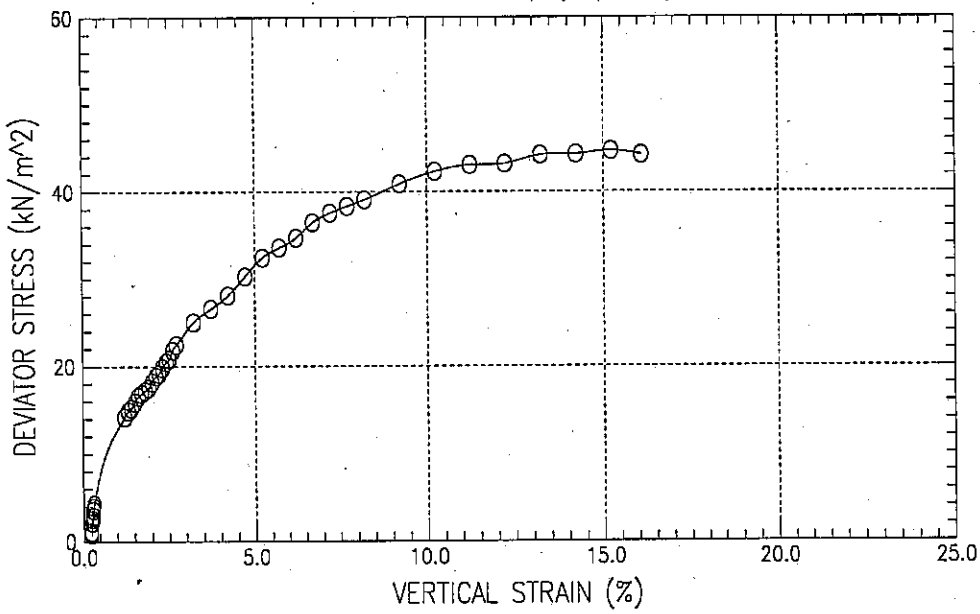




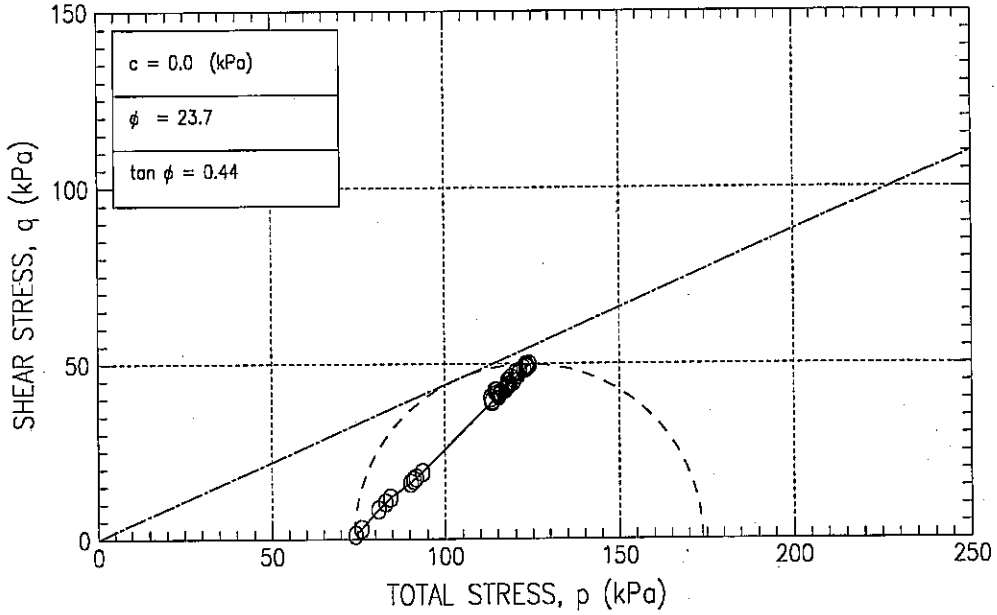
Washington State D.O.T.
Project Name : I5 TO INTERNATIONAL BORD
Project No : OL-3500 Boring No : H-4-99 Sample No : U-6/F
Test Date : 6/23/99 Test No : 29896F Depth : 25.7-26 FT
Description : WET GRAY CLAY
Remarks :

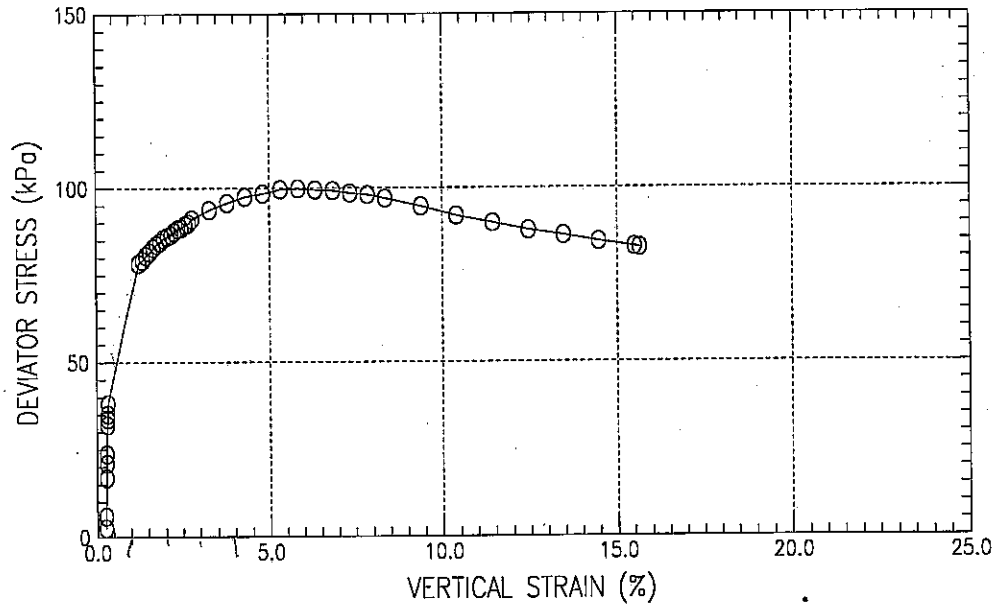
UNCONSOLIDATED UNDRAINED TRIAXIAL TEST



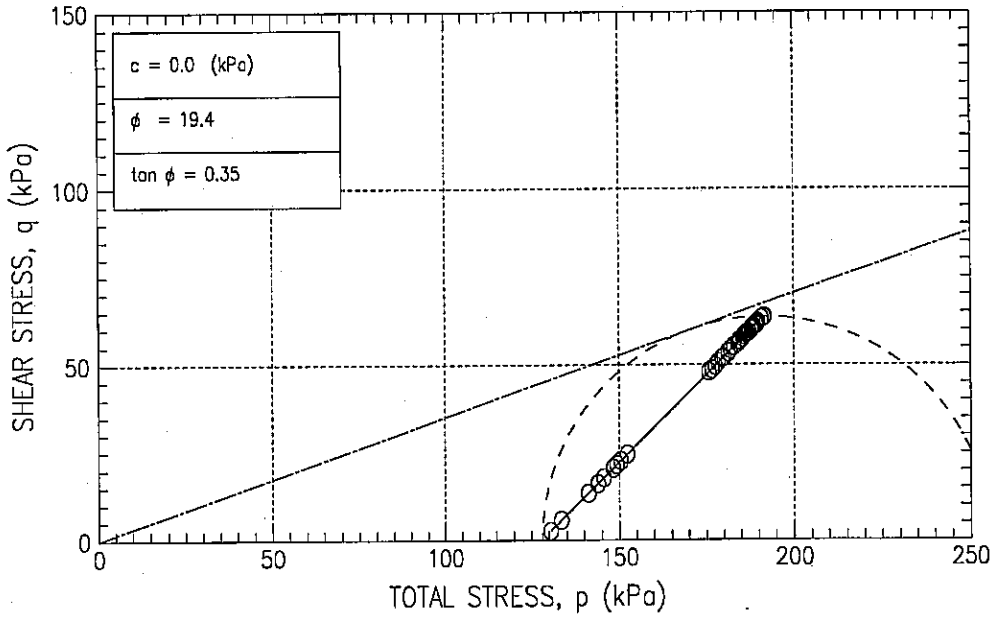


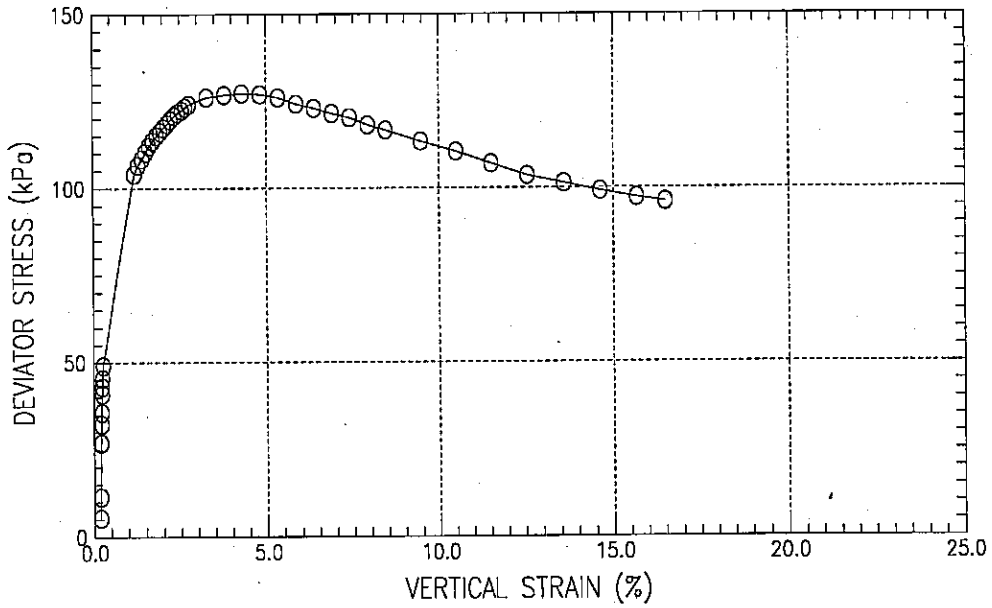
Washington State D.O.T.
Project Name : I5 TO INTERNATIONAL BORD
Project No : OL-3500 Boring No : H-4-99 Sample No : U-10/A
Test Date : 6/28/99 Test No : 298910A Depth : 38-38.3 FT
Description : MOIST DK GRAY CLAY W/GRAVEL & SAND
Remarks :



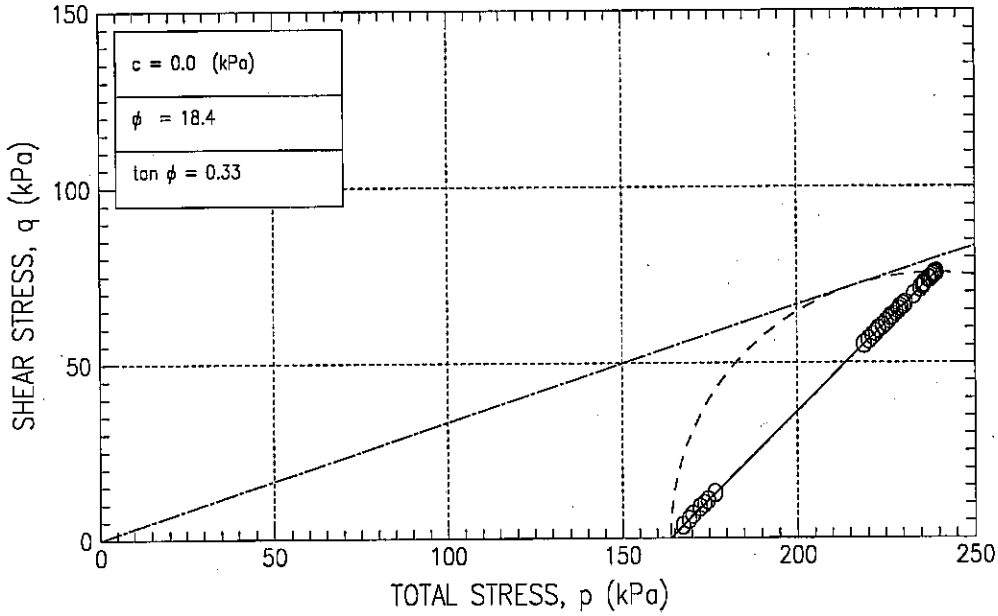


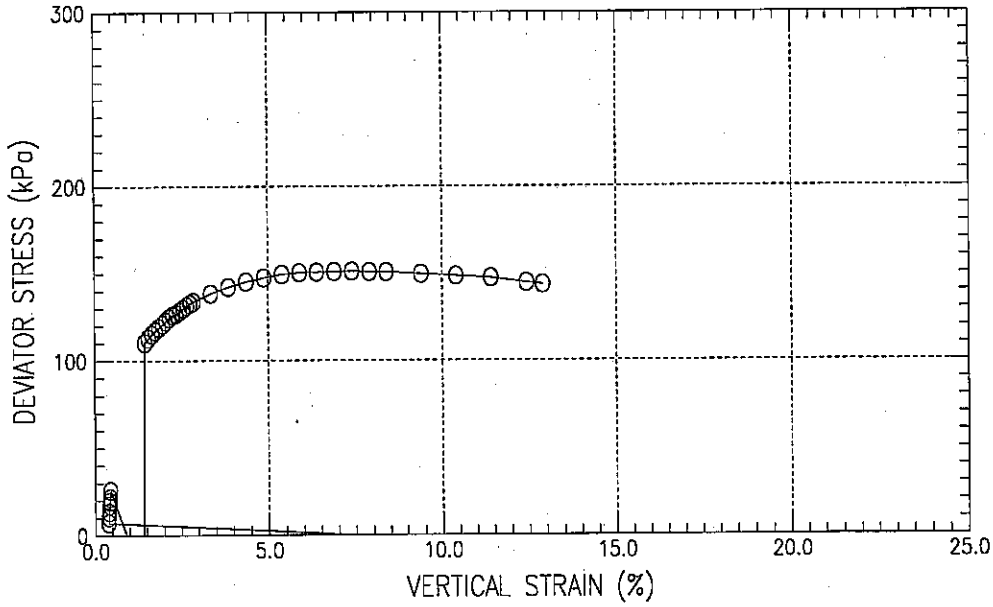
Washington State D.O.T.
Project Name : I5 TO INTERNATIONAL BORD
Project No : OL-3500 Boring No : H-4-99 Sample No : U-12/B
Test Date : 7/6/99 Test No : 298912B Depth : 43.3-43.7
Description : WET DK GRAY CLAY
Remarks :



