Geotechnical Investigation
Proposed Seawatch Development
Phases 1, 2 and 3
Pacific City, Oregon

Prepared for:
Nestucca Ridge Development, Inc.
Attn.: Ms. Mary Jones and Mr. Jeff Schons
P.O. Box 189
Pacific City, Oregon 97135

Project #Y042429b

March 18, 2005

H.G. Schlicker & Associates, Inc.

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To: **Nestucca Ridge Development, Inc.**
Attn.: Ms. Mary Johns and Mr. Jeff Schons
P.O. Box 189
Pacific City, Oregon 97135

Subject: **Geotechnical Investigation**
Proposed Seawatch Development
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Dear Ms. Jones and Mr. Schons:

The accompanying report presents the results of our geotechnical investigation of the above subject site.

After you have reviewed our report, we would be pleased to discuss the report and to answer any questions you might have.

This opportunity to be of service is sincerely appreciated. If we can be of any further assistance, please contact us.

H.G. SCHLICKER & ASSOCIATES, INC.

J. Douglas Gless, MSc, RG, CEG, LHG
President/Principal Engineering Geologist

JDG:cch

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Dear Ms. Jones and Mr. Schons:

1.0 Introduction

At your request and authorization, H.G. Schlicker & Associates, Inc. has completed a geotechnical investigation for the proposed Seawatch Development, Pacific City, Oregon (Figures 1, 2 and 3). The subsurface exploration portion of this investigation was completed for the entire proposed subdivision (Figure 4). However, our geotechnical recommendations for development were limited to Phases 1, 2 and 3 of the proposed development (Figure 3). Geotechnical recommendations for Phase 4, and other areas proposed for future development, will be provided at a later date.

This investigation was the second phase of a two phase study, with the first phase consisting of a geologic hazards investigation, the results of which our provided in our February 9, 2005 Geologic Hazards Report.

It is our understanding that Nestucca Ridge Development would like to develop the property as a planned development. This report addresses the subsurface conditions at the site and provides geotechnical recommendations for development. The scope of our work consisted of the following:

1. Site visits which included site observations and measurements.

2. Subsurface exploration utilizing test pits and drilled borings. The subsurface exploration included sampling, insitu soil testing, and ground water level determination where ground water was encountered.

3. Laboratory testing of selected samples collected during our subsurface exploration.

4. Preparation of this report of our findings, conclusions and geotechnical recommendations for development.

To better describe the various areas of the site, and to be consistent with our Geologic Hazards Report, we have divided the subject site into a series of subareas, as shown on Figure 5. These subareas will be referred to in this report when describing the site. The subareas represent areas of the site which display different topographic, geologic, drainage and/or slope stability conditions. These subareas are unrelated to property boundaries or phases of the proposed subdivision.

2.0 Site Description

The subject site lies in the southern part of the community of Pacific City, along the western slopes of Brooten Mountain (Figure 1). Brooten Mountain is a northwest trending ridge bound to its northeast, northwest and southwest by the Nestucca River. The subject site lies near the northwest end of the ridge where slopes transition from dominantly southwest facing to westerly facing.

The proposed Seawatch development consists of approximately 33 acres and includes the following tax lots (Figure 2):

Map Number	Tax Lot
Map 4S-10-30	500
Map 4S-10-30	504
Map 4S-10-30	505
Map 4S-10-30AC	15000
Map 4S-10-30DB	101
Map 4S-10-30DB	6200

As discussed above, our geotechnical investigation focused on Phases 1, 2 and 3 of the proposed development, as shown on Figure 3. Because the final boundaries for the development phases were not determined prior to our field work, observations and subsurface exploration were also completed in the northeastern part of the site, and this information is included in this report. However, development recommendations for areas outside of Phase 1, 2 and 3 are not provided in this report, but will be provided prior to development of future phases.

The Seawatch site is bound to its west and south by Brooten County Road, to its east by generally vacant forested parcels, and to its north by adjacent residential development (Figures 1 and 3). The site ranges in elevation from approximately 20 to 285 feet, M.S.L., and displays irregular topography indicative of ancient landslide terrain. Based on our review of topographic

maps and stereo pairs of aerial photographs, the area of the site lies within an ancient landslide complex. Please refer to our February 9, 2005 Geologic Hazards Report for additional information regarding landslide hazards at the site.

Much of the central part of the site has been cleared in the recent past, and is currently vegetated primarily with grasses. The west facing slopes along the west-central part of the site (Subareas K, M and N) are generally vegetated with fern, blackberries, young deciduous trees, and brush. The northwesternmost part of the site (Subarea O) and the southern part of the site (Subareas G, H and I) are vegetated with fern, deciduous and conifer trees, salal, and other brush. Areas along the eastern part of the site are moderately to well vegetated with deciduous and conifer trees.

3.0 Project Description

Proposed Phase 1 includes 19 single family residential units, a fitness center, and sales office; proposed Phase 2 includes 11 single family residential units, 2 town homes units, and a manager unit; and proposed Phase 3 includes 7 single family residential units, and 42 town homes units. Several roads are proposed which will provide access throughout the site. Access to the site will be by way of Fisher Road, located near the northwestern part of the site, which intersects with Brooten County Road. Phase 1 includes construction of a proposed residential access road (Heron Way) at the northeastern part of the site, and improvement to the existing Brooten Mountain Road. Figure 6 shows the preliminary street improvements/grading plan for the development.

4.0 Subsurface Exploration

Subsurface soil and rock conditions were evaluated from information obtained from 26 test pits excavated to depths of 5 to 14 feet on February 24 and 25, 2005, and 5 borings completed to depths of 11.5 to 25 feet on March 1 and 2, 2005. The test pits and borings were logged by an Oregon Certified Engineering Geologist from our office who visually classified the subsurface soils in accordance with the Unified Soil Classification System (USCS). Bulk and relatively undisturbed samples of the subsurface soils were collected for observation, soil classification and laboratory analysis. Standard Penetration Tests (SPT) were conducted in the field at selected depth intervals within the borings.

The locations of the test pits and borings are shown on Figure 4, and detailed logs are provided in Appendices A and B, respectively. The test pit and boring locations were staked and flagged in the field so that they can be surveyed.

5.0 Laboratory Testing

Representative samples of the subsurface soils were tested to verify field soil conditions and to evaluate selected geotechnical properties. The laboratory testing program consisted of the following:

- Moisture Content
- Dry Density
- Atterberg Limits
- Residual Direct Shear
- Modified Proctor

The results of the laboratory testing are provided in Appendix C.

6.0 Subsurface Conditions

In general, test pits and borings at the site encountered medium stiff to stiff, clayey silt; underlain by basalt and mudstone. The upper 1 to 2 feet of the clayey silt was generally organic and soft. The silts typically contain minor to substantial amounts of residual mudstone and basalt rock fragments which are indicative of soils weathered from colluvium and landslide deposits. Where these soils were wet to saturated, they were softer.

Basalt was encountered at depths from 3 feet to more than 14 feet throughout the central and southern parts of the site. We encountered two distinct basalt units, an upper coarse-grained basalt which commonly weathered to a granular texture; and a lower, fractured, dark gray, fine-grained, hard basalt. The upper several feet of the coarse-grained basalt was typically nearly completely weathered to sandy, clayey silt.

Very stiff to hard, weathered mudstone was encountered at the northeasternmost part of the site at depths from 5 to 10 feet. The mudstone was typically tan to brown with black oxidation along fractures.

Subarea A

As discussed in our Geologic Hazards Report, A large landslide feature occupies much of Subarea A. This landslide appears to have failed to depths of 10 to 20 feet. Test pits TP-6 and TP-8 encountered landslide deposits from depths of 9 feet to more than 13 feet, respectively. These deposits consisted of mixed silt, sand, and mudstone fragments, and were generally stiff to very dense. These deposits are underlain by very stiff to hard, weathered mudstone deposits. Cat roads along the upper part of the slope exposed landslide deposits consisting of mixed basalt and mudstone fragments from 1 inch to more than 3 feet diameter. Basalt fragments in the landslide deposits appear to originate from in-place basalt near the upper part of the hillside.

Central and Eastern Parts of Subareas B and C

The eastern part of Subareas B and C generally encountered stiff, clayey silt overlying mixed landslide deposits consisting of stiff to medium dense, clayey silt, sand, and weathered basalt fragments. These deposits appear be old debris slide and flow deposits which originated from higher elevations east of the site. Test pit TP-9, located near the center part of Subarea B encountered highly fractured basalt below approximately 6 feet of pit run, basalt rock fill. This fractured basalt may also be ancient landslide deposits.

Western Parts of Subareas B and C

A large stockpile of sandy fill is present along the small ridge feature that makes up the western parts of Subareas B and C. This fill stockpile is underlain by approximately 2 to 6 feet of older pit run fill consisting of basalt fragments ¼ to 3 feet diameter. In test pits TP-10, TP-11 and TP-26, along the margins of the fill area, we generally encountered 3 to 7 feet of medium stiff to stiff clayey silt with weathered mudstone and basalt fragments; underlain by hard mudstone (in TP-10) and basalt (in TP-11 & 26). Mudstone was not encountered in test pits or borings south of TP-10, other than as fragments in clayey silt.

Subarea D

Test pit TP-3 was located in Subarea D and encountered 12 feet of medium stiff to stiff, slightly clayey to clay silt, with some soft zones; underlain by weathered basalt.

Subarea E

As discussed in our Geologic Hazards Report, Subarea E lies in an area where we observed indications of recent landsliding to depths of 7 to 15 feet. Test Pits TP-1 and TP-2 were completed at the toe of the landslide and encountered interbedded soft to stiff, clayey silt, medium dense silty sand, and gravel with mudstone and basalt fragments to depths of 5 to 8 feet. Wood fragments were encountered in TP-2 at a depth of 8 feet. These materials are indicative of weathered colluvial and landslide deposits. These deposits were underlain by 5 to 6 feet of sandy, clayey silt; underlain by weathered, fractured, hard basalt below 10 to 14 feet. Water seepage was encountered at varying depths from 3 to 11 feet.

Boring B-1 was completed near the upper, southern margins of the landslide feature and encountered hard basalt at 6.5 feet. Boring B-2 was completed near the head of the landslide feature and encountered soft to medium stiff, clayey silt from the surface to approximately 9 feet; underlain by medium stiff to stiff, clayey, sandy silt (residual basalt) with weathered basalt fragments to 23 feet; underlain by hard, weathered, basalt.

Subarea F

Subarea F generally encountered medium stiff to stiff, clayey silt; underlain by hard basalt rock. Fractured basalt was encountered at shallow depths (2 to 5 feet) along the southern margins of the subarea, near the upper edge of the south slope. These basalts were typically overlain by mixed silt and basalt fragments. Basalts in the central and northern parts of the subarea were generally encountered at depths below 10 feet.

Subarea J

Subarea J is similar to Subarea F, with shallow basalt underlying stiff clayey silt along the southern part of the subarea, with the basalt contact becoming deeper toward the north. Test pit TP-17 encountered stiff, clayey silt from 0 to 9.5 feet; underlain by residual basaltic soils from 9.5 to 13 feet, but did not encounter hard basalt. Test pit TP-15, located near the head of the broad swale located in Subarea K, encountered hard weathered basalt at a depth of 11 feet, overlain by medium stiff to stiff, clayey silt.

Subarea L

Subarea L is mantled by approximately 1 to 5.5 feet of uncontrolled fill consisting of mixed silt and basalt and mudstone fragments. This fill is underlain by medium stiff to stiff, clayey silt; underlain by hard, weathered basalt. Test pit TP-13 encountered hard basalt at a depth of 1.5 feet, underlying uncontrolled fill and organic silt.

Subareas G, H, I, K, M, N & O

These subareas lie along the moderately steep to very steep, south and west facing slopes. Test pits and borings were not completed in these subareas due to limited access. Basalt is exposed along road cuts along the lower parts of these subareas. Outcrops are not exposed in Subarea O as the result of landsliding in this area.

7.0 Slope Stability

In our Geologic Hazards Report dated February 8, 2005, we provide detailed discussion regarding slope stability hazards at the site. The results of our geotechnical investigation generally confirmed the findings presented in our Geologic Hazards Report. However, based on our additional reconnaissance east of the subject property, we now believe that the risk of future debris flows impacting the broad swale feature in Subarea D is generally low. Subarea D lies within Phase 1 of the proposed development. However, we continue to believe that the stream channels located in Subareas A, B, O and G are at risk of being impacted by future debris flows in the event of upslope landsliding. Debris flows could impact the area where the stream channel crosses proposed Heron Way, located at the northeastern part of the site.