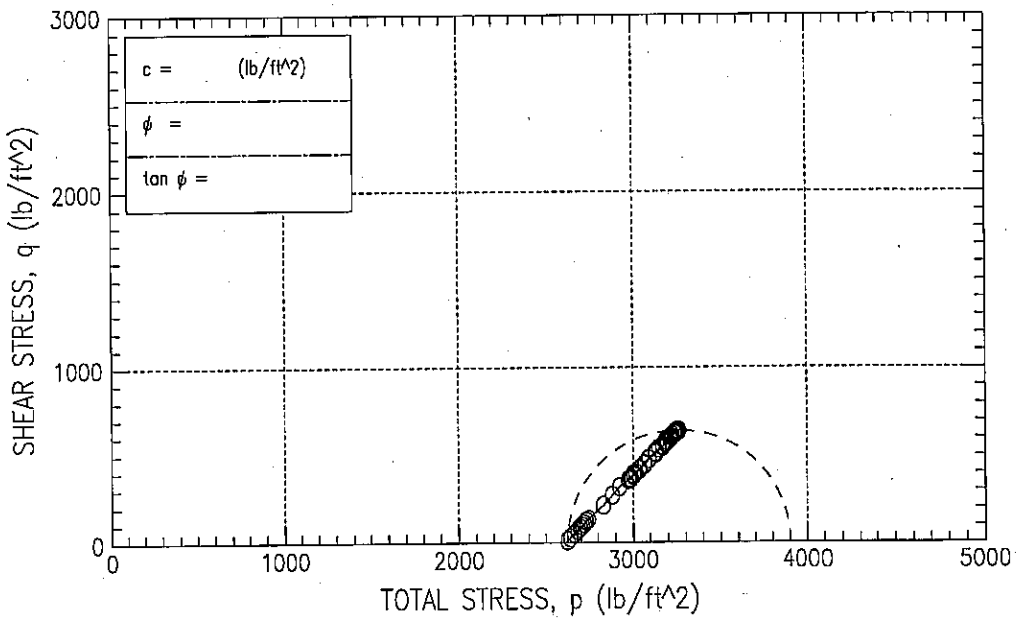


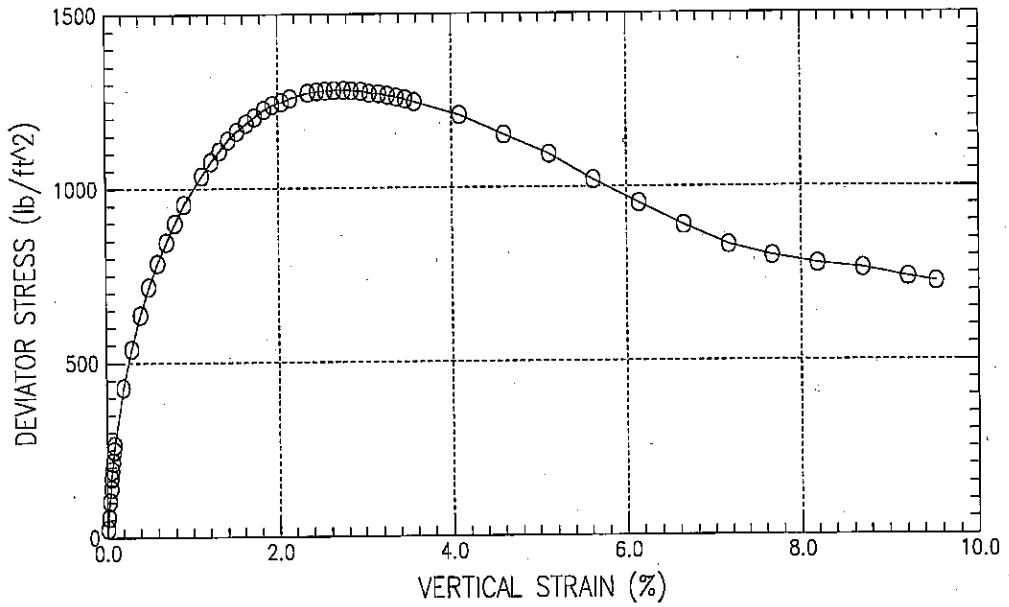
Washington State D.O.T.
Project Name : I5 TO INTERNATIONAL BORD
Project No : OL-3500 Boring No : H-4-99 Sample No : U-12/C
Test Date : 7/2/99 Test No : 298912C Depth : 43.7-44 FT
Description : WET DK GRAY CLAY
Remarks :



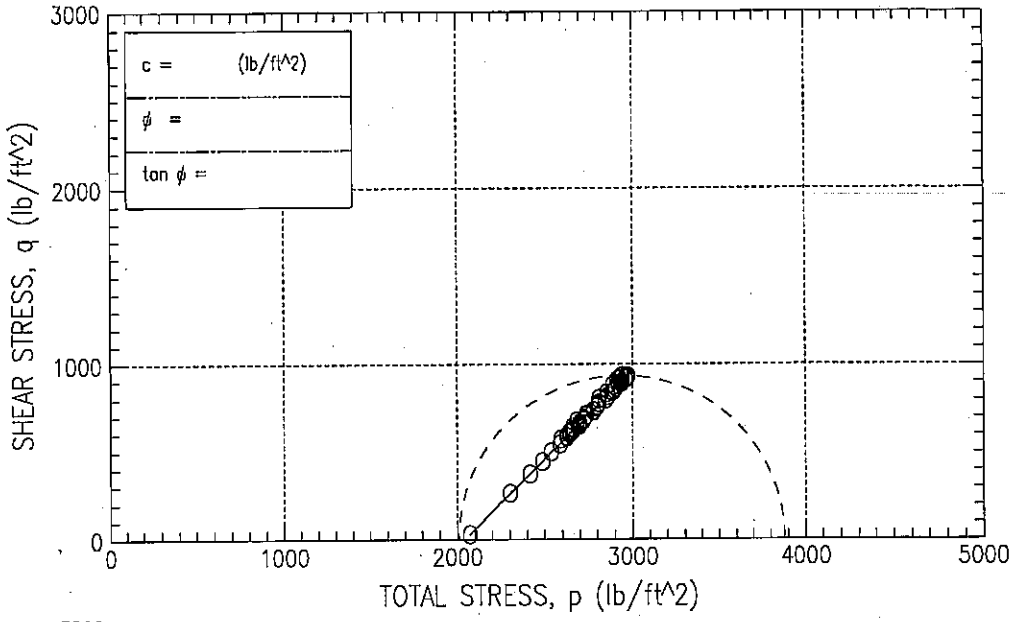


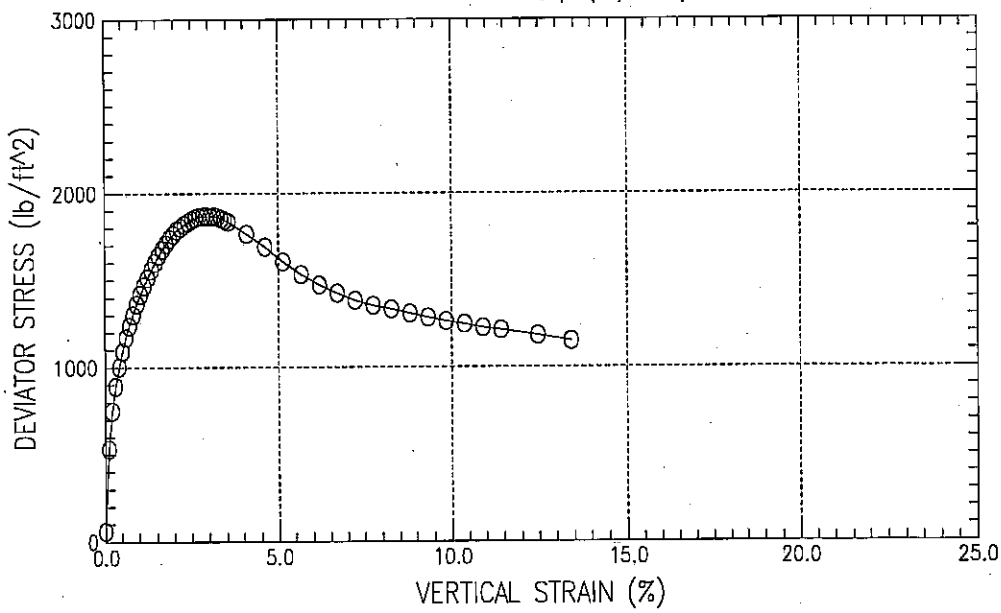
Washington State D.O.T.
Project Name : I5 TO INTERNATIONAL BORD
Project No : OL-3500 Boring No : H-4-99 Sample No : U-12/E
Test Date : 7/1/99 Test No : 298912E Depth : 44.3-44.7
Description : WET DK GRAY CLAY
Remarks :



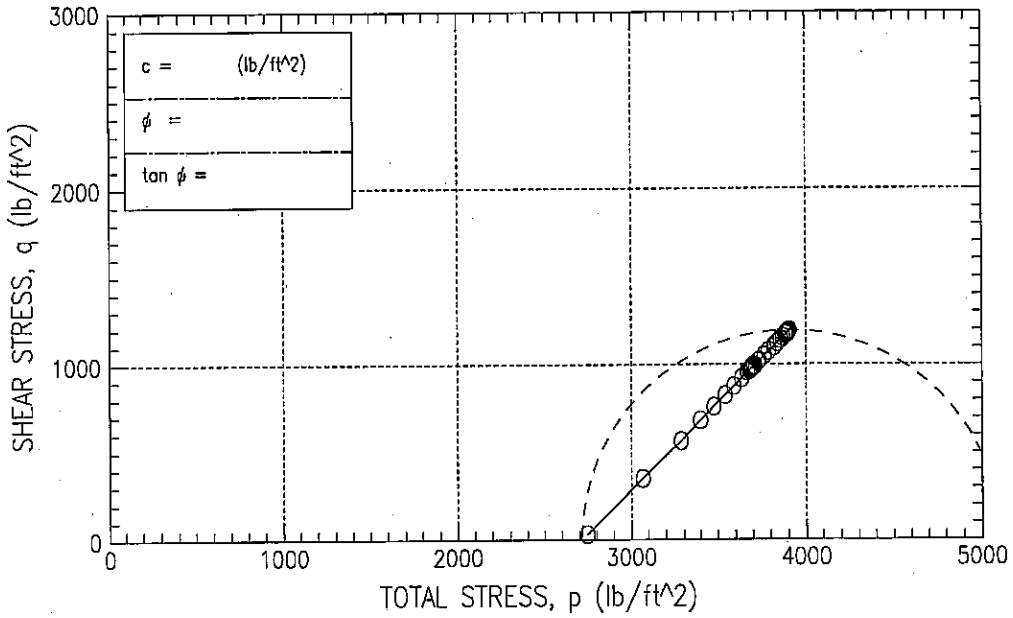


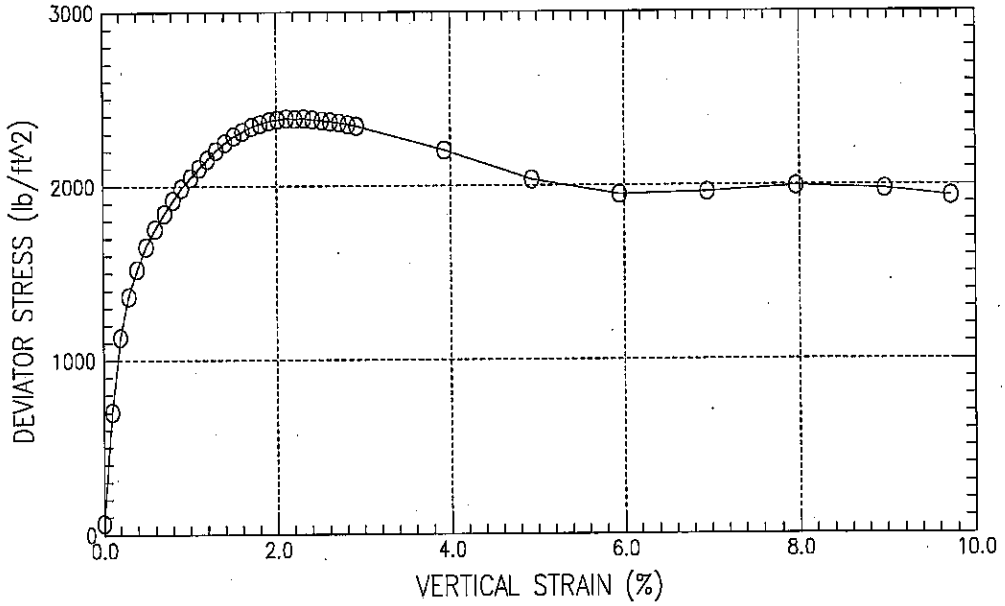
Washington State D.O.T.
Project Name : I-5 TO INT'L BORDER
Project No : OL-3500 Boring No : H-8-99 Sample No : S-12
Test Date : 11/12/99 Test No : 312312C Depth : 29-29.5 FT
Description : MOIST DK GRAY CLAY
Remarks :





Washington State D.O.T.
Project Name : I-5 TO INTNL BOUNDARY
Project No : OL-3500 Boring No : H-8-99 Sample No : S-12
Test Date : 10/25/99 Test No : 312312A Depth : 29.5 TO 30
Description : SAMPLE CONDITION - GOOD
Remarks : SAMPLE HAS BEEN LOCKED OFF FOR 10 DAYS





Washington State D.O.T.
Project Name : I-5 TO INTRNL BORDER
Project No : OL-3500 Boring No : H-8-99 Sample No : S-12
Test Date : 10-22-99 Test No : 312312B Depth : 30 FT
Description : SAMPLE HAS INDENT NEAR BASE
Remarks : USING LOADTRAC FRAME

APPENDIX D – LUMINAIRE/CAMERA POLE FOUNDATION TYPES

LUMINAIRE/CAMERA POLE FOUNDATION TYPE RECOMMENDATIONS

LUMINAIRE NUMBER	CAMERA POLE NUMBER	LINE	STATION	OFFSET	CLOSEST BORING	RETAINING WALL SUPPORT AVAILABLE	STANDARD FOUNDATION DESIGN POSSIBLE*
1	N/A	L Line	0+774	13.0 RT	TH-2-01	No	No
2	N/A	L Line	0+817	14.0 RT	"	No	No
3	N/A	Y Line	0+957	8.3 RT	"	No	No
4	N/A	B Line	1+047	10.6 RT	TH-1-01	No	No
5	N/A	L Line	0+940	13.8 LT	"	No	No
6	N/A	L Line	1+000	10.3 LT	"	No	No
7	N/A	L Line	1+058	10.9 LT	"	No	No
8	N/A	L Line	1+117	11.7 LT	TH-3-01	No	No
9	N/A	L Line	1+159	15.5 RT	TH-4-01	No	No
10	N/A	L Line	1+162	12.3 LT	TH-3-01	No	No
11	N/A	L Line	1+184	15.9 RT	TH-4-01	No	No
12	N/A	L Line	1+191	12.3 LT	TH-3-01	No	No
13	N/A	L Line	1+209	15.6 RT	TH-4-01	No	No
14	N/A	L Line	1+211	12.0 LT	TH-3-01	No	No
15	N/A	L Line	1+231	17.6 RT	TH-4-01	No	No
16	N/A	H Line	1+020	19.0 RT	"	No	No
17	N/A	L Line	1+240	18.0 LT	TH-3-01	No	No
18	N/A	H Line	0+978	15.2 RT	TH-4-01	No	No
19	N/A	H Line	1+029	15.2 LT	TH-3-01	No	No
20	N/A	L Line	1+274	19.4 RT	TH-4-01	No	No
21	N/A	L Line	1+270	19.3 LT	TH-3-01	No	No
22	N/A	L Line	1+282	16.0 LT	"	No	No
23	N/A	L Line	1+294	16.1 RT	TH-4-01	No	No
24	N/A	L Line	1+314	15.7 LT	TH-3-01	No	No
25	N/A	L Line	1+331	15.8 RT	TH-4-01	No	No
26	N/A	L Line	1+352	16.0 LT	TH-3-01	No	No
27	N/A	L Line	1+371	16.5 RT	TH-12-01	No	Yes
28	N/A	L Line	1+389	15.6 LT	"	No	Yes
29	N/A	LR Line	1+412	15.7 RT	"	No	Yes
"	"	"	"	"	"	No	Yes
"	"	"	"	"	"	No	Yes
30	N/A	LL Line	1+429	12.4 LT	"	No	Yes
"	"	"	"	"	"	No	Yes
"	"	"	"	"	"	No	Yes
31	N/A	LR Line	1+459	15.5 RT	TH-5-01	No	Yes
32	N/A	LL Line	1+465	12.5 LT	"	No	Yes
33	N/A	LL Line	1+505	11.5 LT	"	Yes	Yes
34	N/A	LR Line	1+504	15.9 RT	"	Yes	Yes
35	N/A	LL Line	1+547	12.0 LT	TH-5-01	Yes	Yes
36	N/A	LR Line	1+546	15.6 RT	"	Yes	Yes
37	N/A	LR Line	1+588	15.9 RT	TH-12-99	Yes	Yes
38	N/A	LL Line	1+593	12.2 LT	TH-3-99	Yes	Yes
39	N/A	LL Line	1+630	2.5 RT	"	Yes	Yes

* Allowable Lateral Bearing Pressure > 96 kPa (2000 psf) Page 1

LUMINAIRE/CAMERA POLE FOUNDATION TYPE RECOMMENDATIONS

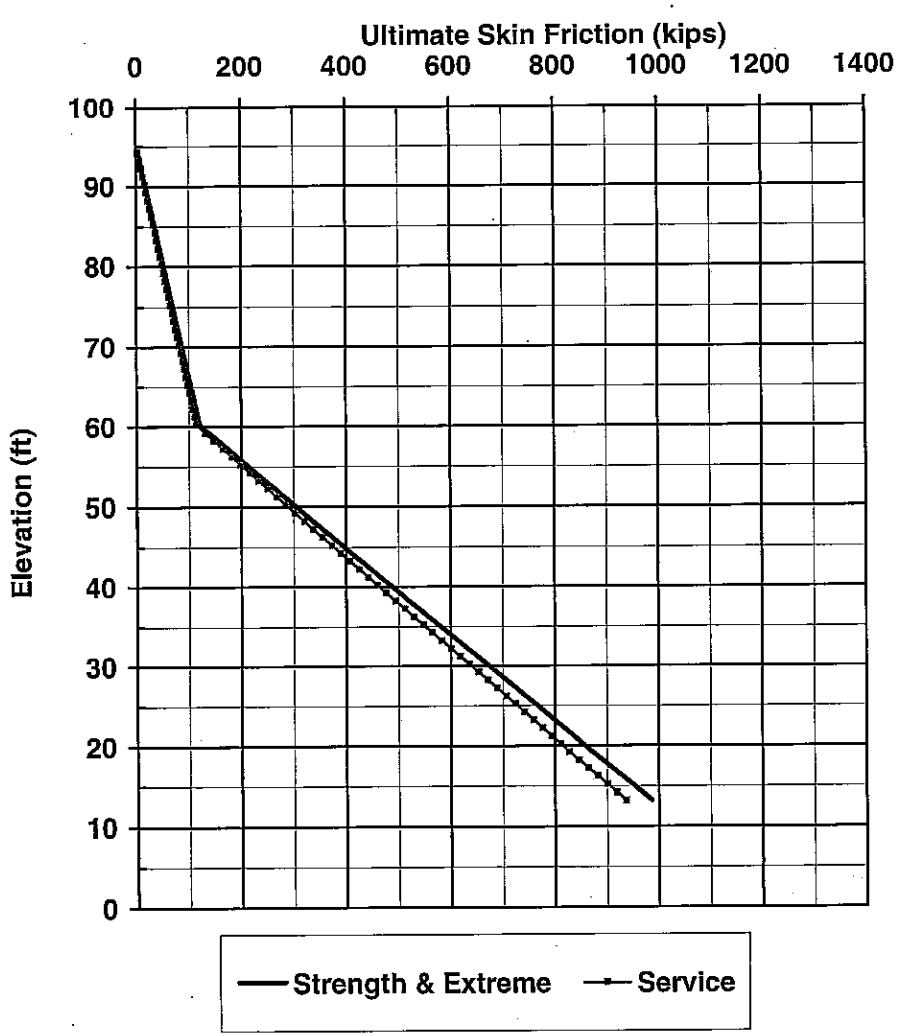
LUMINAIRE NUMBER	CAMERA POLE NUMBER	LINE	STATION	OFFSET	CLOSEST BORING	RETAINING WALL SUPPORT AVAILABLE	STANDARD FOUNDATION DESIGN POSSIBLE*
40	N/A	L Line	1+639	9.0 LT	"	Yes	Yes
41	N/A	LR Line	1+637	2.6 LT	TH-12-99	Yes	Yes
42	N/A	LR Line	1+686	4.5 LT	TH-11-99	Yes	Yes
43	N/A	L Line	1+690	8.7 RT	"	Yes	Yes
44	N/A	LL Line	1+691	3.0 RT	TH-4-99	Yes	Yes
45	N/A	L Line	1+742	9.5 LT	TH-6-01	Yes	Yes
46	N/A	LR Line	1+740	3.0 LT	TH-1-99	Yes	**No**
47	N/A	LL Line	1+768	3.2 RT	TH-6-01	Yes	Yes
48	N/A	L Line	1+790	8.6 RT	TH-10-99	Yes	Yes
49	N/A	L Line	1+790	8.6 RT	"	Yes	Yes
48	N/A	L Line	1+790	8.6 RT	"	Yes	Yes
50	N/A	L Line	1+837	8.4 LT	TH-2-99	Yes	**No**
51	N/A	T Line	1+814	8.7 RT	TH-10-99	Yes	Yes
52	N/A	T Line	1+849	32.7 RT	"	Yes	Yes
53	N/A	LL Line	1+882	10.8 LT	TH-2-99	Yes	**No**
54	N/A	LL Line	1+939	11.0 LT	TH-8-99	Yes	Yes
55	N/A	LR Line	1+931	8.2 RT	TH-7-01	Yes	**No**
56	N/A	LR line	1+931	8.2 RT	"	Yes	**No**
57	N/A	T Line	1+946	32.9 RT	"	Yes	**No**
58	N/A	L Line	2+023	8.8 LT	TH-8-01	Yes	Yes
59	N/A	L Line	2+023	8.8 LT	"	Yes	Yes
60	N/A	T Line	2+001	8.7 RT	TH-9-01	Yes	Yes
61	N/A	T Line	2+252	9.0 RT	TH-11-02	Yes	**No**
62	N/A	T Line	2+114	7.2 LT	TH-10-02	Yes	**No**
N/A	543CC0006	L Line	1+110	19.0 LT	TH-3-01	**No**	**No**
N/A	543CC0008	LR Line	1+706	13.5 RT	TH-11-99	Yes	Yes
N/A	543CC0010	LR Line	1+932	8.0 RT	TH-7-01	Yes	**No**
N/A	543CC0011	T Line	2+026	5.0 RT	TH-9-01	Yes	Yes

* Allowable Lateral Bearing Pressure > 96 kPa (2000 psf)

APPENDIX E – AXIAL CAPACITY CHARTS FOR DRILLED SHAFTS

D Street Bridges, SR-543, SR-5 to International Boundary

Diameter 4.00 FT
Casing TEMPORY



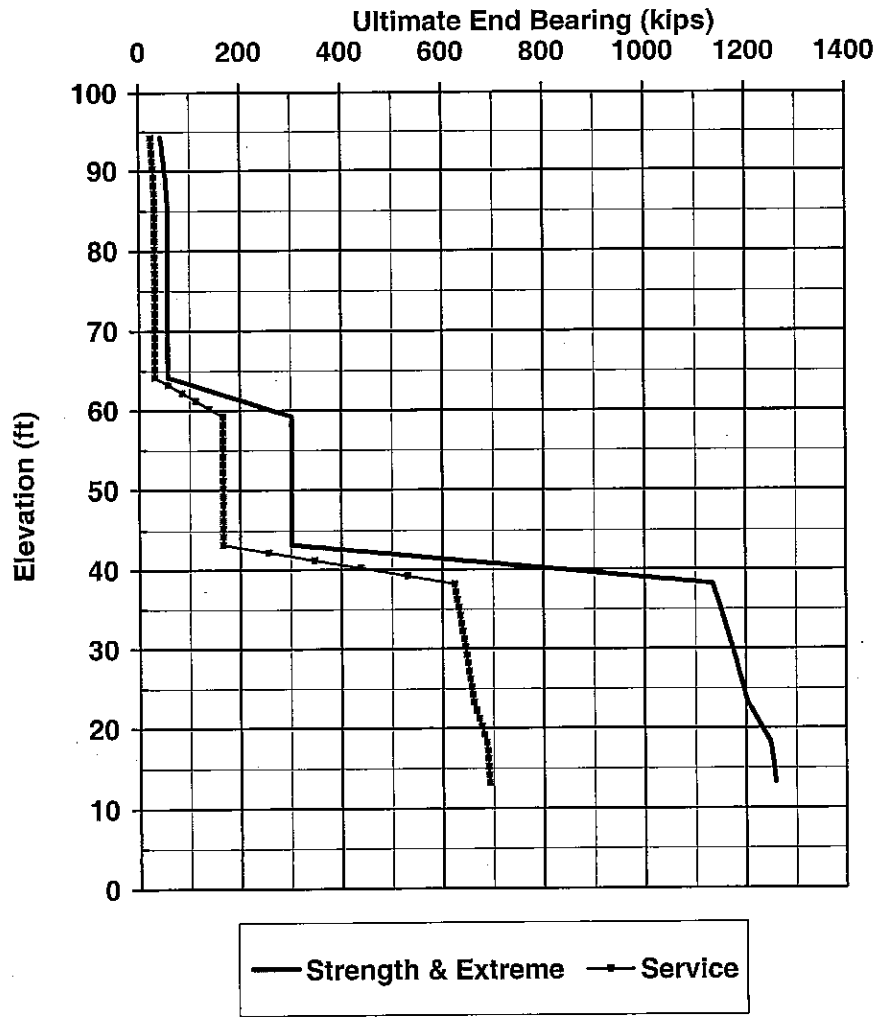
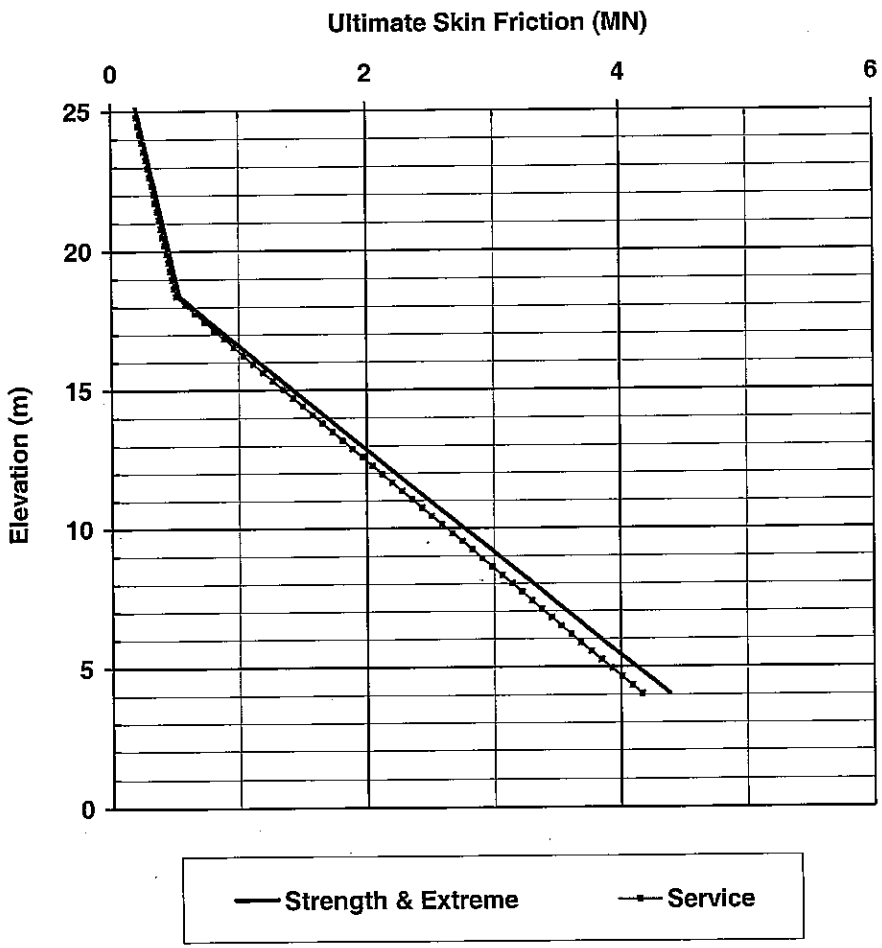


Figure E-2

D Street Bridges, SR-543, SR-5 to International Boundary

Diameter 1.22 M
Casing TEMPORARY



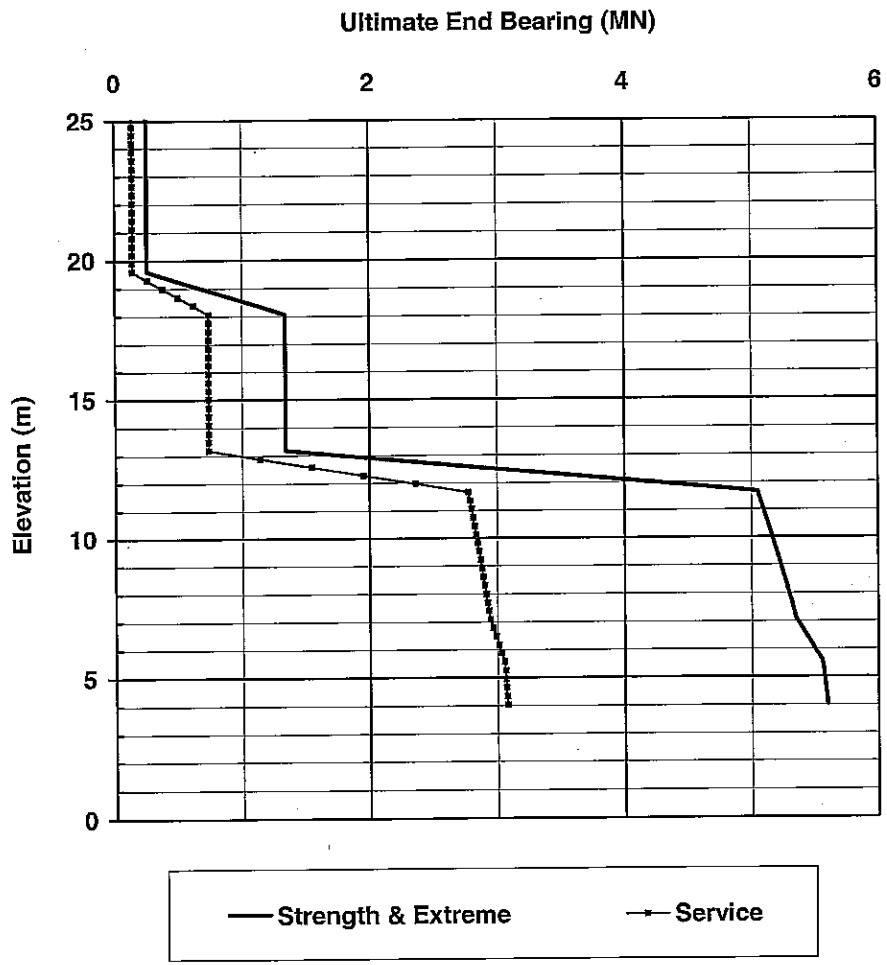


Figure E-1

APPENDIX F - P-Y CURVE INPUT PARAMETERS

SR-5 to International Boundary Modifications
P-Y Curve Parameters for LPILE Input

Retaining Wall 1, Sta 1+612 - 1+703 and Retaining Wall 5, Sta 1+500 - 1+708 (TH-3--99) - Static Analyses

Boring Elevation = 31.2m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	STATIC ANALYSES: Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1A	(3.3) - (1.8)	(10.8)-(5.9)	SAND	4	19.6	0.07	125	0.0	0.0	0	-	33	16	60
1B	(1.8) - 5.8	(5.9) - 19.0	SAND	4	9.8	0.04	63	0.0	0.0	0	-	31	11	40
2	5.8 - 7.4	19.0 - 24.3	SAND	4	8.3	0.03	53	0.0	0.0	0	-	29	3	10
3	7.4 - 13.5	24.3 - 44.3	CLAY	1	7.5	0.03	48	12.9	1.9	270	0.02	0	0	0
4	13.5 - 16.5	44.3 - 54.1	SAND	4	8.3	0.03	53	0.0	0.0	0	-	29	3	10
5	>16.5	>54.1	SAND	4	11.4	0.04	73	0.0	0.0	0	-	42	46	170

Retaining Wall 2, Sta 1+728 - 1+808 and Retaining Wall 6, Sta 1+724 - 1+948 (TH-2-99) - Static Analyses