8.0 Findings and Conclusions

As discussed in our Geologic Hazard Report, the site lies in an area of ancient landslide topography with areas of younger landsliding. Many of the older, larger landslide features observed in the area of the site appear to have occurred during a time of relative higher sea levels when ocean waves were actively eroding slopes at higher elevations. Most of the active landslides present in the area of Phases 1, 2 and 3 of the proposed development are small to moderately sized, and are typically confined to stream valley slopes, and moderate to steep slopes along the western and southern parts of the site. Additionally, future landsliding upslope and east of the site has a potential to generate debris slide and debris flows that could impact stream areas at the site.

The native soils at the site generally consist of medium stiff to stiff, low to moderate plasticity, clayey silts; underlain by basalt and mudstone. Hard and residual rock fragments in the silty soils indicate that much of the silty soil was deposited by ancient debris flow and debris slides. Basalts and mudstones were generally encountered at depths from a few feet to greater than 10 feet below existing grades, indicating substantial weathering and erosion of the ancient landslide deposits.

Development within the portion of Subarea E where recent landsliding has occurred will require slope stabilization measures. Recommendations for stabilization in this area will be provided prior to development of Phase 4.

Based on our geotechnical investigation, and based on our review of the Site Plan for Phases 1, 2 and 3 (Figure 3), the proposed development within these phases appears appropriate for the site conditions, provided that the following recommendations are adhered to during design and construction. Geotechnical recommendations for the areas of the development outside of Phases 1, 2 and 3 will be provided prior to development of those areas.

9.0 Recommendations for Phases 1, 2 and 3

We recommend that structures not be placed along moderately to very steeply sloping areas at the western and southern parts of the site at this time, as shown on Figure 7. Any vegetation removal or grading within these sloping areas should be approved by our firm. Additionally, we recommend that structures not be placed near streams that could be subjected to possible debris flows. Figure 7 shows a small area at the northeasternmost corner of Phase 1 where we recommend structures not be placed due to debris flow hazards.

Figure 7 shows areas of Phases 1, 2 and 3 where foundations will need to bear in undisturbed, hard basalt. These areas include upper slopes along the southern and southwestern parts of the site. If basalt is not encountered within 8 feet depth of the ground surface in these areas, building loads should be supported on piers embedded a minimum of 8 feet below existing grades. Basalts were generally encountered at shallow depths along the southernmost part of the site. However, basalts were encountered below 8 feet in the sloping areas north of TP-12, and in

the areas of TP-15 and TP-17. The areas shown on Figure 7 requiring deep foundations or basalt embedment will also require lot specific geologic hazards reports prior to design and construction.

The remaining areas of the site, the unshaded areas shown on Figure 7, may be developed utilizing conventional shallow foundations.

Prior to foundation design, a representative of our firm should stake those areas of the site where specialized foundations are recommend and lot specific geologic hazards reports will be needed.

9.1 Site Preparation

Prior to grading, building and pavement areas of the site should be cleared of vegetation and surface or buried obstructions. Vegetated areas of the site that are not planned for immediate development or landscaping are generally recommended to be left undisturbed to minimize the potential for erosion or slope instability.

Removal of organic topsoil, fill, or any soft, organic, or otherwise unsuitable soils will be required beneath proposed pavements, walls, and building components. It is anticipated that overall stripping depths for the topsoil and fill will be approximately 1 to 3 feet, however depths may vary. Additionally, the fill stockpile in the vicinity of Subarea C will need to be removed. An additional 2 to 6 feet of older rocky fill lies under the fill stockpile. This older fill will also need to be removed. In addition, approximately 1 to 5.5 feet of uncontrolled fill underlies much of Subarea L which will need to be removed.

All test pits in foundation and pavement areas should be excavated to their full depth and replaced with clean crushed aggregate, placed in 12 inch loose lifts and compacted to 90 percent of the Modified Proctor (ASTM D-1557). The approximate locations of the test pits are shown on Figure 4. At the time of our site visits we staked and flagged each test pit location.

Construction traffic should be directed over access roads and staging areas constructed of a minimum of 16 inches of clean, crushed aggregate placed over a geotextile such as Mirafi 500X (or equivalent).

9.2 Materials for Fill

The on-site clayey silt is considered suitable for use as structural fill provided it is free from organic materials and other debris; however the soils are expected to have a moisture content well in excess of optimum conditions, regardless of the time of the year, and accordingly, will require significant drying to achieve compaction. Based on the

laboratory maximum density tests, the on-site fine-grained soils have an optimum moisture content of approximately 42 percent. At the time of our subsurface exploration the on-site soils ranged in moisture content from approximately 60 to 90 percent. Modification of the on-site soils with lime or cement amendment may be necessary to achieve proper compaction.

The use of on-site basalt for structural fill will require processing of the basalt material prior to use, which would include crushing, screening, and testing of processed material. We should approve all materials used as fill.

Representative samples of the materials to be used for fill will need to be tested to determine the maximum density and optimum moisture content and will need to be approved by our firm.

9.3 Structural Fill

All fill materials placed within structural areas should consist of granular materials, placed in 8 inch lifts at or near optimum moisture content, and compacted to 90% of maximum dry density based on a Modified Proctor (ASTM-D1557). Fill should be free of organics, deleterious materials, and contain no particles greater than 4 inches in diameter. To minimize the number of field and laboratory tests, fill materials should be from a single source and of a consistent character. All structural fill shall be approved by a representative of our firm.

All areas to receive fill shall be stripped of all soft soils, organic soils, organic debris and existing fill. Areas that slope steeper than 5H:1V and are to receive fill shall be benched. Benches shall be cut into native, non-organic, stiff to dense soils. Fills shall not be placed along slopes steeper than 3 horizontal to 1 vertical (3H:1V) unless approved by a representative of our firm.

9.4 Wet Weather Grading/Erosion Control

Wet weather grading is not generally recommended due to the fine-grained nature of the shallow soils. If wet weather grading is unavoidable due to construction schedules, stabilization of the subgrade soils may become necessary. If wet weather grading is unavoidable due to construction schedules, stabilization of the subgrade soils with a geotextile and aggregate (or by other means such as lime or cement modification) will likely become necessary. The use of clean, well graded granular fill (containing less than 5 percent material passing the No. 200 sieve) is recommended. Thickness of applied granular fill should be sufficient to stabilize the subgrade soils. Applied thickness of granular fills may be reduced by the use of geotextiles.

As discussed above, construction traffic should be directed over access roads and staging areas constructed of a minimum of 16 inches of clean, crushed aggregate placed over a geotextile such as Mirafi 500X (or equivalent), regardless of weather conditions.

Vegetation should be removed only as necessary and exposed areas should be replanted following construction.

Temporary sediment fences should be installed downslope of any disturbed areas of the site until permanent vegetation cover can be established. Exposed sloping areas steeper than 3 horizontal to 1 vertical (3H:1V) should be protected with a straw erosion control blanket (North American Green S150 or equivalent) to provide erosion protection until permanent vegetation can be established. Erosion control blankets should be installed as per the manufacturers recommendations. Erosion control will need to be undertaken to meet Tillamook County and project requirements.

9.5 Excavations

Temporary unsupported slopes above the water table and less than 10 feet in height should be sloped no steeper than 1 horizontal to 1 vertical (1H:1V). Permanent unsupported cuts should be constructed no steeper than 2 horizontal to 1 vertical (2H:1V). Our firm should approve all excavations below a depth of 10 feet or where water seepage is observed. Temporary excavation in excess of 4 feet in depth with cuts steeper than 1H:1V will require appropriate shoring to provide for worker safety as per OSHA requirements.

Ground water seepage was encountered in several test pits at depths from 3 to 11 feet, and therefore dewatering of some excavations may be required. If ground water is encountered during excavation, dewatering of excavations should be the responsibility of the contractor.

Excavations should be protected during wet weather by covering exposed areas, or through the use of aggregate and/or geotextile, as discussed above (Section 9.4 Wet Weather Grading/Erosion Control).

Silty soils at the site should be easily excavated using standard excavating equipment, such as backhoes or trackhoes. If hard basalt and mudstone is encountered during excavation, specialized equipment such as rock breakers will be required for excavation. However, we anticipate that the upper several feet of basalt or mudstone units encountered will be weathered and highly fractured, and should be excavatable using large excavating equipment with toothed rippers.

9.6 Unanticipated Conditions

Unanticipated subsurface conditions are commonly encountered during site excavation and grading, particularly when ground water or soft soil conditions are present. Therefore, we should observe footing, slab and pavement excavations prior to placing fill, and/or forming and pouring concrete to assure that suitable bearing soils have been reached. At the time of our observations we may recommend additional excavation if suitable bearing soils have not been reached, or other improvements such as overexcavation and replacement with structural fill.

9.7 Building Foundations

Figure 7 shows those areas which can utilize conventional shallow foundations bearing in native silty soil, and those areas that will require foundations that bear in hard basalt or mudstone below silty soils, or that require piers embedded a minimum of 8 feet below existing grades where basalt or mudstone is not encountered.

Conventional Shallow Foundations

Building loads may be supported on individual and/or continuous spread footings bearing on undisturbed native, stiff to dense soil, hard basalt or mudstone, or compacted structural fill placed on these materials. Foundations placed on stiff to dense soil may be designed for an allowable dead plus live load bearing capacity of 1,500 pounds per square foot with an increase of one-third allowed for short term wind or seismic loads. Foundations placed on native, hard basalt or mudstone may be designed for an allowable dead plus live load bring capacity of 4,000 pounds per square foot with an increase of one-third allowed for short term wind or seismic loads. A representative of our firm should observe foundation excavations prior to forming and pouring concrete to ensure that adequate bearing materials have been reached.

Footings should have a minimum width of 12 inches for a one story structure, 15 inches for a two story structure, or 18 inches for a three story structure.

Exterior footings should be embedded a minimum of 12 inches below the lowest adjacent finished grade for a one story structure, 18 inches for a two story structure, or 24 inches for a three story structure. Interior footings should be embedded a minimum of 6 inches below finished grades. Generally, interior footings placed on sloping or benched ground should be embedded or set back in such a manner as to provide a minimum horizontal distance between the foundation component and face of slope or bench of one foot per every foot of elevation change.

Exterior footings placed on sloping ground steeper than 3H:1V should be stepped, or daylighted basement foundations should be utilized.

Lateral loads can be resisted by passive pressures acting against footings and by frictional resistance between foundation elements and supporting materials. A passive resistance of 200 pounds per square foot per foot of embedment depth and a friction factor of 0.30 may be used for design for foundations bearing in native, undisturbed, stiff to dense soils. A passive resistance of 400 pounds per square foot per foot of embedment depth and a friction factor of 0.45 may be used for design for foundations bearing in native, undisturbed, hard basalt. A passive resistance of 400 pounds per square foot per foot of embedment depth and a friction factor of 0.35 may be used for design for foundations bearing in native, undisturbed, hard mudstone.

Deepened Foundations

As discussed above, deepened foundations are recommended in those areas shown on Figure 7 where buildings will be located near and along slopes where shallow undisturbed basalt is not present. Based on our investigation, we believe that deepened foundations will be required in the areas north of TP-12, and in the areas of TP-15 and TP-17.

Deepened foundations may consist of basement foundations, or pier and grade beam systems with basement footings or piers embedded a minimum of 8 feet below existing grades.

The areas shown on Figure 7 requiring deep foundations, or basalt embedment, will require lot specific geologic hazards reports prior to design and construction.

Floor Slabs

All areas beneath slabs should be excavated a minimum of 6 inches into native, non-organic, stiff to dense soils. The exposed subgrade in the slab excavation shall be left in a smooth undisturbed condition. This is usually best accomplished with a smooth (no-teeth) bucket on an excavator. The slab excavation should then be backfilled with a minimum of 6 inches of ¾ inch minus, clean, free-draining, crushed rock placed in 8 inch lifts maximum which are compacted to 90 percent of the Modified Proctor (ASTM-D1557). Reinforcing of the slab is recommended and the slab should be fully waterproofed in accordance with structural design and geologic considerations. It is likely that all below grade slabs, such as daylight basement slabs, will require underdrain systems.