Boring Elevation = 30.1 m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	STATIC ANALYSES: Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1A	(1.4) - 0.1	(4.6) - 0.4	SAND	4	18.1	0.07	115	0.0	0.0	0	-	29	3	10
1B	0.1 - 1.3	0.4 - 4.3	SAND	4	8.3	0.03	53	0.0	0.0	0	-	28	1	5
3	1.3 - 13.5	4.3 - 44.3	CLAY	1	7.5	0.03	48	19.2	2.8	400	0.02	0	0	0
5	> 13.5	> 44.3	SAND	4	11.4	0.04	73	0.0	0.0	0	-	42	46	170

Retaining Wall 3, Sta 1+651 - 1+703 and Retaining Wall 7 , Sta 1+562 - 1+707 (TH-12-99) - Static Analyses

Boring Elevation = 26.8 m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	STATIC ANALYSES: Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1A	(4.5) - (3.0)	(14.8)-(9.8)	SAND	4	19.6	0.07	125	0.0	0.0	0	-	42	46	170
1B	(3.0) - (0.8)	(9.8) - (2.6)	SAND	4	9.8	0.04	63	0.0	0.0	0	-	36	26	95
2	(0.8) - 5.3	(2.6) - 17.4	CLAY	2	8.3	0.03	53	71.9	10.4	1500	0.007	0	80	300
3	5.3 - 11.3	17.4 - 37.1	CLAY	1	7.5	0.03	48	4.8	0.7	100	0.02	0	0	0
4	>11.3	>37.1	SAND	4	11.4	0.04	73	0.0	0.0	0	-	42	46	170

SR-5 to International Boundary Modifications
P-Y Curve Parameters for LPILE Input

Retaining Wall 4, Sta 1+723 - 1+793, Retaining Wall 8, Sta 1+723 - 1+831, and Retaining Wall 9, Sta 1+723 - 1+886 (TH-10-99) - Static Analyses

Boring Elevation = 38.3 m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	STATIC ANALYSES: Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1A	(9.1) - (7.6)	(29.9)-(24.9	SAND	4	19.6	0.07	125	0.0	0.0	0	-	36	26	95
1B	(7.6) - (5.1)	(24.9)-16.7	SAND	4	11.4	0.04	73	0.0	0.0	0	-	38	31	115
2	(5.1) - (0.6)	(16.7)-(2.0)	CLAY	2	8.3	0.03	53	71.9	10.4	1500	0.007	0	80	300
3	(0.6) - 18.3	(2.0) - 60.0	CLAY	1	7.5	0.03	48	6.2	0.9	130	0.02	0	0	0
5	>18.3	>60.0	SAND	4	9.8	0.04	63	0.0	0.0	0	-	42	46	170

Retaining Wall 6, Sta 1+948 - 1+982 (TH-8-01) - Static Analyses

Boring Elevation = 28.6 m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	STATIC ANALYSES: Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1A	(2.6) - (1.1)	(8.5)-(3.6)	SAND	4	19.6	0.07	125	0.0	0.0	0	-	33	16	60
1B	(1.1) - 3.5	(3.6) - 11.5	SAND	4	8.3	0.03	53	0.0	0.0	0	-	30	8	30
2	3.5 - 5.0	11.5 - 16.4	CLAY	2	8.3	0.03	53	38.3	5.6	800	0.01	0	0	0
3	5.0 - 9.6	16.4 - 31.5	CLAY	1	7.5	0.03	48	6.2	0.9	130	0.02	0	0	0
5	>9.6	>31.5	SAND	4	9.8	0.04	63	0.0	0.0	0	-	42	46	170

Retaining Wall 7, Sta 1+501 - 1+562 (TH-5-01) - Static Analyses

Boring Elevation = 38.3 m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	STATIC ANALYSES: Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
2A	(2.1) - (0.6)	(6.9)-(2.0)	SAND	4	18.1	0.07	115	0.0	0.0	0	-	29	3	10
2B	(0.6) - 3.4	(2.0) - 11.2	SAND	4	9.8	0.04	63	0.0	0.0	0	-	32	14	50
3	3.4-18.6	11.2-61.0	CLAY	1	7.5	0.03	48	12.9	1.9	270	0.02	0	0	0
5	>18.6	>61.0	SAND	4	11.4	0.04	73	0.0	0.0	0	-	42	46	170

SR-5 to International Boundary Modifications
P-Y Curve Parameters for LPILE Input

Retaining Walls 9 and 10, Sta 1+886 - 2+040 (TH-9-01) - Static Analyses

Boring Elevation = 28.6 m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	STATIC ANALYSES: Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1	(2.6) - (1.4)	(8.5)-(4.6)	SAND	4	19.6	0.07	125	0.0	0.0	0	-	30	8	30
2	(1.4) -1.7	(4.6) - 5.6	CLAY	2	8.3	0.03	53	71.9	10.4	1500	0.01	0	80	300
3	1.7 - 13.9	5.6 - 45.6	CLAY	1	7.5	0.03	48	6.2	0.9	130	0.02	0	0	0
5	> 13.9	>45.6	SAND	4	11.4	0.04	73	0.0	0.0	0	-	42	46	170

Bridge Abutment Walls (TH-4-99) - Static Analyses

Boring Elevation = 34.5 m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	STATIC ANALYSES: Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1A	(5.3) - (3.8)	(17.4)-(12.5)	SAND	4	19.6	0.07	125	0.0	0.0	0	-	33	16	60
1B	(3.8) - 2.0	(12.5) - 6.6	SAND	4	8.3	0.03	53	0.0	0.0	0	-	29	3	10
3	2.0 - 12.4	6.6 - 40.7	CLAY	1	7.5	0.03	48	24.0	3.5	500	0.01	0	0	0
4	12.4 - 18.5	40.7 - 60.7	SAND	4	9.8	0.04	63	0.0	0.0	0	-	36	26	95
5	> 18.5	>60.7	SAND	4	11.4	0.04	73	0.0	0.0	0	-	42	46	170

TH-2-01, Boblett Street Intersection Signal Poles and all Non Standard Luminaires and Camera Poles

Ground Surface Elevation = 21.6 m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	STATIC ANALYSES: Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1	0.0 - 2.1	0.0 to 7.0	CLAY	1	7.6	0.03	48	0.0	3.5	500	0.20	0	0	0
3	2.1 - 9.3	7.0 - 30.5	CLAY	1	7.6	0.03	48	0.0	1.4	200	0.20	0	0	0

SR-5 to International Boundary Modifications
P-Y Curve Parameters for LPILE Input

TH-2-01, Boblett Street Intersection Signal Poles and all Non Standard Luminaires and Camera Poles

Ground Surface Elevation = 21.6 m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	CYCLIC ANALYSES									
					Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1	0.0 - 9.3	0.0 - 30.5	CLAY	1	7.6	0.03	48	0.0	1.4	200	0.20	0	0	0

TH-3-01, H Street Intersection

Ground Surface Elevation = 22.5 m

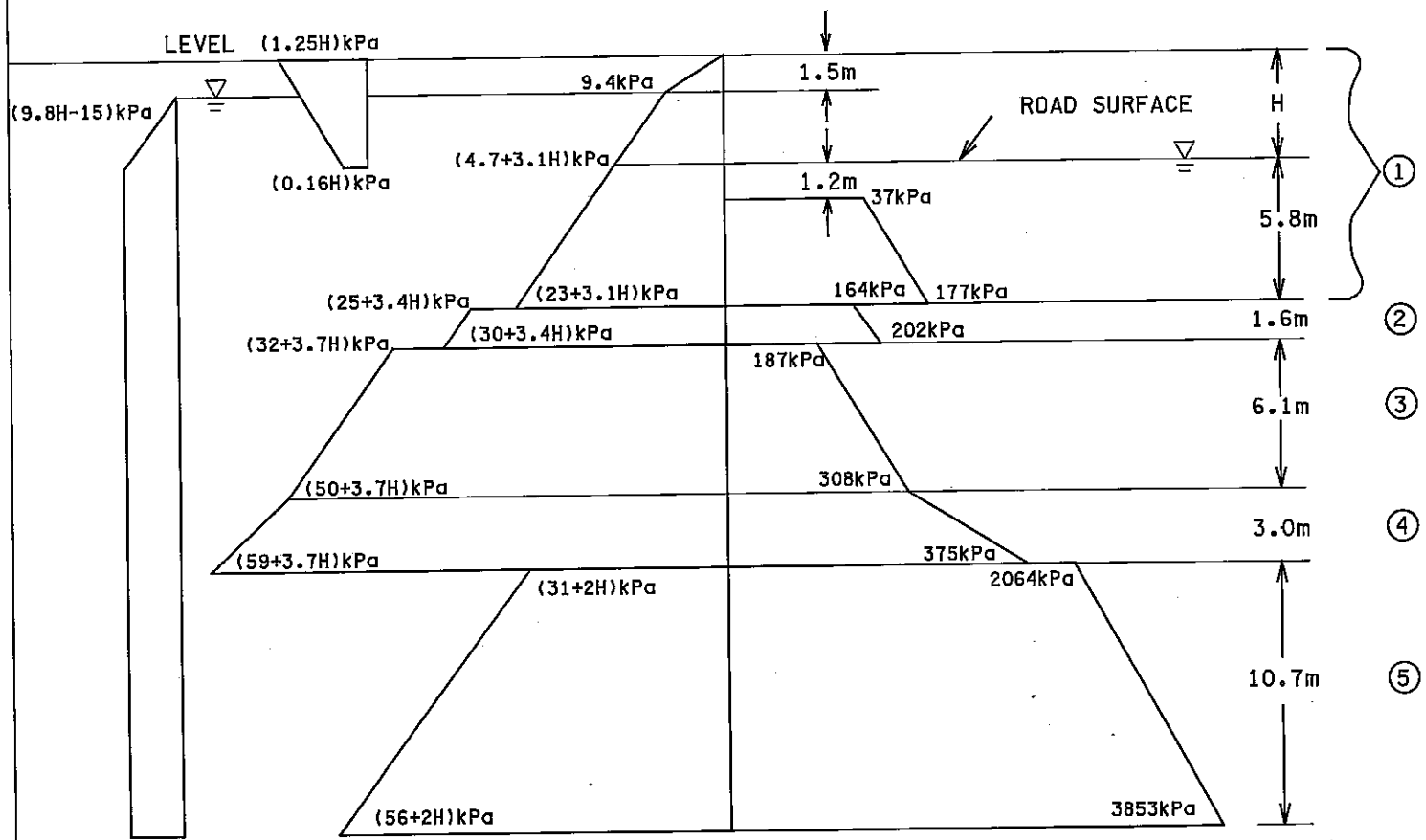
Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	STATIC ANALYSES									
					Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1	0.0 - 1.5	0.0 to 5.0	CLAY	1	7.6	0.03	48	0.0	3.5	500	0.20	0	0	0
2	1.5 - 39.9	5.0 - 131.0	CLAY	1	7.6	0.03	48	0.0	1.4	200	0.20	0	0	0

TH-3-01, H Street Intersection

Ground Surface Elevation = 22.5 m

Soil Unit	Depth (Above) Below Road Surface		Soil Type	Soil Profile Type (KSOIL)	CYCLIC ANALYSES									
					Effective Unit Weight of Soil			Saturated Undrained Strength, Su			Axial Strain ε_{50}	Friction Angle ϕ	Modulus of Subgrade Reaction	
	m	ft			kN/m3	pci	pcf	kPa	psi	psf	(%)	(deg)	MN/m3	pci
1	0.0 - 1.5	0.0 to 5.0	CLAY	1	7.6	0.03	48	0.0	1.4	200	0.20	0	0	0
2	1.5 - 39.9	5.0 - 131.0	CLAY	1	7.6	0.03	48	0.0	1.4	200	0.20	0	0	0

APPENDIX G – LATERAL PRESSURE DIAGRAMS



① Ø =31°
γ_m = 19.6 kN/m^3
γ_{sub} = 9.8 kN/m^3
K_a = 0.32
K_p = 3.12
ΔK_{ae} = 0.08

② Ø =29°
γ_{sub} = 8.3kN/m^3
K_a = 0.35
K_p = 2.88

③ Ø =27°
γ_{sub} = 7.5 kN/m^3
K_a = 0.38
K_p = 2.66

④ Ø =27°
γ_{sub} = 8.3 kN/m^3
K_a = 0.38
K_p = 2.66

⑤ Ø =42°
γ_{sub} = 11.4 kN/m^3
K_a = 0.20
K_p = 14.66

RETAINING WALL 1 STATION 1+612-1+703
RETAINING WALL 2 STATION 1+728-1+808
RETAINING WALL 5 STATION 1+500-1+680

FIGURE G-1: EARTH PRESSURE DIAGRAM

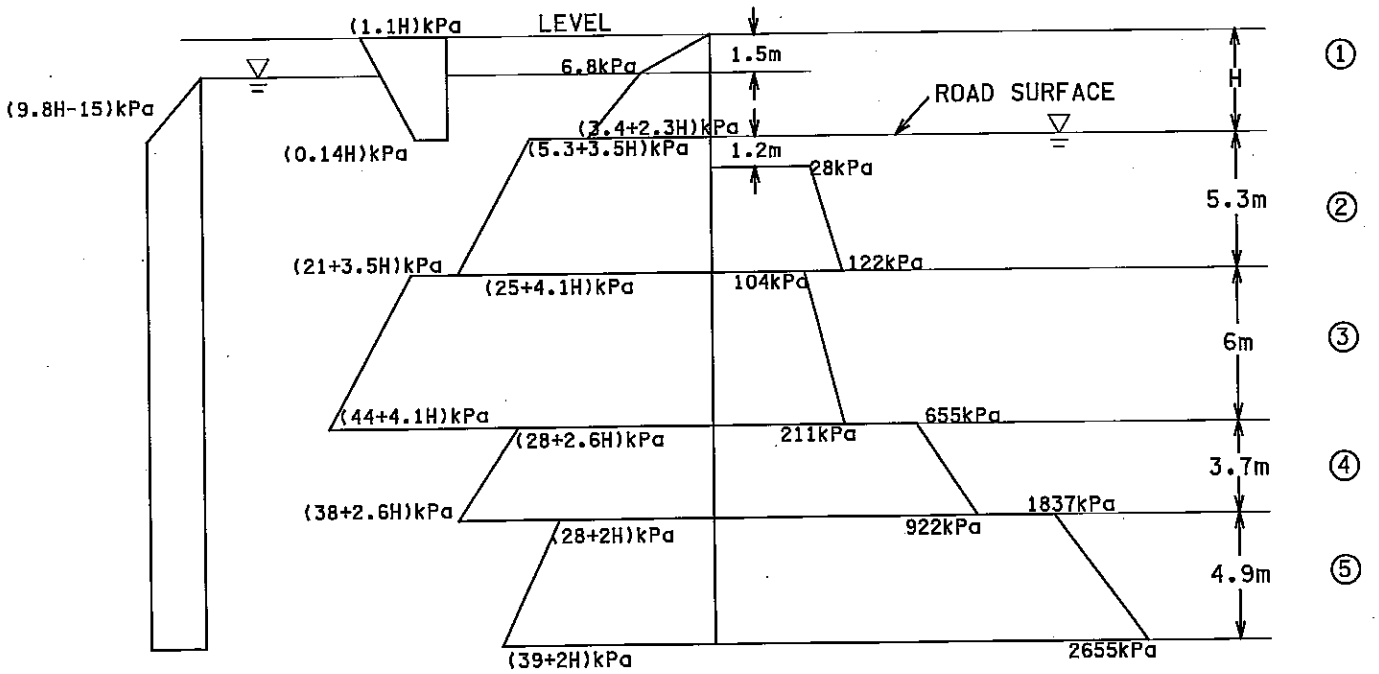
JOB 0L-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:08:54 PM



① $\varnothing = 39°$
$\gamma_m = 19.6\ kN/m^3$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.23$
$K_p = 10.63$
$\Delta K_{ae} = 0.07$

② $\varnothing = 28°$
$\gamma_{sub} = 8.3 kN/m^3$
$K_a = 0.36$
$K_p = 2.77$

③ $\varnothing = 24°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.42$
$K_p = 2.37$

④ $\varnothing = 35°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.27$
$K_p = 7.36$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 3 STATION 1+562-1+703
RETAINING WALL 7 STATION 1+562-1+680

FIGURE G-2: EARTH PRESSURE DIAGRAM

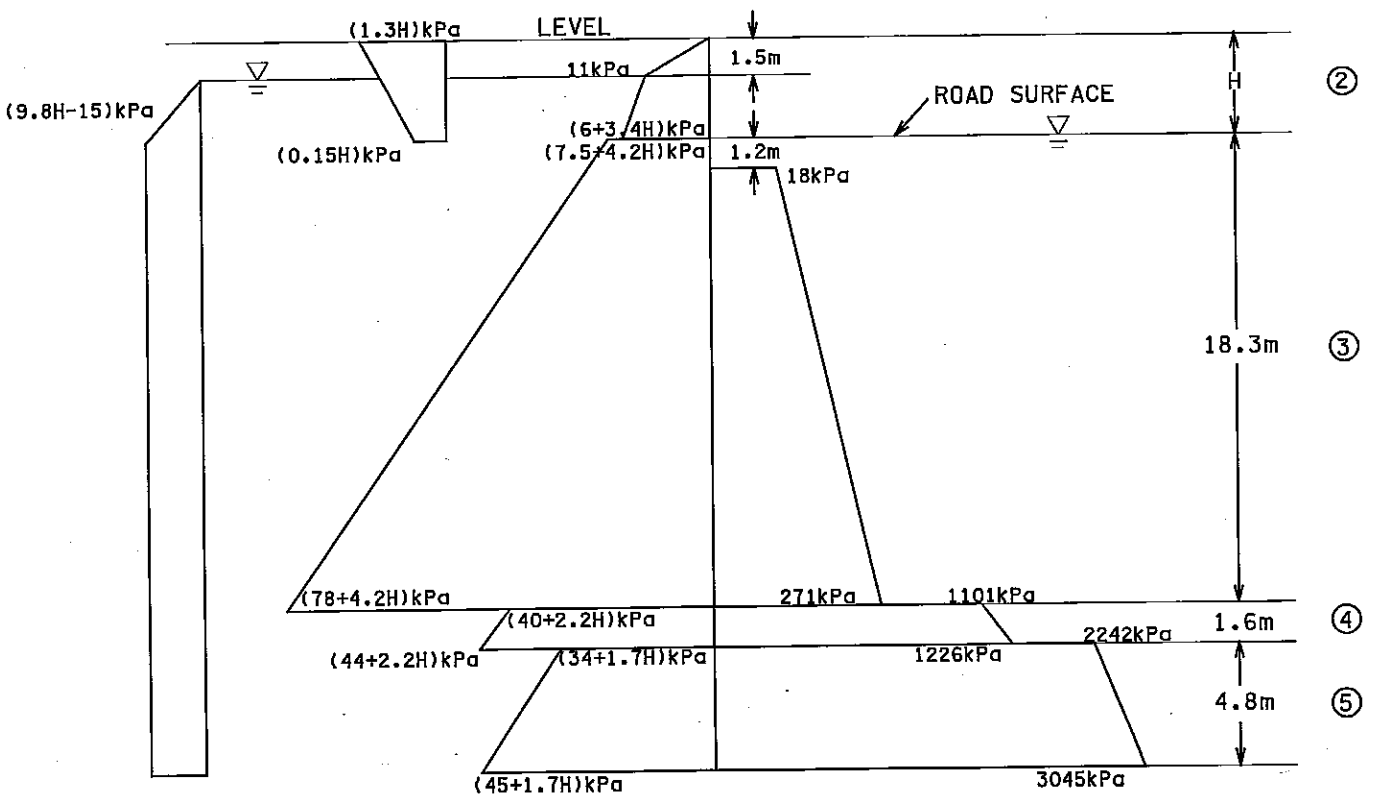
JOB 01-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:09:45 PM



② $\varnothing = 25°$
$\gamma_m = 18.1\ kN/m^3$
$\gamma_{sub} = 8.3\ kN/m^3$
$K_a = 0.41$
$K_p = 2.46$
$\Delta K_{ae} = 0.09$

③ $\varnothing = 19°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.51$
$K_p = 1.97$

④ $\varnothing = 36°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.26$
$K_p = 8.02$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 4 STATION 1+723-1+793
RETAINING WALL 7 STATION 1+501-1+562

FIGURE G-3: EARTH PRESSURE DIAGRAM

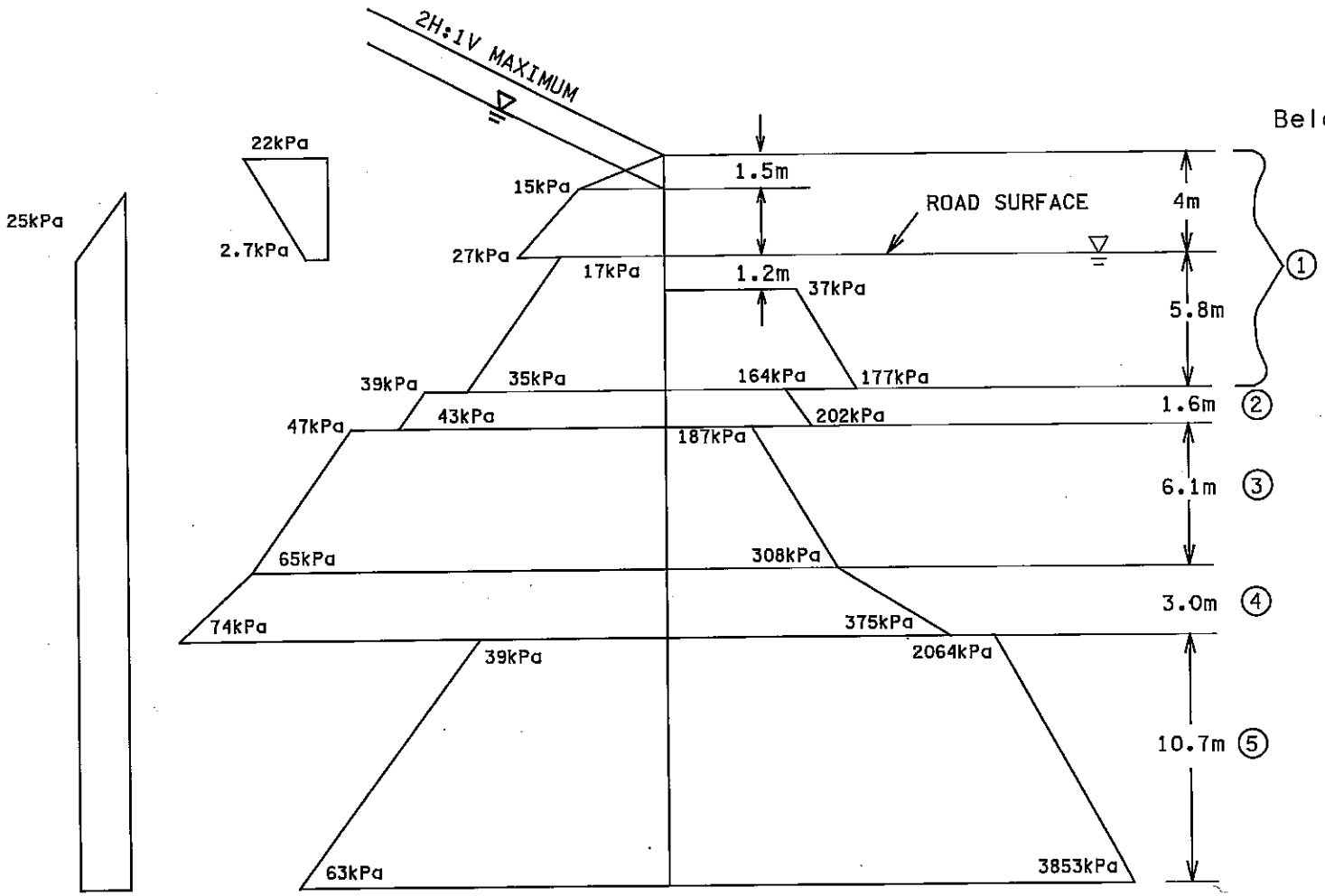
JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:09:35 PM



Above Base of Excavation

① $\varnothing = 31°$
$\gamma_m = 19.6\ kN/m^3$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.50$
$K_p = 3.12$
$\Delta K_{ae} = 0.35$

Below Base of Excavation

① $\varnothing = 31°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.32$
$K_p = 3.12$

② $\varnothing = 29°$
$\gamma_{sub} = 8.3\ kN/m^3$
$K_a = 0.35$
$K_p = 2.88$

③ $\varnothing = 27°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.38$
$K_p = 2.66$

④ $\varnothing = 27°$
$\gamma_{sub} = 8.3\ kN/m^3$
$K_a = 0.38$
$K_p = 2.66$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 5 STATION 1+680-1+708
RETAINING WALL 6 STATION 1+724-1+948

FIGURE G-4: EARTH PRESSURE DIAGRAM

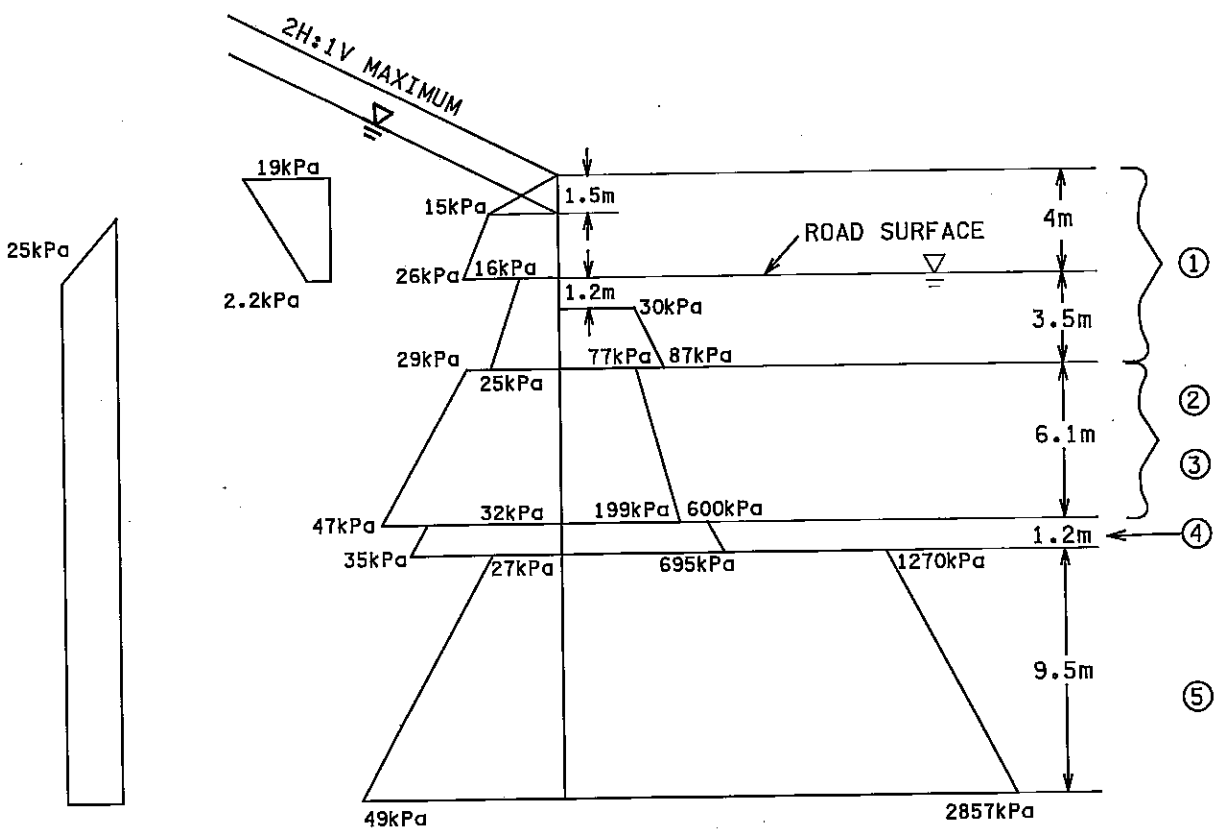
JOB 01-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:08:59 PM



Above Base of Excavation

① $\varnothing = 30°$
$\gamma_m = 18.1\ kN/m^3$
$\gamma_{sub} = 8.3\ kN/m^3$
$K_a = 0.54$
$K_p = 3.00$
$\Delta K_{ae} = 0.33$

Below Base of Excavation

① $\varnothing = 30°$
$\gamma_{sub} = 8.3\ kN/m^3$
$K_a = 0.33$
$K_p = 3.00$

② ③ $\varnothing = 27°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.38$
$K_p = 2.66$

④ $\varnothing = 36°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.26$
$K_p = 8.02$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 6 STATION 1+948-1+982

FIGURE G-5: EARTH PRESSURE DIAGRAM

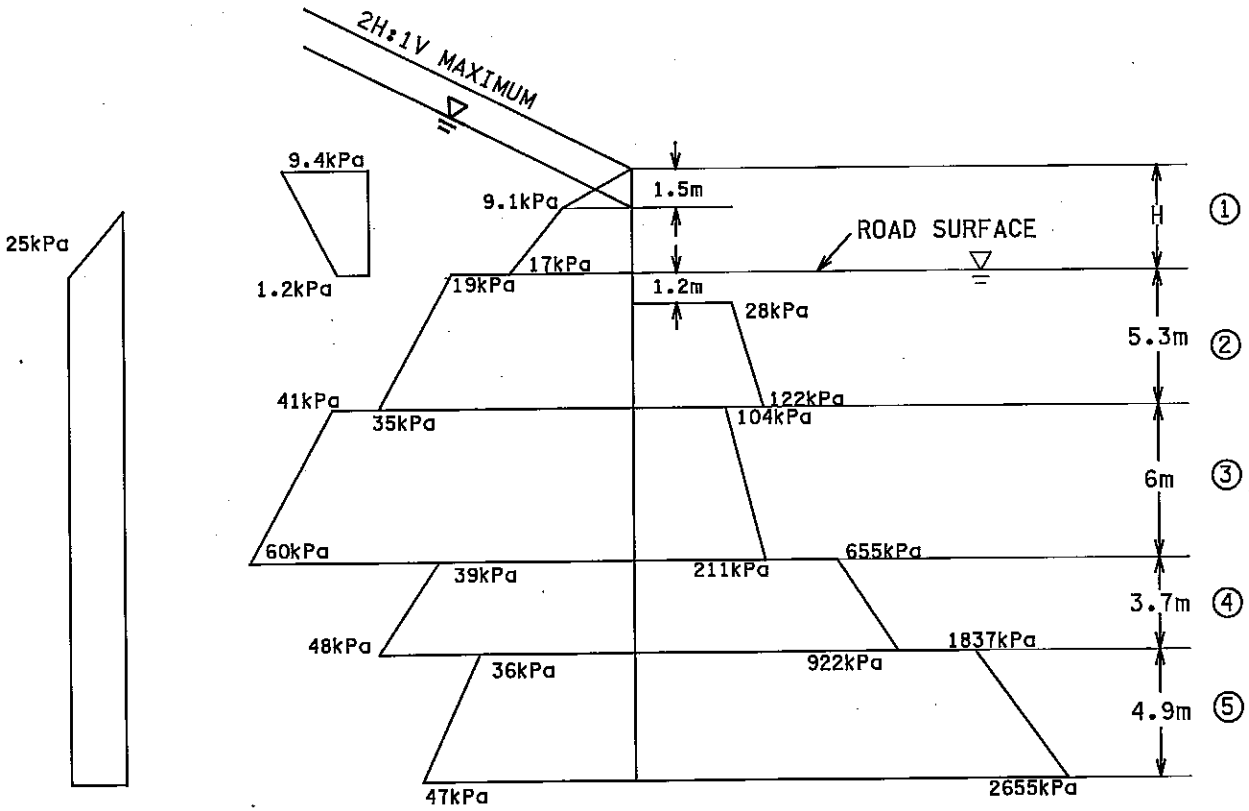
JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:09:16 PM