9.8 Retaining Walls

Free standing retaining walls shall be designed for a lateral active earth pressure expressed as an equivalent fluid pressure (EFP) of 40 pounds per square foot per linear foot, assuming level backfill. An EFP of 50 pounds per square foot per linear foot should be used assuming sloping backfill of 2H:1V. Retaining walls supporting native,

undisturbed basalt or mudstone may be designed for an EFP of 30 pounds per square foot per linear foot, assuming level backfill. This requires that the wall be fully drained to prevent the build-up of hydrostatic pressures.

Foundation and basement walls should be designed for a lateral at-rest pressure expressed as an equivalent fluid pressure (EFP) of 60 pounds per square foot per linear foot, assuming level backfill behind wall equal to a distance of at least half of the height of the wall. If foundation and basement walls will be designed as partially restrained retaining walls, an EFP of 50 pounds per square foot per linear foot may be used, assuming level backfill. This requires that the wall be fully drained to prevent the build-up of hydrostatic pressures.

The above equivalent fluid pressures assume that there will be no surcharge loads from vehicles or structures. If surcharge loads will be applied to the retaining walls, the resulting forces on the walls will need to be added to the forces given above.

Backfill for walls should be placed in 12 inch horizontal lifts and machine compacted to 90 percent of the maximum dry density as determined by ASTM-D1557. Compaction within 2 feet of the wall should be accomplished with light weight hand operated compaction equipment. Drainage of the retaining wall should consist of slotted PVC drains placed at the base of the wall on the backfilled side and backfilled with free-draining crushed rock (less than 5% passing the 200 mesh sieve) protected by non-woven filter fabric (Mirafi 140 N or equivalent) placed between the native soil and the backfill. Proper drainage of retaining walls is extremely important due to high ground water conditions in areas of the site.

Seismic Wall Loads

For seismic loading, a unit pseudostatic force equal to (19 pcf)(H^2), where H is the height of the wall in feet, should be added to the static active or at-rest lateral earth pressures. The location of the pseudostatic force can be assumed to act a distance of 0.6H above the base of the wall.

9.9 Site Drainage

Temporary Construction Drainage

Surface water should be diverted from excavations by means of temporary drainage facilities. Excavations should be de-watered as necessary by pumping or other suitable methods. Ponding of surface water in structural areas should also be prevented to the extent practical utilizing temporary drainage facilities.

Permanent Site Drainage

Surface water should be diverted from the building foundation to approved disposal points by grading the ground surface to slope away from the foundation to prevent ponding near the structures. All roof drains should be collected and tight-lined in a separate system independent of any foundation drains and discharged to an approved disposal point.

Permanent subsurface drainage of each building perimeter is recommended to prevent potential subjection of foundations and slabs to hydrostatic pressures and to help keep the moisture content of subgrade materials from extreme seasonal variations. Construction of a continuous subdrain system that surrounds the building perimeter and is sloped (minimum 0.5 percent) to a tight line drain pipe discharging to the storm sewer system is recommended. No water should be discharged onto existing slopes, unless tightlined to existing drainages, or approved by a representative of our firm. The perimeter drain excavation should be constructed in a manner to prevent undermining of any foundation or slab component or disturbance to supporting soils.

Permanent underslab drainage should be provided where below grade floor slabs are utilized, as per the architects recommendations.

Areas in existing drainage swales will require underdrains, such as french or blanket drains. Based on our review of the grading plan (Figure 6), fills are planned for the head of the drainage swale at the southwestern part of the site. Underdrains will be required for this fill area.

9.10 Pavement Areas

All pavement areas shall be stripped of all soft and organic soils and any existing fill prior to placing subbase or base course fills. Pavement sections shall be designed by the project engineer. A representative of our firm should be provided the opportunity to review pavement designs, and we should observe pavement excavations prior to placing fills to verify that adequate bearing soils have been reached. If adequate soils have not been reached we may recommend additional excavation and/or additional subbase or base thickness, and/or the use of geotextiles.

To confirm that subgrade soils beneath pavements have been properly prepared, a proof roll test shall be conducted prior to placement of base materials. All areas to receive pavements shall be proof-rolled with a fully loaded 12 cubic yard dump truck having a minimum weight of 60,000 pounds. A representative of our firm shall observe proof-rolling and mark any areas needing repair. Repair will typically consist of over-excavating soft, pumping, weaving and rutting areas and replacing with structural fill.

Some pavement areas are underlain by several feet of soft or loose soils. These areas will likely need to be overexcavated and backfilled to the bottom of the base rock elevation with well compacted, clean "shot rock" (Pit Run). Final determination of subgrade and subbase preparation in these areas will need to be accomplished when these areas have been exposed by rough grading and they can be better evaluated. Placement of geotextile fabrics prior to backfilling may be required in some locations particularly where wet and soft soils are encountered.

Proposed Heron Way

All existing fills lying in the road prism in the area of Heron Way should be removed. Based on our subsurface investigation, we anticipate that 5 to 9 feet of fill underlies the proposed road area, however depths may vary.

The slopes along the south side of the proposed road are experiencing active shallow landsliding, and therefore stabilization measures will need to be included in the road design. Retaining structures along the south side of the road will be required. The retaining structures may include gabion walls, solder pile walls, concrete cantilevered retaining walls, or mechanically stabilized earth. Our firm should be consulted and approve all retaining structures used.

As discussed above in Section 7.0 (Slope Stability) of this report, the small stream channel in the area of Heron Way is at risk of being impacted by debris flows in the event of upslope landsliding. In the event of a debris flow, the section of Heron Way that crosses the stream could be impacted, and repair of the roadway would be necessary.

Proposed grading in the Heron Way area is not shown on the Grading Plan (Figure 6). Our firm should review the grading plans for Heron Way prior to grading operations.

Improvements to Brooten Mountain Road

As discussed in our Geologic Hazards Report, failing fills were observed along the west side of Brooten Mountain Road in the easternmost part of Subarea O. Failing fills in this area will need to be removed and replaced with new structural fill. Retention of fills along the west side of Brooten Mountain Road may be required. An underdrain is also recommend for this area. Our firm should review the grading plans for the improved section of Brooten Mountain Road prior to grading operations.

9.11 Seismic Considerations

The structures and all structural elements should be designed to meet current International Building Code (IBC) seismic requirements. Based on our knowledge of subsurface conditions at the site, and our analysis using the guidelines recommended in

the IBC, the structure should be designed to meet IBC Seismic Design Category D requirements for both short-period (0.2 second) and long-period (1-second) response accelerations, with an S_{DS} value (0.2 second) of 1.0g and an S_{DL} value (1.0 second) of 0.60g.

9.12 Workers Safety

All construction activities should be completed as per OSHA standards, and all State and local laws, rules, regulations and codes.

10.0 Additional Services

Design Review

This geotechnical report pertains to a specific site and development. It is not applicable to adjacent sites nor is it valid for types of developments other than that to which it refers. Any variation from the site or development necessitates a geotechnical review in order to determine the validity of the design concepts evolved herein.

Geotechnical review of final plans and specifications is recommended to determine whether the recommendations detailed in this report have been properly interpreted and incorporated in the design and construction documents. At the completion of our review we will issue a letter of conformance for the plans and specifications.

Construction Monitoring

Because of the judgmental character of geotechnics, as well as the potential for adverse circumstances arising from construction activity, observations during site preparation, excavation, and construction will need to be carried out by a representatives of our firm. These observations then may serve as a basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein to the benefit of the project. Moreover, field observations become increasingly important should earthwork proceed during adverse weather conditions.

11.0 Limitations

The Oregon Coast is a dynamic environment with inherent unavoidable risks to development. Landsliding, erosion, tsunamis, storms, earthquakes and other natural events can cause severe impacts to structures built within this environment and can be detrimental to the health and welfare of those who choose to place themselves within this environment. The client is warned that, although this report and our previous Geologic Hazards Report are intended to identify the geologic hazards causing these risks, the scientific and engineering communities knowledge and understanding of geologic hazard processes is not complete. This report pertains to the subject site only, and is not applicable to adjacent sites nor is it valid for types of

development other than that to which it refers. Geologic conditions including materials, processes and rates can change with time and therefore a review of the site and/or this report may be necessary as time passes to assure its accuracy and adequacy.

Our investigation was based on engineering geological and geotechnical reconnaissance and a limited review of published information. The data presented in this report are believed to be representative of the site. The conclusions herein are professional opinions derived in accordance with current standards of professional practice and no warranty is expressed or implied. The performance of this site during a seismic event has not been evaluated. If you would like us to do so, please contact us. This report may only be copied in its entirety.

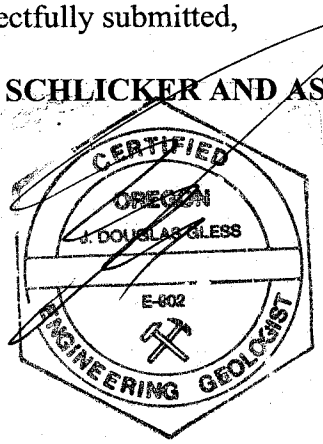
12.0 Disclosure

H.G. Schlicker & Associates, Inc. and the undersigned Licensed Engineering Geologists have no financial interest in the subject site, the project or the Client's organization.

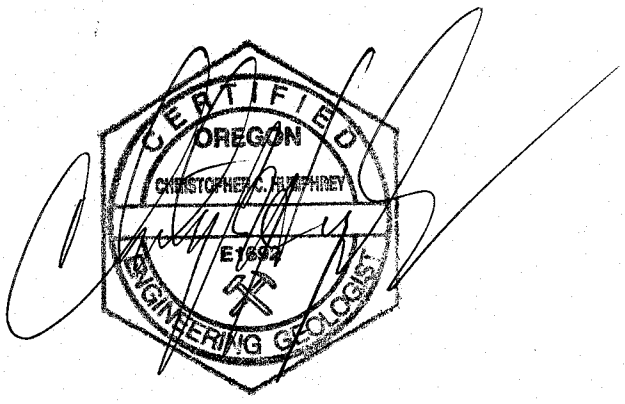
It has been our pleasure to serve you. If you have any questions concerning this report, or the site, please contact us.

Respectfully submitted,

H.G. SCHLICKER AND ASSOCIATES, INC.