① $\varnothing = 39°$
$\gamma_m = 19.6\ kN/m^3$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.31$
$K_p = 10.63$
$\Delta K_{ae} = 0.15$

② $\varnothing = 28°$
$\gamma_{sub} = 8.3 kN/m^3$
$K_a = 0.36$
$K_p = 2.77$

③ $\varnothing = 24°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.42$
$K_p = 2.37$

④ $\varnothing = 35°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.27$
$K_p = 7.36$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 7 STATION 1+680-1+707

FIGURE G-6: EARTH PRESSURE DIAGRAM

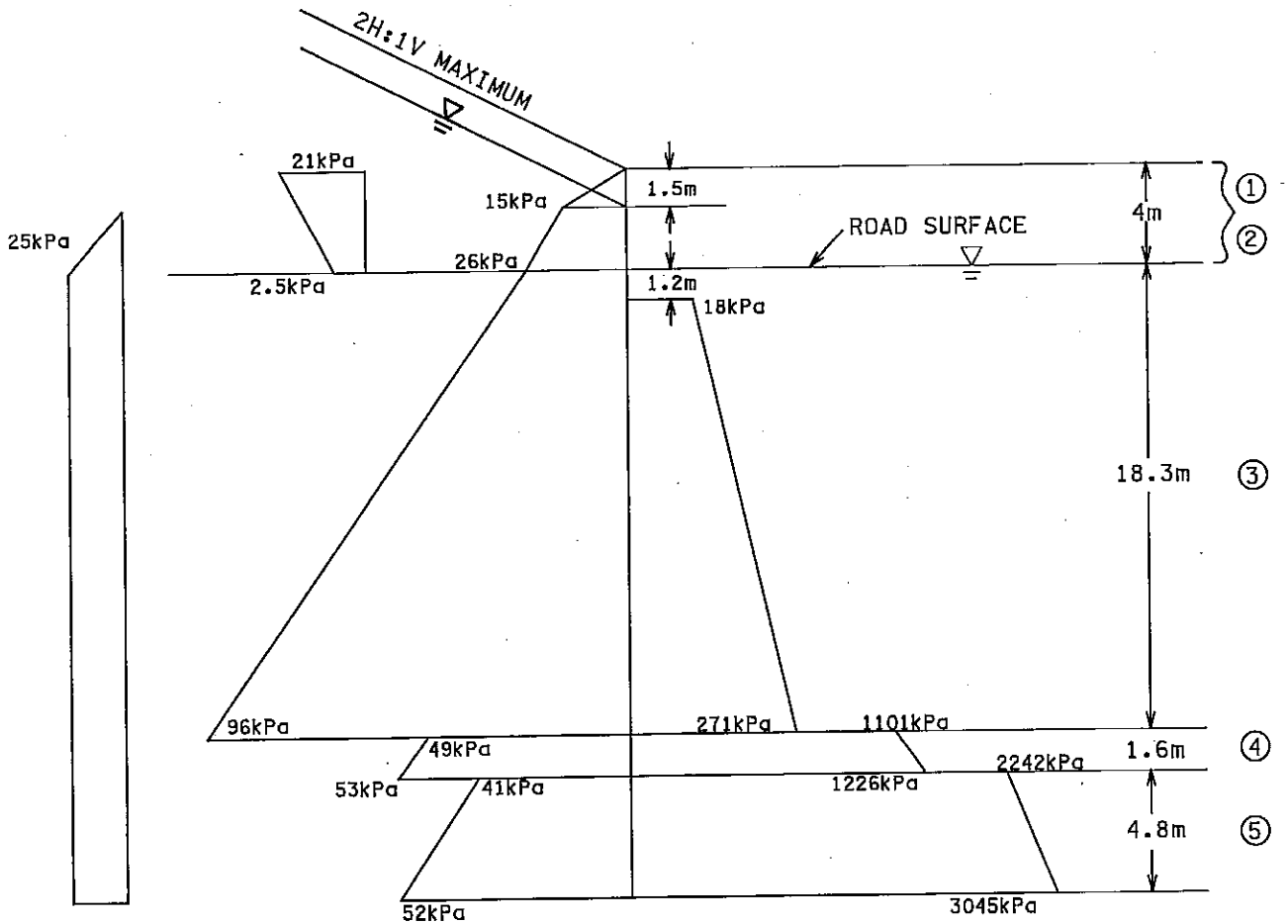
JOB 01-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:09:53 PM



① ② $\varnothing = 31°$
$\gamma_m = 18.9\ kN/m^3$
$\gamma_{sub} = 9.1\ kN/m^3$
$K_a = 0.50$
$K_p = 3.12$
$\Delta K_{ae} = 0.35$

③ $\varnothing = 19°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.51$
$K_p = 1.97$

④ $\varnothing = 36°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.26$
$K_p = 8.02$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 8 STATION 1+723-1+831
RETAINING WALL 9 STATION 1+831-1+866

FIGURE G-7: EARTH PRESSURE DIAGRAM

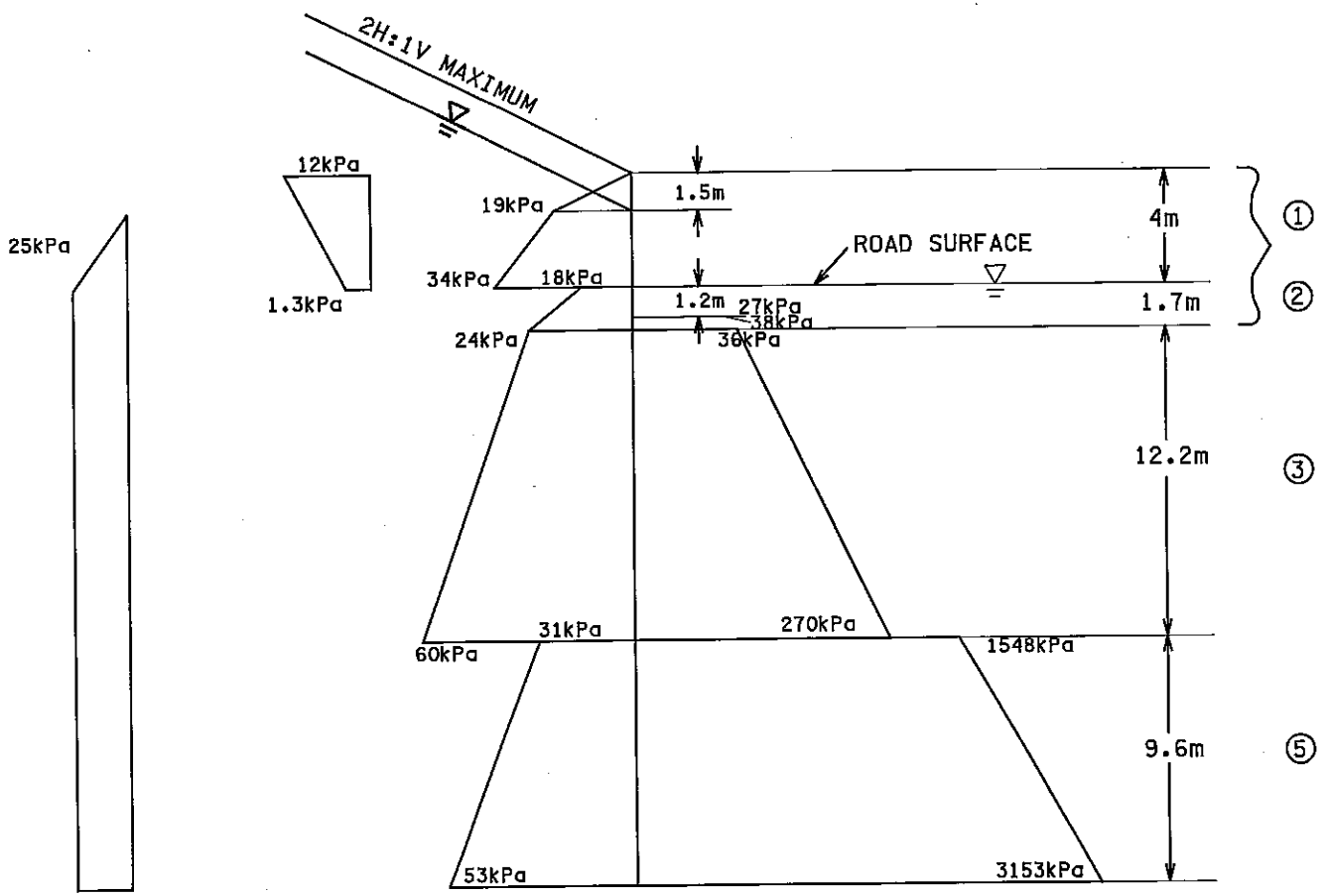
JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:09:39 PM



Above Base of Excavation

① $\varnothing = 27°$
$\gamma_m = 18.1\ kN/m^3$

② $\gamma_{sub} = 8.3\ kN/m^3$
$K_a = 0.70$
$K_p = 2.66$
$\Delta K_{ae} = 0.20$

Below Base of Excavation

① $\varnothing = 27°$

② $\gamma_m = 8.3\ kN/m^3$
$K_a = 0.38$
$K_p = 2.66$

③ $\varnothing = 26°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.39$
$K_p = 2.56$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 9 STATION 1+866-1+900

FIGURE G-8: EARTH PRESSURE DIAGRAM

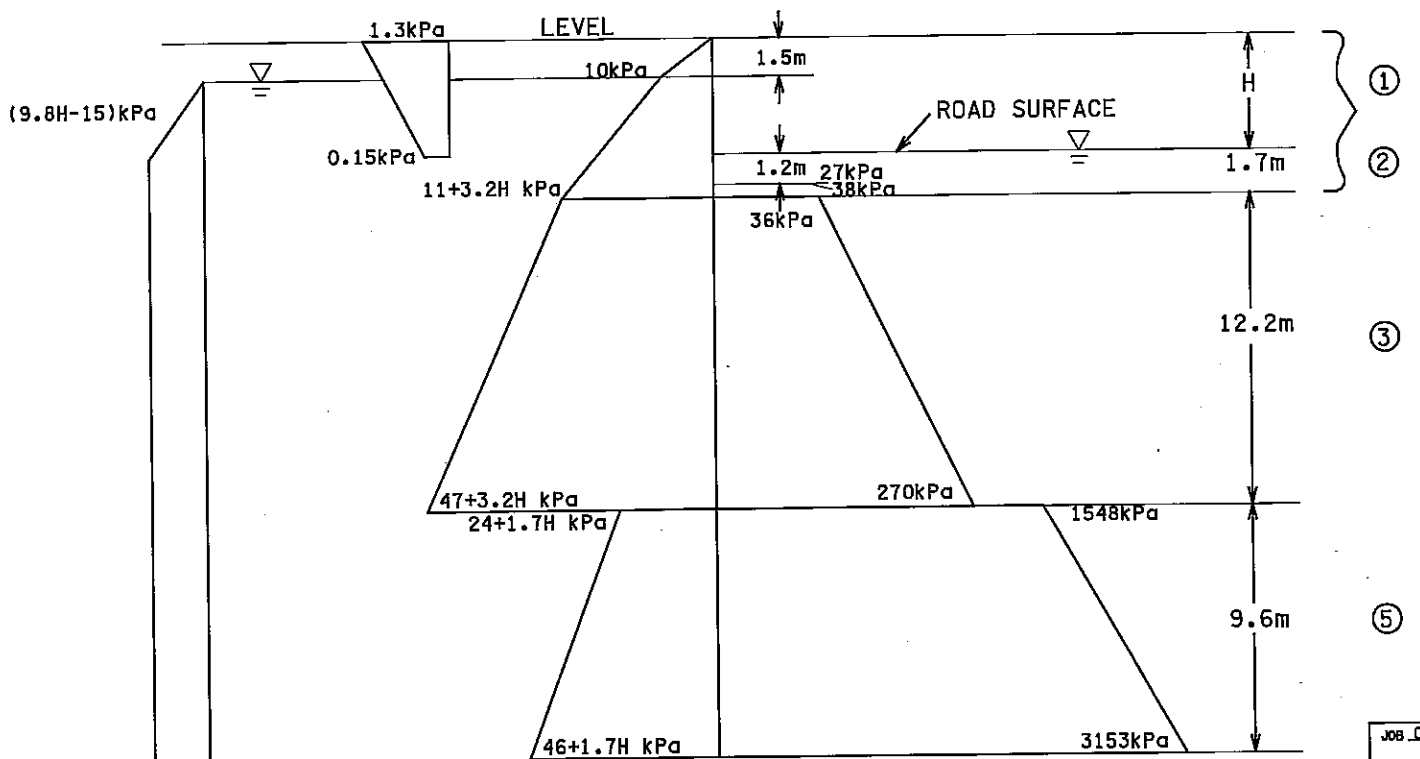
JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:09:30 PM



① Ø =27°
② γ_m = 18.1 kN/m^3
γ_{sub} = 8.3 kN/m^3
K_a = 0.38
K_p = 2.66
ΔK_{ae} = 0.09

③ Ø =26°
γ_{sub} = 7.5 kN/m^3
K_a = 0.39
K_p = 2.56

⑤ Ø =42°
γ_{sub} = 11.4 kN/m^3
K_a = 0.20
K_p = 14.66

RETAINING WALL 9 STATION 1+900-1+949
RETAINING WALL 10 STATION 1+949-2+040

FIGURE G-9: EARTH PRESSURE DIAGRAM

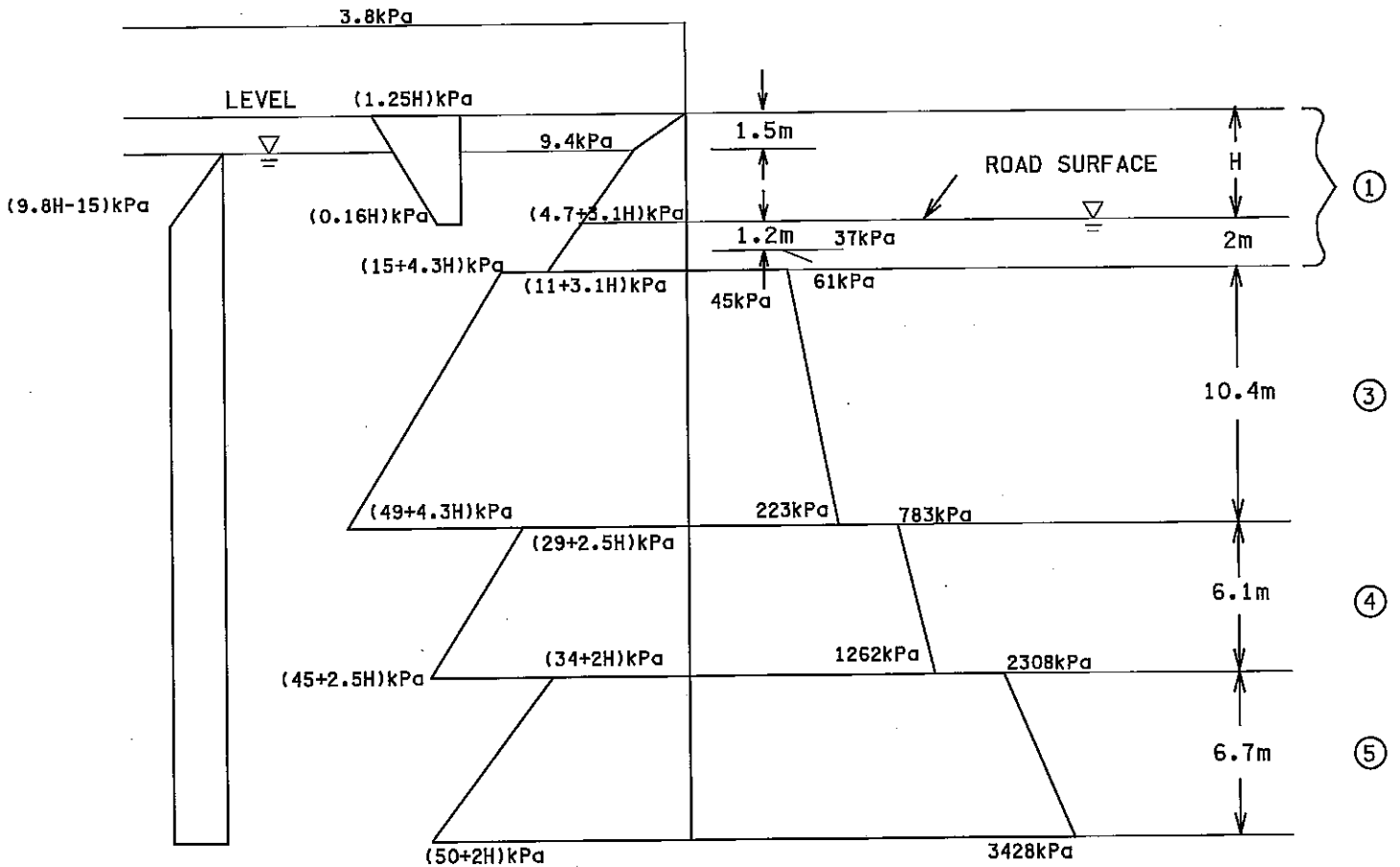
JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:09:22 PM