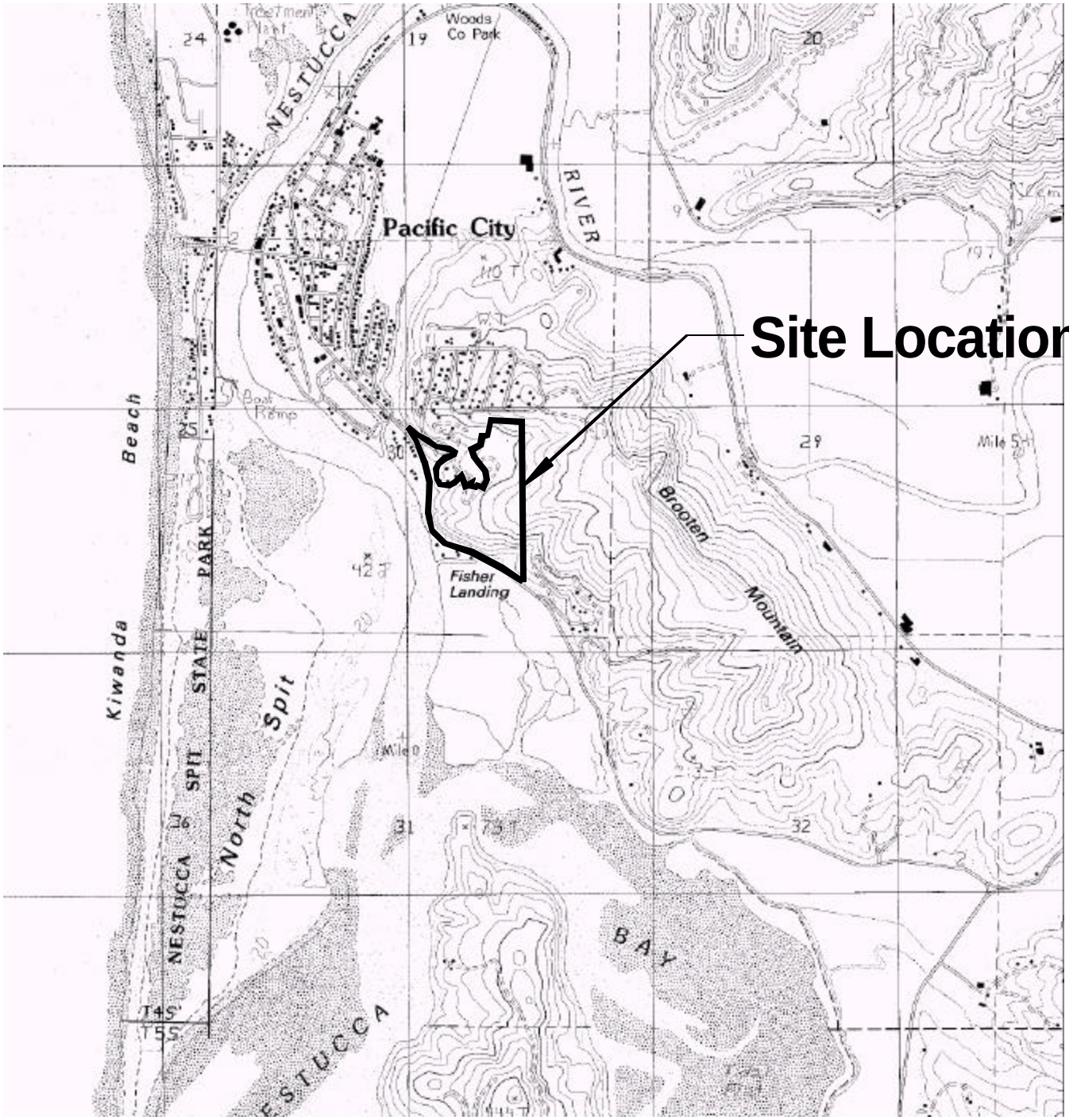


J. Douglas Gless, MSc, RG, CEG, LHG
President/Principal Engineering Geologist



Christopher Humphrey, MSc, RG, CEG
Senior Engineering Geologist

JDG:cch



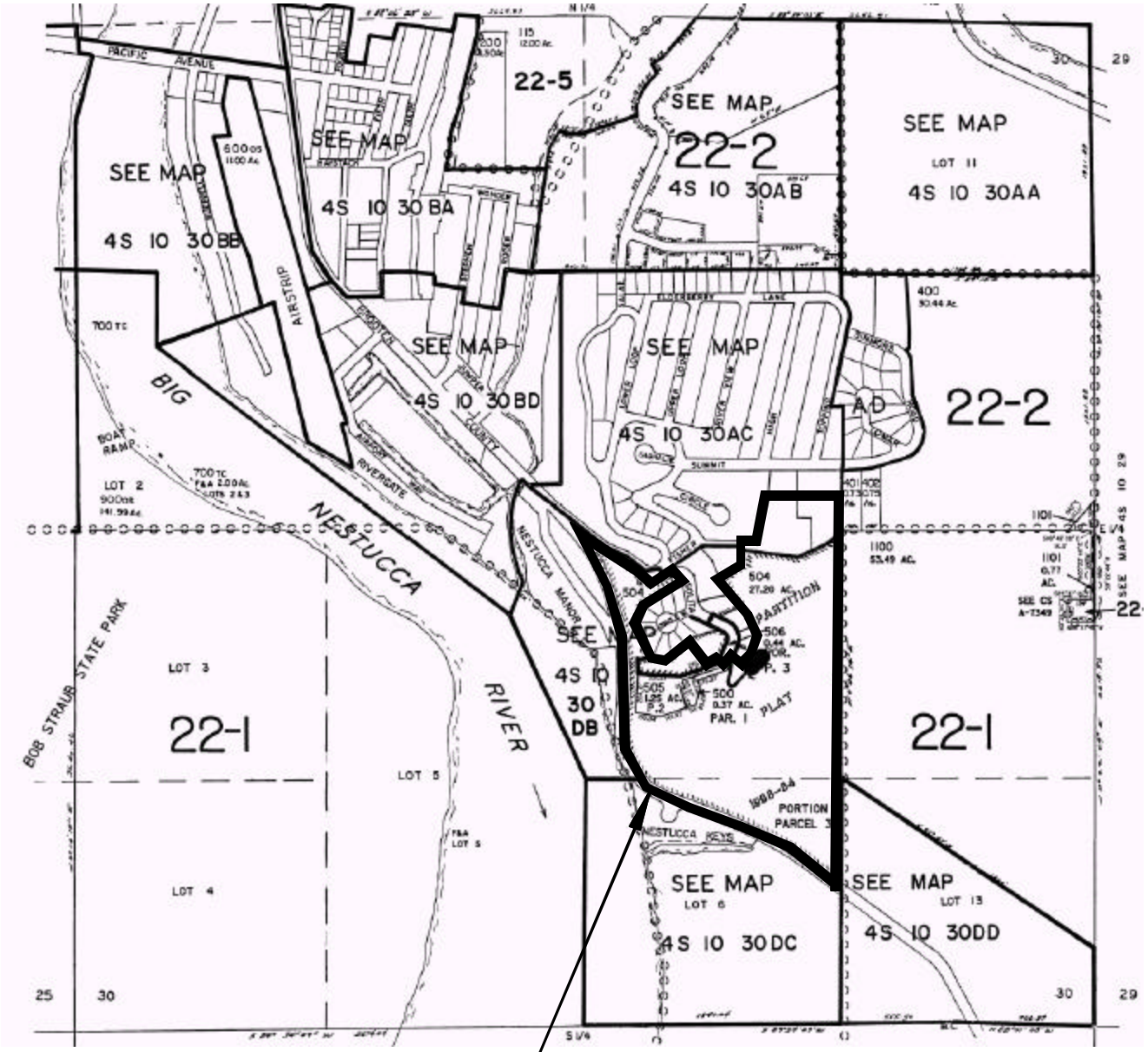
N

Date: 03/18/2005 Scale: 1" = 2,000'	**Project #Y042429b**	Prepared by: CCH Approved by: JDG

Location Map
Seawatch Development
Pacific City, Oregon

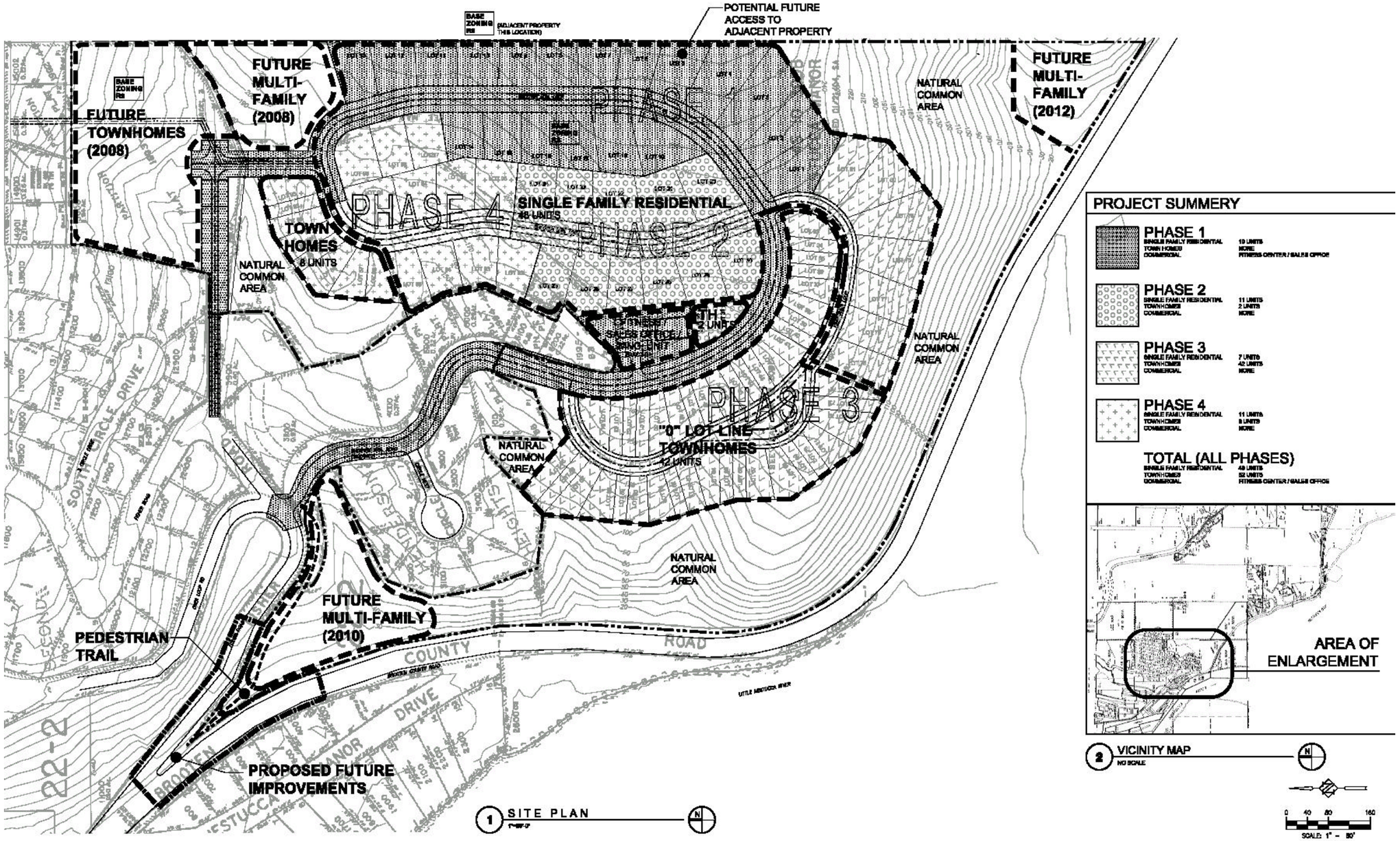
H.G. Schlicker & Associates, Inc.

Figure 1



Subject Site

Date: 03/18/2005	**Project #Y042429b**	Prepared by: CCH Approved by: JDG
Plat Map Seawatch Development Pacific City, Oregon		
H.G. Schlicker & Associates, Inc.		**Figure 2**



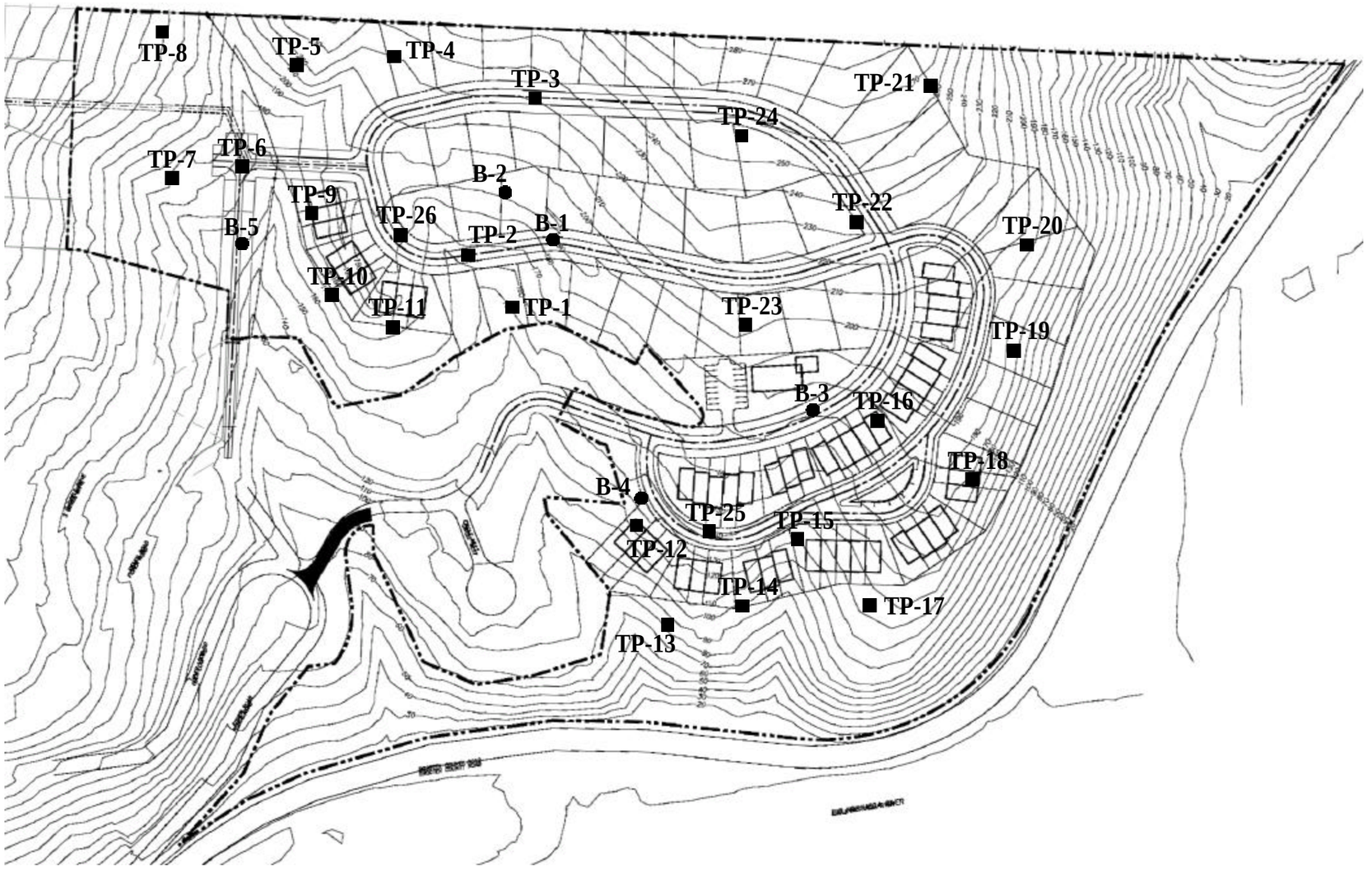
Site Plan Provided by Client.