① Ø =31°
γ_m = 19.6 kN/m^3
γ_{sub} = 9.8 kN/m^3
K_a = 0.32
K_p = 3.12
ΔK_{ae} = 0.08

③ Ø =23°
γ_{sub} = 7.5 kN/m^3
K_a = 0.44
K_p = 2.28

④ Ø =36°
γ_{sub} = 9.8 kN/m^3
K_a = 0.26
K_p = 8.02

⑤ Ø =42°
γ_{sub} = 11.4 kN/m^3
K_a = 0.20
K_p = 14.66

BRIDGE ABUTMENT WALLS

FIGURE G-10: EARTH PRESSURE DIAGRAM

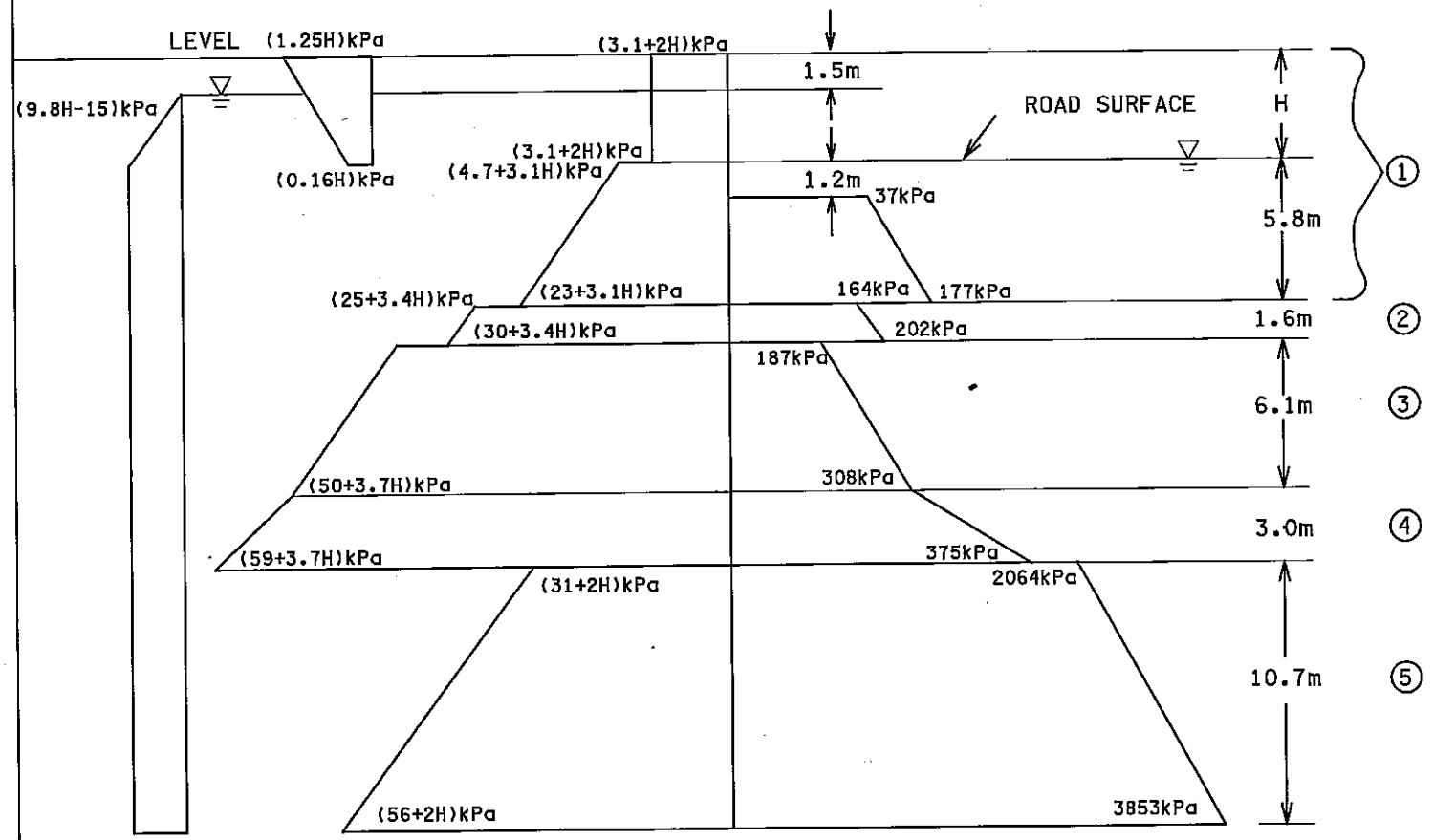
JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:09:04 PM



① $\varnothing = 31°$
$\gamma_m = 19.6\ kN/m^3$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.32$
$K_p = 3.12$
$\Delta K_{ae} = 0.08$

② $\varnothing = 29°$
$\gamma_{sub} = 8.3 kN/m^3$
$K_a = 0.35$
$K_p = 2.88$

③ $\varnothing = 27°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.38$
$K_p = 2.66$

④ $\varnothing = 27°$
$\gamma_{sub} = 8.3\ kN/m^3$
$K_a = 0.38$
$K_p = 2.66$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 1 STATION 1+612-1+703
RETAINING WALL 2 STATION 1+728-1+808
RETAINING WALL 5 STATION 1+612-1+680

FIGURE G-11: EARTH PRESSURE DIAGRAM (BRACED EXCAVATION)

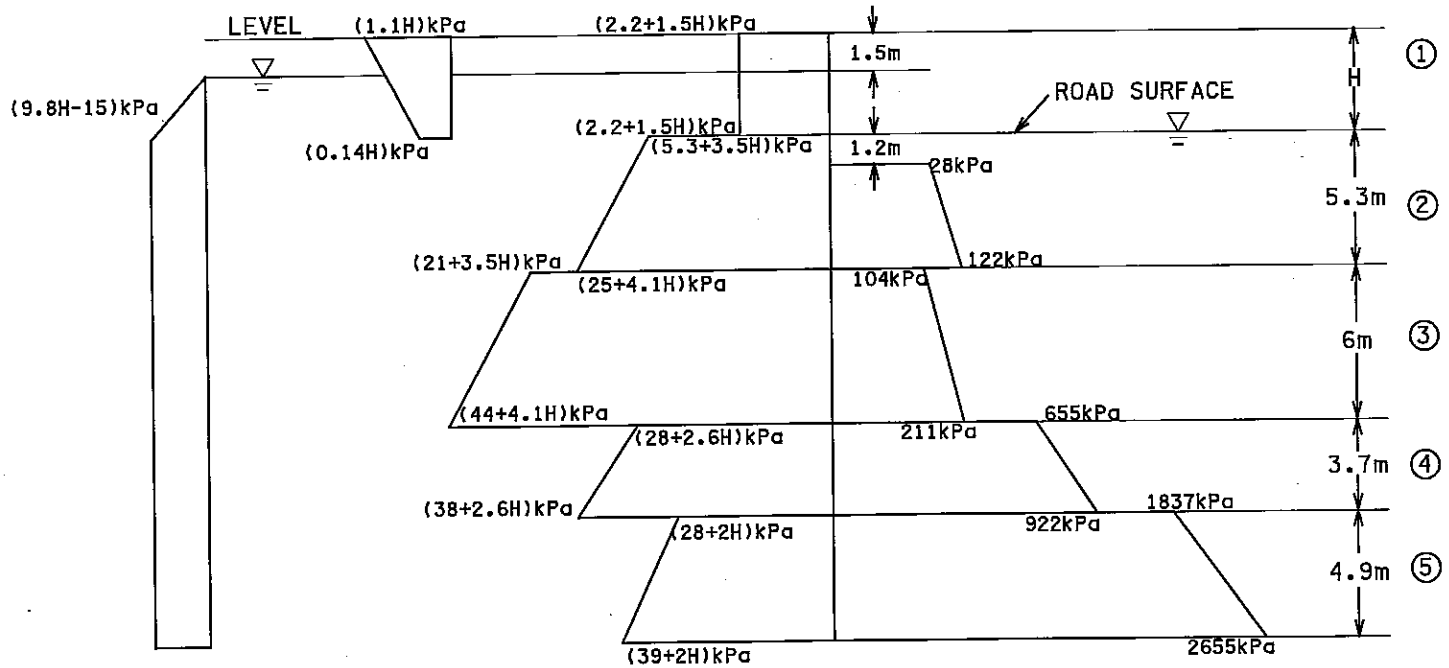
JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:10:39 PM



① $\varnothing = 39°$
$\gamma_m = 19.6\ kN/m^3$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.23$
$K_p = 10.63$
$\Delta K_{ae} = 0.07$

② $\varnothing = 28°$
$\gamma_{sub} = 8.3 kN/m^3$
$K_a = 0.36$
$K_p = 2.77$

③ $\varnothing = 24°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.42$
$K_p = 2.37$

④ $\varnothing = 35°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.27$
$K_p = 7.36$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 3 STATION 1+651-1+703
RETAINING WALL 7 STATION 1+651-1+680

FIGURE G-12: EARTH PRESSURE DIAGRAM (BRACED EXCAVATION)

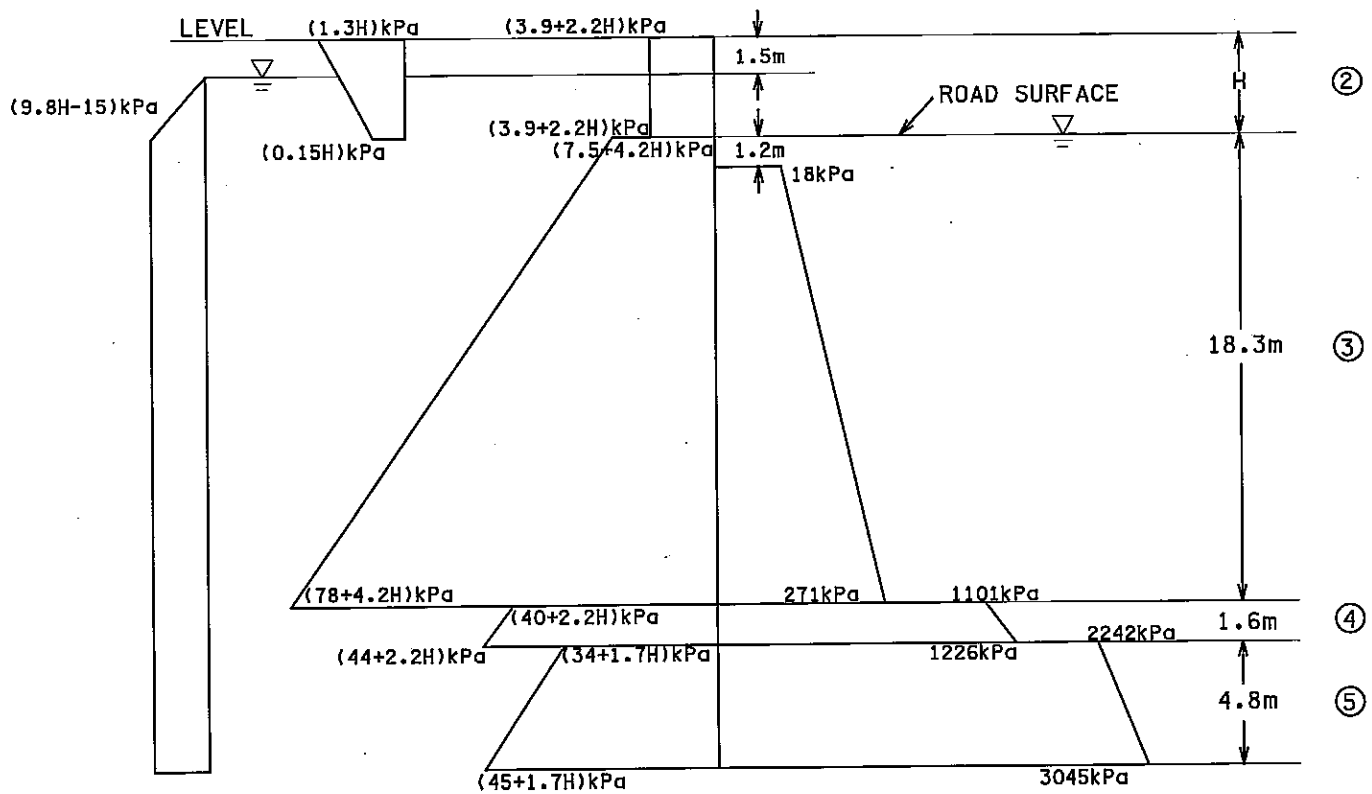
JOB 01-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:10:02 PM



② $\varnothing = 25°$
$\gamma_m = 18.1\ kN/m^3$
$\gamma_{sub} = 8.3\ kN/m^3$
$K_a = 0.41$
$K_p = 2.46$
$\Delta K_{ae} = 0.09$

③ $\varnothing = 19°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.51$
$K_p = 1.97$

④ $\varnothing = 36°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.26$
$K_p = 8.02$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 4 STATION 1+723-1+793

FIGURE G-13: EARTH PRESSURE DIAGRAM (BRACED EXCAVATION)

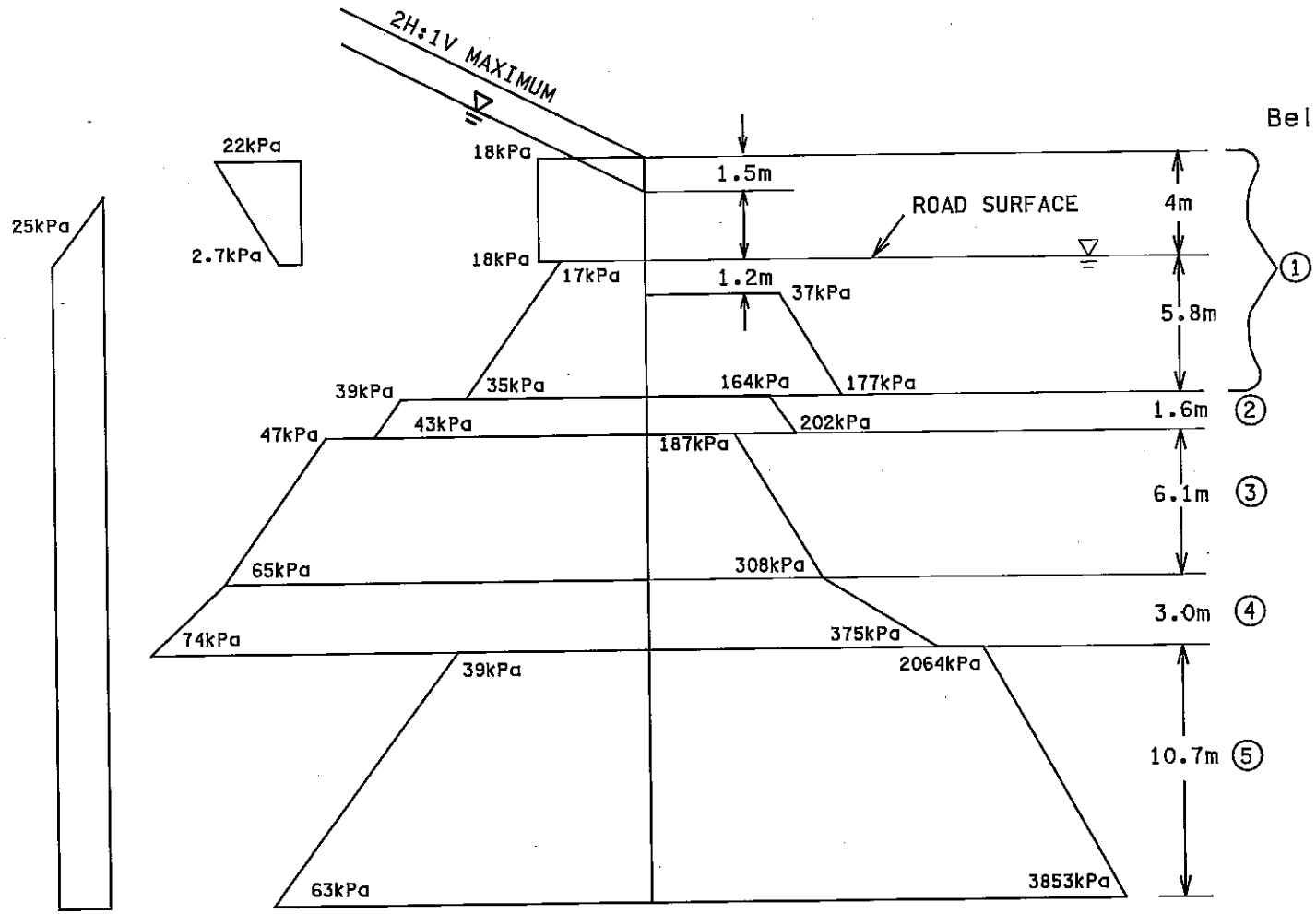
JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:10:14 PM