Date: 03/18/05	**Project #Y042429b**	Prepared by: CCH
Scale: 1" = 200'		Approved by: JDG

Site Plan
Seawatch Development
Pacific City, Oregon

H.G. Schlicker & Associates, Inc.

Figure 3



TP-1 = Test Pit Location

B-1 = Boring Location

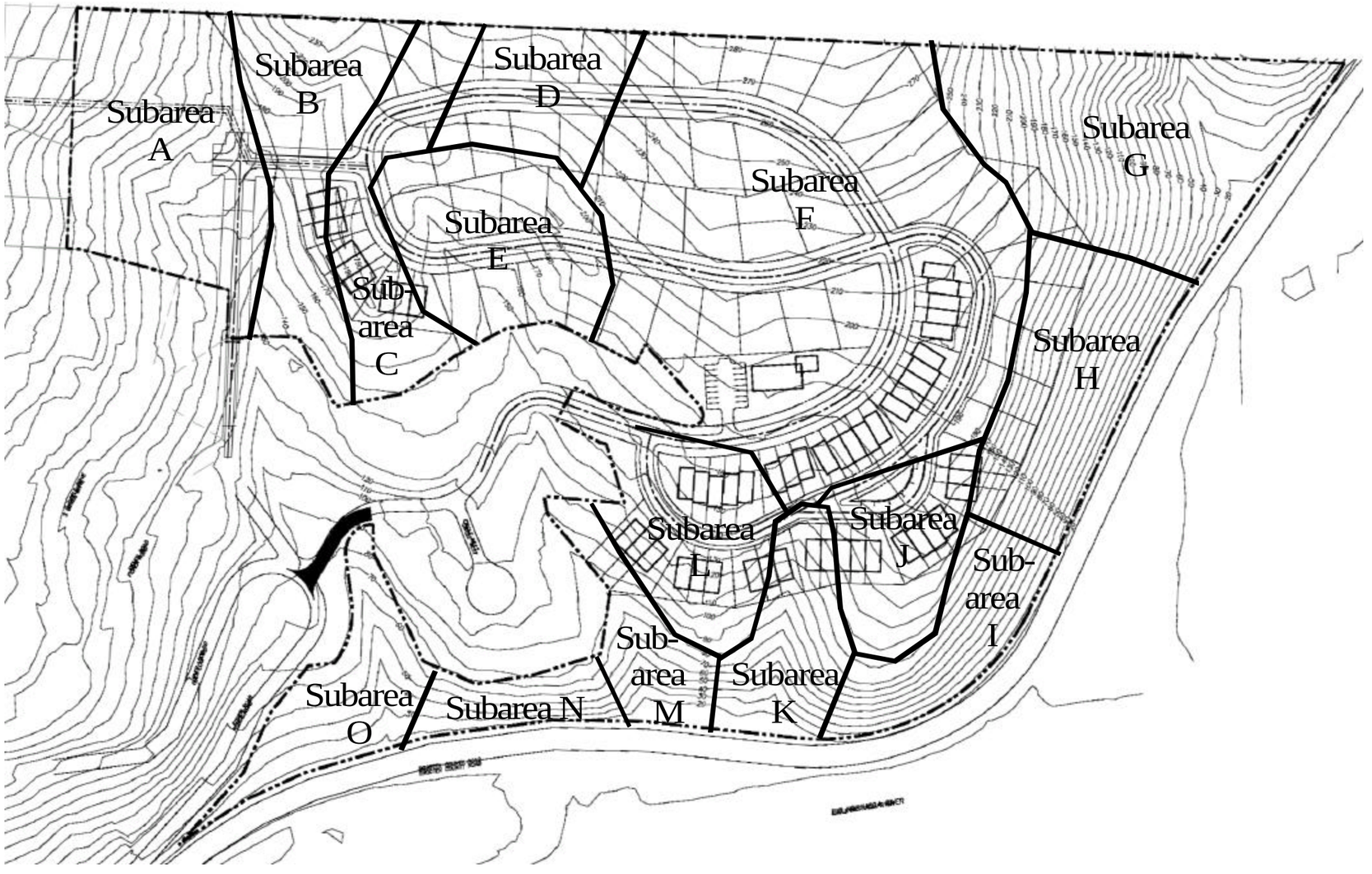
All Test Pit and Boring Locations are Approximate.
Development Plan and Topographic Map Provided by Client.

Date: 03/18/05	Project #Y042429b	Prepared by: CCH
Scale: 1" = 200'		Approved by: JDG

Test Pit and Boring Location Map
Seawatch Development
Pacific City, Oregon

H.G. Schlicker & Associates, Inc.

Figure 4



Note: Subareas are used for description purposes in the Geotechnical Investigation Report dated March 18, 2005.
All Locations are Approximate.
Base Map Provided by Client.

Date: 03/18/05	**Project #Y042429b**	Prepared by: CCH
Scale: 1" = 200'		Approved by: JDG

Subarea Map
Seawatch Development
Pacific City, Oregon

H.G. Schlicker & Associates, Inc.

Figure 5

Plan Provided by Client.

Date: 03/18/05	**Project #Y042429b**	Prepared by: CCH
Scale: 1" = 200'		Approved by: JDG

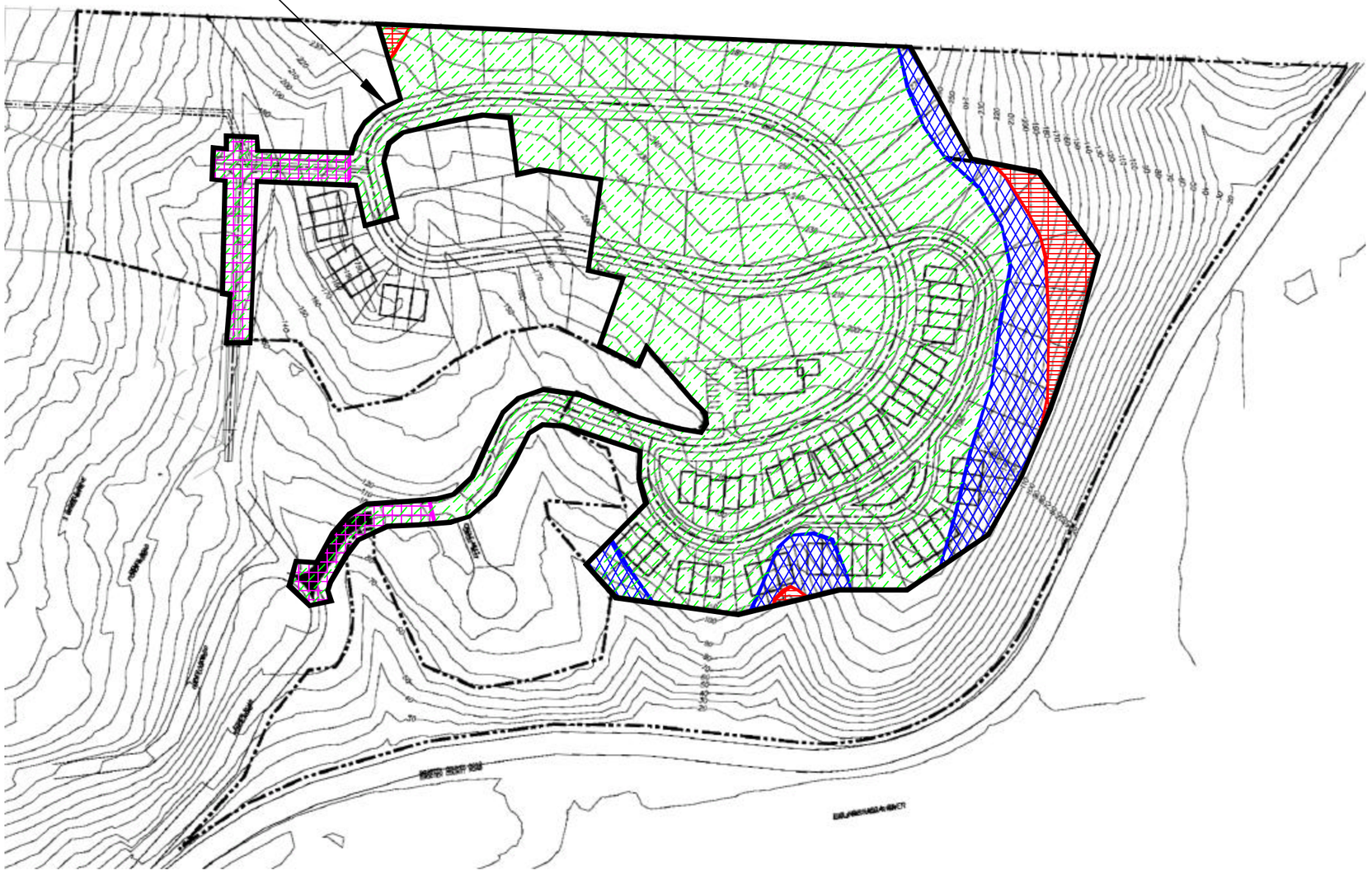
Street Improvements/Grading Plan

Seawatch Development
Pacific City, Oregon

H.G. Schlicker & Associates, Inc.

Figure 6

Boundary to Phases 1, 2 and 3



= Areas where development may occur using conventional land development methods and shallow foundations on silty soils.

= Areas where foundations should bear in undisturbed hard basalt. Where shallow basalt is not present building loads shall be supported on deep foundations embedded a minimum of 8 feet below existing grades.

= Road areas where existing fill will need to be removed and replaced, and where retaining structures may be required.

= Areas where structures are not recommended.

= Areas outside of Phases 1, 2 and 3.

Note: All Locations are Approximate. Hazard boundaries should be staked and flagged by a representative of H.G. Schlicker & Associates, Inc. Base Map Provided by Client.

N

Date: 03/18/05	**Project #Y042429b**	Prepared by: CCH
Scale: 1" = 200'		Approved by: JDG

Development Constraints
Phases 1, 2, and 3, Seawatch Development
Pacific City, Oregon

H.G. Schlicker & Associates, Inc.

Figure 7

APPENDIX A
- Test Pit Logs -

TEST PIT LOG EXPLANATION

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS), ASTM D2487			
MAJOR DIVISIONS		GROUP SYMBOL	GROUP NAME
COARSE-GRAINED SOILS	GRAVELS	GW	Well-graded gravel
		GP	Poorly-graded gravel
		GM	Silty gravel
		GC	Clayey gravel
	SANDS	SW	Well-graded sand
		SP	Poorly-graded sand
		SM	Silty sand
		SC	Clayey sand
FINE-GRAINED SOILS	SILTS AND CLAYS Liquid Limits Less than 50	ML	Silt with low plasticity
		CL	Clay with low plasticity
		OL	Organic silt or organic clay with low plasticity
	SILTS AND CLAYS Liquid Limits 50 or more	MH	Silt with high plasticity
		CH	Clay with high plasticity
		OH	Organic silt or organic clay with high plasticity
HIGHLY ORGANIC SOILS		PT	Peat, Muck, and other highly organic soils.

TEST PIT LOGS

TP-1

Depth (ft.)	USCS	Description
0 - 1.4	ML	CLAYEY SILT; soft to medium stiff, medium brown, wet, with 3 to 8% rock fragments (1/8 to ½" diameter) and roots. (Pocket Penetrometer - 0.5 to 1.0 tons/ft^2)
1.4 - 5.0	ML-MH	CLAYEY SILT; medium stiff to stiff, medium brown, wet, with some rock fragments. (Pocket Penetrometer - 1.0 to 1.5 tons/ft^2)
5.0 - 8.0	ML	SANDY, CLAYEY SILT (RESIDUAL BASALT); soft to medium stiff, wet to saturated, with minor rock fragments. Water Seepage at 8 feet.
8.0 - 10.0	ML	SANDY, CLAYEY SILT (RESIDUAL BASALT); medium stiff, wet to saturated, with minor rock fragments.
10.0 - 12.0	(Rock)	WEATHERED BASALT; hard, black, platy fractured, weathered to a granular texture. Water Seepage at 11 feet.

TP-2

Depth (ft.)	USCS	Description
1.0 - 2.0	ML	CLAYEY SILT; soft to medium stiff, medium brown, wet, with 3 to 8% rock fragments (1/8 to ½" diameter) and roots.
2.0 - 5.0	ML-MH	CLAYEY SILT; soft to medium stiff, brown, wet to saturated, with 5 to 10% mudstone and basalt rock fragments (1/8 to 1" diameter). (Pocket Penetrometer - 0.5 to 1.0 tons/ft^2). Water Seepage at 3 feet.
5.0 - 8.0	SM-GM	MIXED CLAYEY SILT, SILTY SAND AND GRAVEL; medium dense, brown to yellow brown to gray, mottled, wet, with fine- to coarse-grained sand, and 20 to 40% fine- to coarse-grained, round to subangular mudstone and basaltic cobbles ½ to 6" diameter. Contains interbeds of gray, clayey silt. **Encountered wood fragments at 8 feet.**
8.0 - 14.0	ML-SM	SANDY CLAYEY SILT (RESIDUAL ROCK, POSSIBLY BASALT); medium stiff, yellow brown, mottled, wet, with 70 to 80% weak, highly weathered, sand sized grains.
14.0	(Rock)	WEATHERED BASALT; hard, weathered to a granular texture.

TP-3

Depth (ft.)	USCS	Description
0 - 1.6	ML	SLIGHTLY CLAYEY SILT; soft to medium stiff, brown, moist, with roots. (Pocket Penetrometer - 0.5 to 1.5 tons/ft^2).
1.6 - 6.0	ML	SLIGHTLY CLAYEY TO CLAYEY SILT; stiff, medium brown, moist. (Pocket Penetrometer - 2.0 to 2.5 tons/ft^2).
6.0 - 9.0	ML-MH	CLAYEY SILT; medium stiff, brown, damp.
9.0 - 11.0	ML-MH	CLAYEY SILT; soft, brown, wet.
11.0 - 12.0	ML-MH	CLAYEY SILT; medium stiff, brown to medium brown, mottled, wet, with 20 to 40% weathered mudstone fragments ¼ to 1" diameter.
12.0 - 13.0	(Rock)	WEATHERED BASALT; hard, weathered to a granular texture, platy fractured.

TP-4

Depth (ft.)	USCS	Description
0 - 0.6	ML	CLAYEY SILT; stiff, medium to dark brown, moist, slightly organic, with roots. (Pocket Penetrometer - 2.0 to 3.0 tons/ft^2).
0.6 - 3.0	ML	SLIGHTLY CLAYEY SILT; stiff, medium brown, moist, with some roots. (Pocket Penetrometer - 2.0 to 2.5 tons/ft^2).
3.0 - 6.0	ML	SLIGHTLY CLAYEY SILT; stiff, medium brown, moist.
6.0 - 14.0	ML-GM	MIXED CLAYEY SILT AND WEATHERED BASALT FRAGMENTS; stiff to medium dense, 30 to 50% basalt fragments from 6 to 10 feet, and 70 to 80% basalt fragments from 10 to 14 feet. (Appears to be old landslide deposits).

TP-5

Depth (ft.)	USCS	Description
0 - 0.5	ML-GM (Fill)	MIXED SILT, SAND AND WEATHERED BASALT FRAGMENTS (FILL).
0.5 - 3.0	ML-GM	SANDY CLAYEY SILT WITH 20 TO 60% WEATHERED BASALT FRAGMENTS (POSSIBLY ANCIENT LANDSLIDE DEPOSITS); dense, medium brown, moist.

TP-5 (continued)

Depth (ft.)	USCS	Description
3.0 - 12.0	ML	CLAYEY SANDY SILT (RESIDUAL BASALT); stiff, medium brown, moist, with zones of medium dense silty sand. (possibly highly weathered ancient landslide deposits).

TP-6

Depth (ft.)	USCS	Description
0 - 0.6	GM (Fill)	CRUSHED ROCK FILL (PIT RUN) WITH 20 TO 30% SILTY MATRIX; loose to medium dense, with roots.
0.6 - 5.0	ML-GM (Fill)	CLAYEY SILT FILL WITH 30 TO 50% MUDSTONE FRAGMENTS (¼ to 4" diameter).
5.0 - 13.0	ML-GM	MIXED SAND AND SILT (30 to 40%) AND MUDSTONE FRAGMENTS; dense to very dense. Water seepage at 12 feet. (Appears to be old landslide deposits).

TP-7

Depth (ft.)	USCS	Description
0 - 3.0	ML	CLAYEY SILT; medium stiff to stiff, brown, moist, with 2 to 3% tan mudstone fragments (¼ to 1" diameter). (Pocket Penetrometer - 1.0 to 2.0 tons/ft^2).
3.0 - 5.0	CL-ML	CLAYEY SILT TO SILTY CLAY (RESIDUAL MUDSTONE); stiff to very stiff, tan to brown, mottled, slightly sandy, with black oxidized zones along fractures. (Pocket Penetrometer - 2.0 to 3.5 tons/ft^2).
5.0 - 9.0	(Rock)	WEATHERED MUDSTONE; very stiff to hard, fractured, with black oxidation along fractures.

TP-8

Depth (ft.)	USCS	Description
0 - 1.2	GM (Fill)	MIXED SILT AND PIT RUN CRUSHED ROCK FILL; medium dense, with organics.
1.2 - 8.0	ML	CLAYEY SILT; stiff to very stiff, medium brown, moist, with minor rock fragments. (Pocket Penetrometer - 2.0 to 3.0 tons/ft^2).

TP-8 (continued)

Depth (ft.)	USCS	Description
8.0 - 9.0	ML (Rock)	FRACTURED (POSSIBLY DISTURBED) WEATHERED MUDSTONE; stiff, tan to yellow brown to black, mottled, with very stiff to hard, mudstone pebbles 1/8 to ½ inch diameter.
9.0 - 13.0	(Rock)	WEATHERED MUDSTONE; stiff to very stiff to hard, tan to yellow brown, mottled, moist to damp.

TP-9

Depth (ft.)	USCS	Description
0 - 6.0	GW (Fill)	CRUSHED BASALT ROCK FILL (PIT RUN); ¼ to 3 feet diameter, 80 to 90%, with silty matrix.
6.0 - 9.0	(Rock)	WEATHERED FRACTURED BASALT; fine-grained, fractures 1 to 3" apart. It is unclear if this basalt is disturbed (possibly basalt fill).

TP-10

Depth (ft.)	USCS	Description
0 - 6.0	ML	CLAYEY SILT; medium stiff to stiff, medium brown, moist, with minor mudstone fragments.
6.0 - 7.0	ML	FRACTURED MUDSTONE; hard, tan to brown, mottled.

TP-11

Depth (ft.)	USCS	Description
0 - 0.7	ML	ORGANIC CLAYEY SILT; soft to medium stiff, medium to dark brown, moist.
0.7 - 2.2	ML	CLAYEY SILT; medium stiff to stiff, medium brown, moist, with 2 to 5% mudstone fragments, ¼ to 1" diameter. (Pocket Penetrometer - 1.0 to 2.0 tons/ft^2).
2.2 - 7.0	ML	CLAYEY SILT; stiff to very stiff, brown, moist, with 2 to 5% mudstone fragments, ¼ to 1" diameter. (Pocket Penetrometer - 2.0 to 3.0 tons/ft^2).
7.0 - 9.0	(Rock)	WEATHERED BASALT; hard, weathered to a granular texture, platy fractured.

TP-12

Depth (ft.)	USCS	Description
0 - 0.4	GM (Fill)	MIXED SILT AND CRUSHED ROCK FILL; loose, dark brown, moist, organic, with roots.
0.4 - 5.5	ML (Fill)	CLAYEY SILT FILL; stiff to very stiff, medium to dark brown, mottled, moist, slightly organic zones. (Pocket Penetrometer - 1.5 to 3.0 tons/ft^2).
5.5 - 9.0	ML	CLAYEY SILT; medium stiff to stiff, dark brown, moist, with minor organics.
9.0 - 13.0	ML-MH	CLAYEY SILT; medium stiff to stiff, brown to medium brown, moist to damp.
13.0	(Rock)	HARD BASALT; it is unclear if this basalt is in place.

TP-13

Depth (ft.)	USCS	Description
0 - 0.6	ML (Fill)	SILT FILL; soft, dark brown, moist, organic with weathered basalt rock fragments.
0.6 - 1.5	ML	ORGANIC SILT; soft, dark brown, moist.
1.5 - 6.0	(Rock)	WEATHERED BASALT; hard, weathered to a granular texture, platy fractured.

TP-14

Depth (ft.)	USCS	Description
0 - 3.4	ML (Fill)	ORGANIC SILT FILL; loose, medium to dark brown, mottled, moist, with weathered basalt fragments and organic debris.
3.4 - 4.3	ML	CLAYEY SILT; medium stiff to stiff, dark brown, moist, slightly organic.
4.3 - 7.0	(Rock)	WEATHERED BASALT; hard, weathered to a granular texture, platy fractured.

TP-15

Depth (ft.)	USCS	Description
0 - 1.5	ML	SLIGHTLY ORGANIC TO ORGANIC SILT; soft, dark brown, moist, with roots.
1.5 - 5.0	ML	CLAYEY SILT; medium stiff to stiff, medium to dark brown, moist, with minor roots. (Pocket Penetrometer - 0.5 to 1.5 tons/ft^2).
5.0 - 8.0	ML-MH	CLAYEY SILT; stiff, medium brown, moist, with minor organics.
8.0 - 11.0	ML-MH	CLAYEY SILT; medium stiff, medium brown, moist to damp, with some weathered, basalt fragments.
11.0 - 12.0	(Rock)	WEATHERED BASALT; hard, weathered to a granular texture. Approximately 80 to 90% basalt in silty matrix (possibly disturbed).

TP-16

Depth (ft.)	USCS	Description
0 - 1.2	ML	SLIGHTLY ORGANIC SILT; soft to medium stiff, dark brown, moist, with roots.
1.2 - 4.5	ML-MH	CLAYEY SILT; stiff to very stiff, medium to dark brown, moist. (Pocket Penetrometer - 1.5 to 2.5 tons/ft^2).
4.5 - 9.0	ML	SANDY CLAYEY SILT (RESIDUAL BASALT); stiff, medium brown, moist. Sand is weak.

TP-17

Depth (ft.)	USCS	Description
0 - 0.9	ML	SLIGHTLY ORGANIC SILT; medium stiff, dark brown, moist, with roots.
0.9 - 3.0	ML	CLAYEY SILT, stiff to very stiff, medium to dark brown, mottled, moist. (Pocket Penetrometer - 2.0 to 3.0 tons/ft^2).
3.0 - 9.5	ML	CLAYEY SILT; stiff to very stiff, medium brown, moist. (Pocket Penetrometer - 2.0 to 3.0 tons/ft^2).
9.5 - 13.0	ML-MH	SANDY CLAYEY SILT (RESIDUAL BASALT); stiff, medium brown, moist. Sand is weak.

TP-18

Depth (ft.)	USCS	Description
0 - 1.0	ML	ORGANIC SILT; soft, dark brown, moist, with roots.
1.0 - 3.0	ML	CLAYEY SILT; medium stiff, medium to dark brown, moist.
3.0 - 5.0	(Rock)	WEATHERED BASALT; hard, weathered to a granular texture.

TP-19

Depth (ft.)	USCS	Description
0 - 1.5	ML	ORGANIC SILT; soft, dark brown, moist, with roots.
1.5 - 2.0	ML	CLAYEY SILT; medium stiff, medium to dark brown, moist.
2.0 - 5.0	(Rock)	WEATHERED BASALT; hard, weathered to a granular texture.