Above Base of Excavation

① $\varnothing = 31°$
$\gamma_m = 19.6\ kN/m^3$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.50$
$K_p = 3.12$
$\Delta K_{ae} = 0.35$

Below Base of Excavation

① $\varnothing = 31°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.32$
$K_p = 3.12$

② $\varnothing = 29°$
$\gamma_{sub} = 8.3\ kN/m^3$
$K_a = 0.35$
$K_p = 2.88$

③ $\varnothing = 27°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.38$
$K_p = 2.66$

④ $\varnothing = 27°$
$\gamma_{sub} = 8.3\ kN/m^3$
$K_a = 0.38$
$K_p = 2.66$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 5 STATION 1+680-1+703
RETAINING WALL 6 STATION 1+728-1+808

FIGURE G-14: EARTH PRESSURE DIAGRAM (BRACED EXCAVATION)

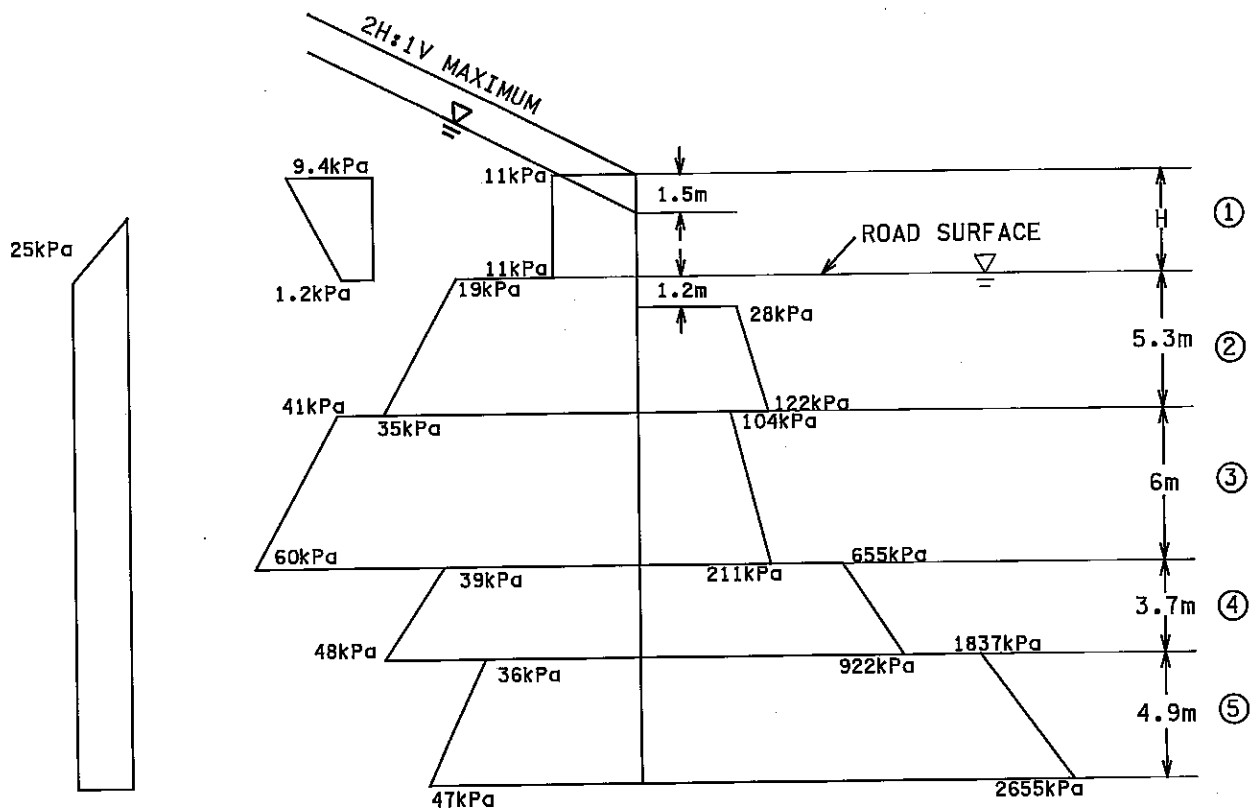
JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:10:34 PM



① $\varnothing = 39°$
$\gamma_m = 19.6\ kN/m^3$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.31$
$K_p = 10.63$
$\Delta K_{ae} = 0.15$

② $\varnothing = 28°$
$\gamma_{sub} = 8.3 kN/m^3$
$K_a = 0.36$
$K_p = 2.77$

③ $\varnothing = 24°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.42$
$K_p = 2.37$

④ $\varnothing = 35°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.27$
$K_p = 7.36$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 7 STATION 1+680-1+703

FIGURE G-15: EARTH PRESSURE DIAGRAM (BRACED EXCAVATION)

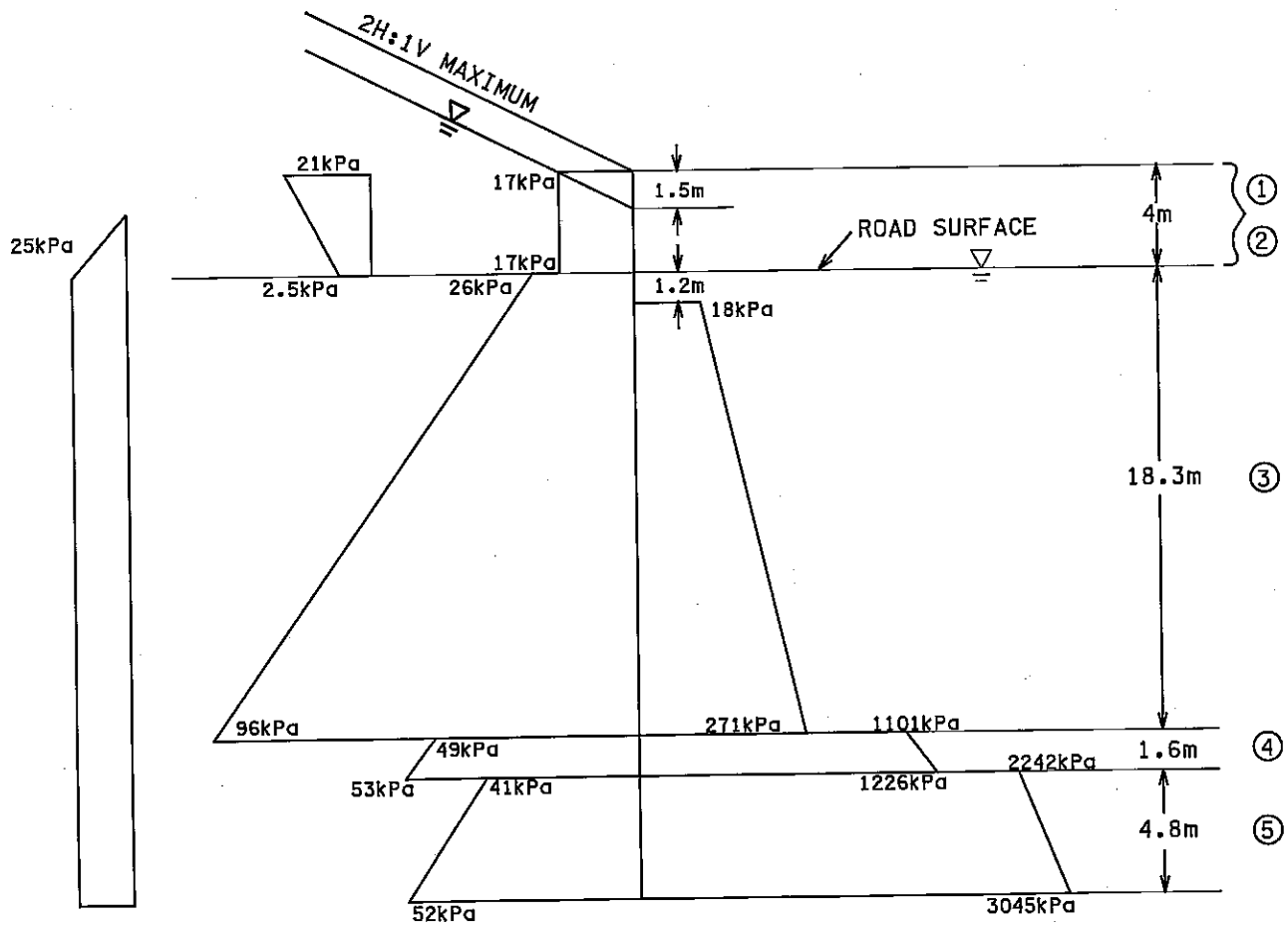
JOB 01-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:09:58 PM



① $\varnothing = 31°$
② $\gamma_m = 18.9\ kN/m^3$
$\gamma_{sub} = 9.1\ kN/m^3$
$K_a = 0.50$
$K_p = 3.12$
$\Delta K_{ae} = 0.35$

③ $\varnothing = 19°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.51$
$K_p = 1.97$

④ $\varnothing = 36°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.26$
$K_p = 8.02$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

RETAINING WALL 8 STATION 1+723-1+793

FIGURE G-16: EARTH PRESSURE DIAGRAM (BRACED EXCAVATION)

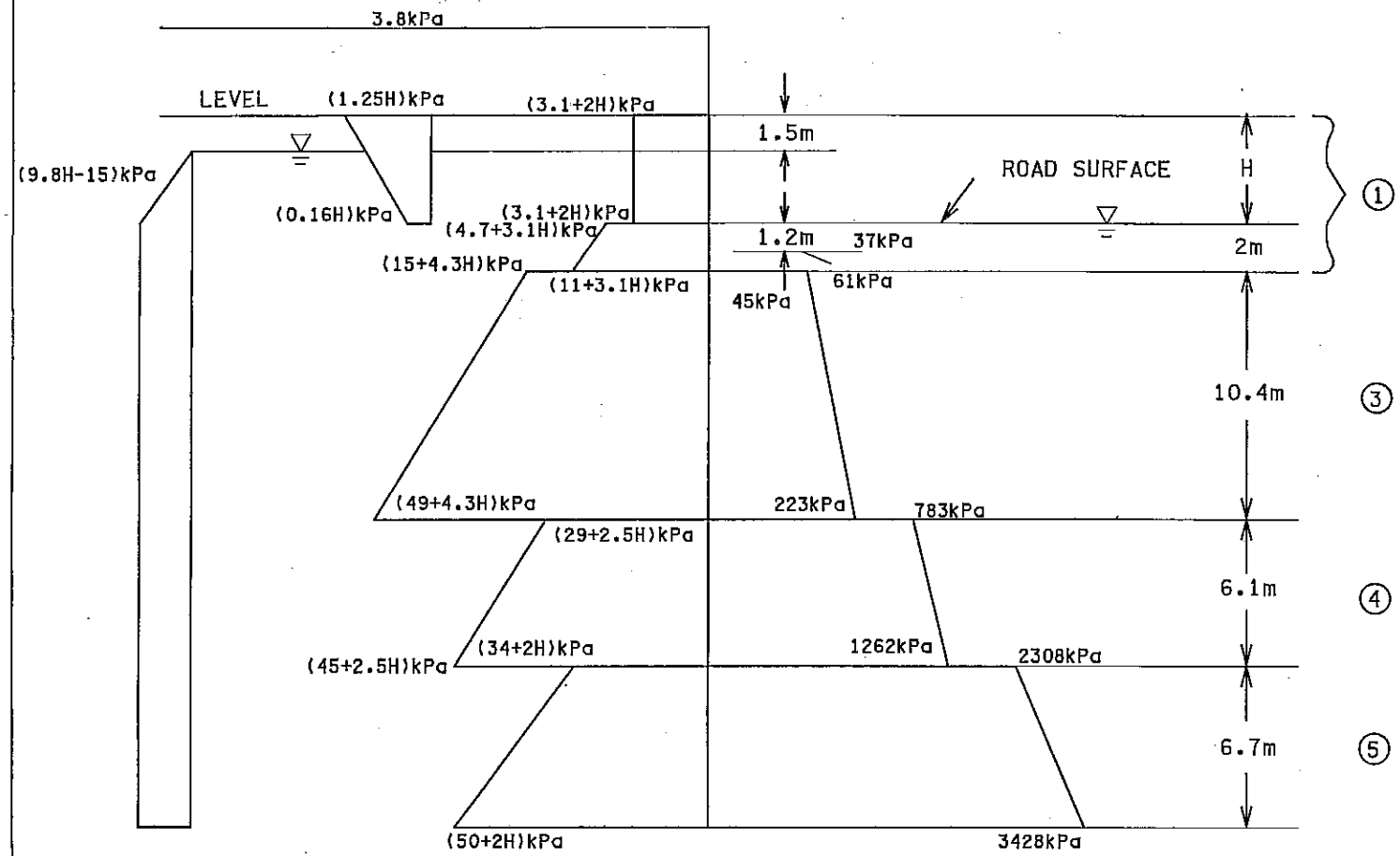
JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:10:07 PM



① $\varnothing = 31°$
$\gamma_m = 19.6\ kN/m^3$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.32$
$K_p = 3.12$
$\Delta K_{ae} = 0.08$

③ $\varnothing = 23°$
$\gamma_{sub} = 7.5\ kN/m^3$
$K_a = 0.44$
$K_p = 2.28$

④ $\varnothing = 36°$
$\gamma_{sub} = 9.8\ kN/m^3$
$K_a = 0.26$
$K_p = 8.02$

⑤ $\varnothing = 42°$
$\gamma_{sub} = 11.4\ kN/m^3$
$K_a = 0.20$
$K_p = 14.66$

BRIDGE ABUTMENT WALLS

FIGURE G-17: EARTH PRESSURE DIAGRAM (BRACED EXCAVATION)

JOB OL-3500 S.R. 543 C.S. _____ LAYOUT _____

I-5 TO INTERNATIONAL BOUNDARY

WASHINGTON STATE TRANSPORTATION COMMISSION
DEPARTMENT OF TRANSPORTATION
MATERIALS BRANCH
T. E. BAKER MATERIALS ENGINEER

DATE 7/2002
SCALE N.T.S. VERT. HORIZ.
SHEET ___ OF ___
DRAWN BY W.M.

...\4-10-02\EarthPressure.dgn 08/01/2002 04:10:29 PM