TP-20

Depth (ft.)	USCS	Description
0 - 1.5	ML-GM	ORGANIC SILT WITH BASALT FRAGMENTS; loose, dark brown, moist.
1.5 - 5.0	(Rock)	WEATHERED BASALT; dark gray, fine-grained, highly fractured, with fracture spacings from ¼ to 2 inches.

TP-21

Depth (ft.)	USCS	Description
0 - 3.0	ML-GM	MIXED ORGANIC SILT AND BASALT FRAGMENTS; soft to loose, dark brown, moist.
3.0 - 5.0	(Rock)	WEATHERED BASALT (DISTURBED) IN SILTY MATRIX; 70 to 80% dark gray, fine-grained, basalt fragments, 1/8 to 1 feet diameter, in medium stiff matrix.
5.0 - 8.0	(Rock)	WEATHERED BASALT; fine-grained, highly fractured.

TP-22

Depth (ft.)	USCS	Description
0 - 1.2	ML	ORGANIC SILT; loose to soft, dark brown, moist, with roots.
1.2 - 4.0	ML	CLAYEY SILT; stiff to very stiff, medium brown, moist, with minor basalt rock fragments. (Pocket Penetrometer - 2.0 to 3.0 tons/ft^2).
4.0 - 7.0	(Rock)	WEATHERED BASALT; hard, fractured, weathered to a granular texture.

TP-23

Depth (ft.)	USCS	Description
0 - 1.6	ML-PT	ORGANIC SILT AND ORGANIC DEBRIS; loose, dark brown, with roots.
1.6 - 2.2	ML-MH	CLAYEY SILT; stiff to very stiff, medium to dark brown, moist. (Pocket Penetrometer - 1.5 to 3.0 tons/ft^2).
2.2 - 7.0	ML	CLAYEY SILT; stiff to very stiff, medium brown, moist. (Pocket Penetrometer - 2.0 to 3.5 tons/ft^2).
7.0 - 11.0	ML-MH	CLAYEY SILT; stiff to very stiff, medium brown, moist.

TP-24

Depth (ft.)	USCS	Description
0 - 1.0	ML-PT	ORGANIC SILT AND ORGANIC DEBRIS; loose, dark brown, with roots.
1.0 - 2.5	ML-MH	CLAYEY SILT; stiff to very stiff, medium to dark brown, moist. (Pocket Penetrometer - 1.5 to 3.0 tons/ft^2).
2.5 - 11.0	ML	CLAYEY SILT; stiff to very stiff, medium brown, moist, with minor basalt fragments.
11.0 - 12.0	(Rock)	SILTSTONE; hard, blue-gray.
12.0 - 12.5	(Rock)	WEATHERED BASALT; hard.

TP-25

Depth (ft.)	USCS	Description
0 - 2.5	ML (Fill)	CLAYEY SILT FILL; medium stiff, brown to dark brown, mottled, moist, with minor rock fragments.
2.0 - 4.0	ML	CLAYEY SILT; stiff to very stiff, medium brown, moist. Pocket Penetrometer - 2.0 to 3.0 tons/ft^2).

TP-25 (continued)

Depth (ft.)	USCS	Description
4.0 - 5.0	ML	CLAYEY SILT; stiff, brown, moist.
5.0 - 5.5	ML	CLAYEY SILT; stiff, brown, moist, with weathered basalt fragments.
5.5 - 6.5	(Rock)	WEATHERED BASALT; hard, fractured, weathered to a granular texture.

TP-26

Depth (ft.)	USCS	Description
0 - 1.0	ML	ORGANIC SILT; medium stiff to loose, dark brown, moist.
1.0 - 3.2	ML-MH	CLAYEY SILT; stiff to very stiff, medium brown, moist, with 2 to 5% weathered basalt fragments.
3.2 - 6.0	(Rock)	WEATHERED BASALT; very dense to hard, platy fractured, weathered to a granular texture.

APPENDIX B
- Boring Logs -

BORING LOG EXPLANATION

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS), ASTM D2487			
MAJOR DIVISIONS		GROUP SYMBOL	GROUP NAME
COARSE-GRAINED SOILS	GRAVELS	GW	Well-graded gravel
		GP	Poorly-graded gravel
		GM	Silty gravel
		GC	Clayey gravel
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		SP	Poorly-graded sand
		SM	Silty sand
		SC	Clayey sand
FINE-GRAINED SOILS	SILTS AND CLAYS Liquid Limits Less than 50	ML	Silt with low plasticity
		CL	Clay with low plasticity
		OL	Organic silt or organic clay with low plasticity
	SILTS AND CLAYS Liquid Limits 50 or more	MH	Silt with high plasticity
		CH	Clay with high plasticity
		OH	Organic silt or organic clay with high plasticity
HIGHLY ORGANIC SOILS		PT	Peat, Muck, and other highly organic soils.

SAMPLE TYPE

SPT = Standard Penetration Test and Split-Barrel Sampler (ASTM D1586); 1 3/8-inch I.D.
2.5" = Modified 2.5-inch I.D. Split-Barrel Sampler.
Shelby = Thin-Walled Tube Sampler (ASTM D1587); 3-inch O.D.

Sampling Interval

= No sample attempted

= Location of retrieved sample.

= Location where sample was attempted with no recovery.

Standard Penetration Test (SPT)

Blows per 6" = Number of blows required to drive SPT sampler 6 inches using a 140 Lb. hammer dropped from a height of 30 inches (recorded in three 6" intervals).
N = Standard Penetration Resistance: Number of blows (N) required to drive SPT sampler 12 inches using a 140 Lb. hammer dropped from a height of 30 inches (ASTM D1586). Field derived SPT (N) values has not been corrected for effective overburden pressures.
P = Indicates that SPT sampler was pushed 6 inches with only the weight of the hammer or drill stem (N = 0).

Location: Pacific City, Oregon	**Job Name**: Seawatch Development	**Project #Y042429b**
Drilling Company: Subsurface Tech.	**Driller**: Kerry	**Boring # B - 1**

Drill Rig	Solid Auger	Hollow Auger XXX	Rotary Wash	**Sheet** 1 **of** 1
Sampler Type	2.5" Split Barrel	2.8"Shelby Tube XX	SPT XXX	**Drilling Time**
Drive Wt. 140 Lb.		**Fall** 30 In.		**Start** / **Finish**
Water Level	**Depth** (Ft.)	**Time**	**Date**	**Time:** 1:10 PM / **Time:** 2:15 PM
				Date: 3/1/05 / **Date**:3/1/05

Field Personnel: C. Humphrey, CEG	**Casing Depth**: (Ft.)	**Ground Elevation**: 190 (Ft.)

Blows per 6"			N	Sample Type	Depth (Ft.)	USCS	Description
					0		
11	7	5	12	SPT	2.5	(Fill)	MIXED SILT AND BASALT ROCK FRAGMENTS (FILL)
				Shelby	5		(Attempted Shelby - no recovery)
50/3			50+	SPT		(Rock)	BASALT; hard, dark gray. (only obtained chips for samples).
					7.5		
					10		
50/2			50+			(Rock)	BASALT; hard, dark gray. (no sample recovered)
							Bottom of boring @ 11.5 feet
							No ground water encountered.

H.G. Schlicker & Associates, Inc.

Location: Pacific City, Oregon	Job Name: Seawatch Development	Project #Y042429b
Drilling Company: Subsurface Tech.	Driller: Kerry	Boring # B - 2

Drill Rig	Solid Auger	Hollow Auger XXX	Rotary Wash	Sheet 1 of 2
Sampler Type	2.5" Split Barrel	2.8"Shelby Tube XX	SPT XXX	Drilling Time
Drive Wt. 140 Lb.		Fall 30 In.		Start: 3:30 PM / Finish: 5:55 PM
Water Level	Depth (Ft.)	Time	Date	Start Date: 3/1/05 / Finish Date: 3/1/05
	21	5:45 PM	3/1/05	

Field Personnel: C. Humphrey, CEG	Casing Depth: (Ft.)	Ground Elevation: 190 (Ft.)

Blows per 6"			N	Sample Type	Depth (Ft.)	USCS	Description
					0		(mixed silt and crushed rock fill)
3	3	4	7	SPT	2.5	ML	CLAYEY SILT; medium stiff, medium brown, moist.
				Shelby	5	ML	CLAYEY SILT
2	2	3	5	SPT		ML	CLAYEY SILT; medium stiff, brown to medium brown, moist.
					7.5		
2	3	6	9	SPT	10	ML	SANDY CLAYEY SILT; medium stiff to stiff, brown to yellow brown, mottled, moist, with 10 - 20% weak basaltic sand. Soil weathered from basalt.
					12.5		
2	3	5	8	SPT	15	SM-ML	SANDY CLAYEY SILT TO SILTY SAND; loose to medium stiff, brown to yellow brown, mottled, moist, with fine- to coarse, weak sand, and 10 to 20% weathered basalt fragments 1/8 to 1/3 inches diameter.
					17.5		
				Shelby			

Location: Pacific City, Oregon	Job Name: Seawatch Development	Project #Y042429b
Drilling Company: Subsurface Tech.	Driller: Kerry	Boring # B - 2

Drill Rig	Solid Auger	Hollow Auger XXX	Rotary Wash	Sheet 2 of 2
Sampler Type	2.5" Split Barrel	2.8"Shelby Tube XX	SPT XXX	Drilling Time
Drive Wt. 140 Lb.		Fall 30 In.		Start: 2:30 PM, Date: 3/1/05 — Finish: 5:55 PM, Date: 3/1/05

Water Level	Depth (Ft.)	Time	Date
	21	5:45 PM	3/1/05

Field Personnel: C. Humphrey, CEG	Casing Depth: (Ft.)	Ground Elevation: 190 (Ft.)

Blows per 6"			N	Sample Type	Depth (Ft.)	USCS	Description
3	3	4	7	STP	20	ML	SANDY CLAYEY SILT; medium stiff, medium brown, wet to saturated, with some weathered basalt fragments. Soil weathered from basalt.
					22.5		
50/2			50+	STP	25	(Rock)	WEATHERED BASALT; hard, brown, course-grained, weathered to a granular texture.
							Bottom of boring @ 25.1 feet
							Ground Water @ 21 feet

H.G. Schlicker & Associates, Inc.

Location: Pacific City, Oregon	Job Name: Seawatch Development	Project #Y042429b
Drilling Company: Subsurface Tech.	Driller: Kerry	Boring # B - 3

Drill Rig	Solid Auger	Hollow Auger XXX	Rotary Wash	Sheet 1 of 2
Sampler Type	2.5" Split Barrel	2.8"Shelby Tube XX	SPT XXX	Drilling Time
Drive Wt. 140 Lb.	Fall 30 In.			Start: 8:50 AM, Date: 3/2/05 / Finish: 10:45 AM, Date: 3/2/05
Water Level	Depth (Ft.)	Time	Date	

Field Personnel: C. Humphrey, CEG	Casing Depth: (Ft.)	Ground Elevation: 175 (Ft.)

Blows per 6"			N	Sample Type	Depth (Ft.)	USCS	Description
					0		(crushed rock fill)
3	2	3	5	SPT	2.5	ML	CLAYEY SILT; medium stiff, medium brown, moist.
				Shelby		ML	CLAYEY SILT; medium stiff to stiff, medium brown, moist, with minor rock fragments.
					5		
5	5	5	10	SPT		ML	CLAYEY SILT; medium stiff to stiff, medium brown, moist, with minor rock fragments.
					7.5		
2	6	10	16	SPT	10	ML	SANDY CLAYEY SILT
						SM	CLAYEY SILTY SAND (COMPLETELY WEATHERED BASALT); medium dense, medium brown to dark brown, moist, with fine- to coarse-grained, angular sand, and 10 to 20% weathered basalt fragments.
					12.5		
26	40	50/3	50+	SPT	15	(Rock)	HIGHLY WEATHERED BASALT; very dense to hard, medium brown to yellow to black, mottled, moist. Weathered to granular texture.
					17.5		

Location: Pacific City, Oregon	**Job Name**: Seawatch Development	**Project #Y042429b**
Drilling Company: Subsurface Tech.	**Driller**: Kerry	**Boring # B - 3**

Drill Rig	Solid Auger	Hollow Auger XXX	Rotary Wash	**Sheet** 2 **of** 2
Sampler Type	2.5" Split Barrel	2.8"Shelby Tube XX	SPT XXX	**Drilling Time**
Drive Wt. 140 Lb.		**Fall** 30 In.		**Start** 8:50 AM / **Finish** 10:45 AM
Water Level	**Depth** (Ft.)	**Time**	**Date**	**Date**: 3/2/05

Field Personnel: C. Humphrey, CEG | **Casing Depth**: (Ft.) | **Ground Elevation**: 175 (Ft.)

Blows per 6"			N	Sample Type	Depth (Ft.)	USCS	Description
20	50/5		50+	SPT	20	(Rock)	HIGHLY WEATHERED BASALT; very dense to hard, medium brown to yellow to black, mottled, moist. Weathered to granular texture.
					22.5		
50/1			50+	SPT	25	(Rock)	BASALT; hard, gray.
							Bottom of boring @ 25 feet
							No ground water surfaces encountered.

H.G. Schlicker & Associates, Inc.

Location: Pacific City, Oregon	**Job Name**: Seawatch Development	**Project #Y042429b**
Drilling Company: Subsurface Tech.	**Driller**: Kerry	**Boring # B - 4**

Drill Rig	Solid Auger	Hollow Auger XXX	Rotary Wash	**Sheet 1 of 2**
Sampler Type	2.5" Split Barrel	2.8"Shelby Tube XX	SPT XXX	**Drilling Time**
Drive Wt. 140 Lb.		**Fall** 30 In.		**Start** / **Finish**
Water Level	**Depth** (Ft.)	**Time**	**Date**	**Time:** 11:15 AM / **Time:** 12:30 PM
				Date: 3/2/05 / **Date**: 3/2/05

Field Personnel: C. Humphrey, CEG	**Casing Depth**: (Ft.)	**Ground Elevation**: 135 (Ft.)

Blows per 6"			N	Sample Type	Depth (Ft.)	USCS	Description
					0		Mixed rock and sill fill, with some concrete debris.
8	11	10	21	SPT	2.5	GM (Fill)	MIXED CLAYEY SILT AND BASALT ROCK FILL; stiff.
8	9	10	19	SPT	5	SM (Fill)	SILTY SAND FILL WITH WEATHERED BASALT FRAGMENTS; stiff.
4	2	3	5	SPT	7.5	ML (Fill)	CLAYEY SILT FILL WITH 20 - 40% BASALT ROCK FRAGMENTS; medium stiff, gray to medium brown, mottled.
3	3	4	7	SPT	10	ML	CLAYEY SILT; medium stiff, medium brown to dark brown at top, moist.
				Shelby		ML-MH	CLAYEY SILT; medium stiff, medium brown, moist to damp, with minor rock basalt rock fragments.
					12.5		
2	2	4	6	SPT		ML-MH	CLAYEY SILT; medium stiff, medium brown, moist to damp, with minor rock basalt rock fragments.
					15		
					17.5		
2	2	3	5			ML	CLAYEY SILT; medium stiff, medium brown, moist to damp, with 10 - 15% weathered basalt fragments 1/8-1/2 inch diameter.

Location: Pacific City, Oregon	Job Name: Seawatch Development	Project #Y042429b
Drilling Company: Subsurface Tech.	Driller: Kerry	Boring # B - 4

Drill Rig	Solid Auger	Hollow Auger XXX	Rotary Wash	Sheet 2 of 2
Sampler Type	2.5" Split Barrel	2.8"Shelby Tube XX	SPT XXX	Drilling Time
Drive Wt. 140 Lb.		Fall 30 In.		Start: 11:15 AM / Finish: 12:30 PM
Water Level	Depth (Ft.)	Time	Date	Start Date: 3/2/05 / Finish Date: 3/2/05

Field Personnel: C. Humphrey, CEG	Casing Depth: (Ft.)	Ground Elevation: 135 (Ft.)

Blows per 6"			N	Sample Type	Depth (Ft.)	USCS	Description
					20		CLAYEY SILT; medium stiff, with rock fragments.
					22.5		
50/1			50+	STP		(Rock)	BASALT; hard, rebound quality.
							Bottom of boring @ 23 feet.
							No ground water encountered.
					25		

H.G. Schlicker & Associates, Inc.

Location: Pacific City, Oregon	Job Name: Seawatch Development	Project #Y042429b
Drilling Company: Subsurface Tech.	Driller: Kerry	Boring # B - 5

Drill Rig	Solid Auger	Hollow Auger XXX	Rotary Wash	Sheet 1 of 2
Sampler Type	2.5" Split Barrel	2.8"Shelby Tube XX	SPT XXX	Drilling Time
Drive Wt. 140 Lb.		Fall 30 In.		Start / Finish

Water Level	Depth (Ft.)	Time	Date	Start Time:	Finish Time:
	13	2:40 PM	3/2/05	1:10 PM	2:30 PM
				Date: 3/2/05	Date: 3/2/05

Field Personnel: C. Humphrey, CEG	Casing Depth: (Ft.)	Ground Elevation: 160 (Ft.)

Blows per 6"			N	Sample Type	Depth (Ft.)	USCS	Description
					0		(Crushed rock Fill)
4	2	2	4	SPT	2.5	ML (Fill)	CLAYEY SILT FILL; soft, medium to dark brown, mottled, wet, with minor organics and 3 to 6% rock fragments 1/8-1/4 inches diameter.
				Shelby			
					5	ML	CLAYEY SILT; stiff, medium brown, with mudstone fragments.
3	4	7	11	SPT		ML	CLAYEY SANDY SILT; stiff, yellow brown to gray brown, mottled, moist, with weathered mudstone fragments.
6	8	10	18	SPT	7.5	ML	SLIGHTLY CLAYEY SILT (HIGHLY WEATHERED MUDSTONE); very stiff, yellow gray to gray, mottled, moist, fractured.
3	5	10	15	SPT	10	ML	SLIGHTLY CLAYEY SILT (HIGHLY WEATHERED MUDSTONE); very stiff, yellow gray to gray, mottled, moist, fractured.
					12.5		
11	18	42	50+	SPT	15	(Rock)	WEATHERED SILTSTONE TO MUDSTONE; hard, brown to dark brown, mottled along fractures.
					17.5		

Location: Pacific City, Oregon	Job Name: Seawatch Development	Project #Y042429b
Drilling Company: Subsurface Tech.	Driller: Kerry	Boring # B - 5

Drill Rig	Solid Auger	Hollow Auger XXX	Rotary Wash	Sheet _2_ of _2_
Sampler Type	2.5" Split Barrel	2.8"Shelby Tube XX	SPT XXX	Drilling Time
Drive Wt. 140 Lb.		Fall 30 In.		Start / Finish

Water Level	Depth (Ft.)	Time	Date	Start Time:	Finish Time:
	13	2:40 PM	3/2/05	1:10 PM	2:30 PM
				Date: 3/2/05	Date: 3/2/05

Field Personnel: C. Humphrey, CEG	Casing Depth: (Ft.)	Ground Elevation: 160 (Ft.)

Blows per 6"			N	Sample Type	Depth (Ft.)	USCS	Description
20	50/2		50+	SPT	20	(Rock)	SILTSTONE; hard, medium gray, dry to moist.
							Bottom of boring @ 20.8 feet
							Ground water @ 13 feet.
					22.5		

H.G. Schlicker & Associates, Inc.

APPENDIX C
- Results of Laboratory Testing -

Northwest Testing, Inc.
A Division of Northwest Geotech, Inc.
9120 SW Pioneer Court, Suite B • Wilsonville, Oregon 97070 503/682-1880 FAX: 503/682-2753

TECHNICAL REPORT

Report To:	Mr. Christopher Humphrey, P.G., C.E.G. H. G. Schlicker & Associates, Inc. 607 Main Street Oregon City, Oregon 97045	**Date:** **Lab No.:**	3/10/05 05-085
Project:	Laboratory Testing Project No. Y042429B	**Project No.:**	1336.1.1

Report of: Moisture content, moisture density relationship, and Atterberg limits of soil.

Sample Identification

As requested, NTI determined moisture content, moisture density relationship, and Atterberg limits on samples of soil delivered to our laboratory on February 28, 2005 by a H.G. Schlicker & Associates representative. All testing was performed in general accordance with the methods indicated. Our laboratory's test results are summarized on the following tables and attached page.

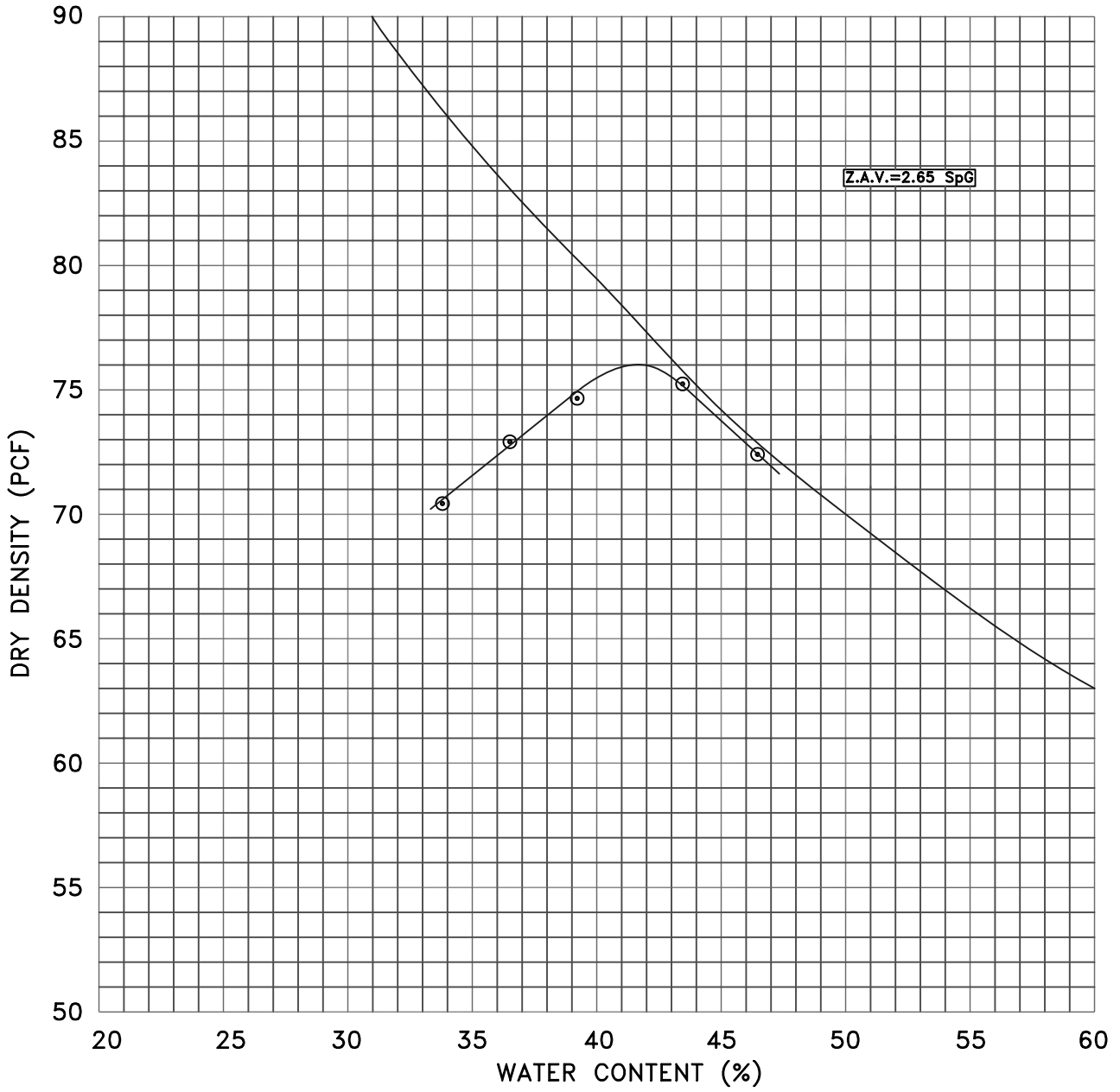
Laboratory Test Results

Moisture Content of Soil and Dry Density of Soil (ASTM D 2216)	
Sample ID	**Moisture Content (Percent)**
TP-3 @ 3'	64.6
TP-7 @ 3'	65.8
TP-8 @ 3'	67.2
TP-15 @ 3'	73.1
TP-17 @ 4'	86.9
TP-23@ 4'	74.2

Atterberg Limits (ASTM D 4318)			
Sample ID	**Liquid Limit**	**Plastic Limit**	**Plasticity Index**
TP-17@ 4'	NP	NP	NP

Attachments: Moisture Density Relationship
Direct Shear Results

Copies: Addressee, (facsimile)

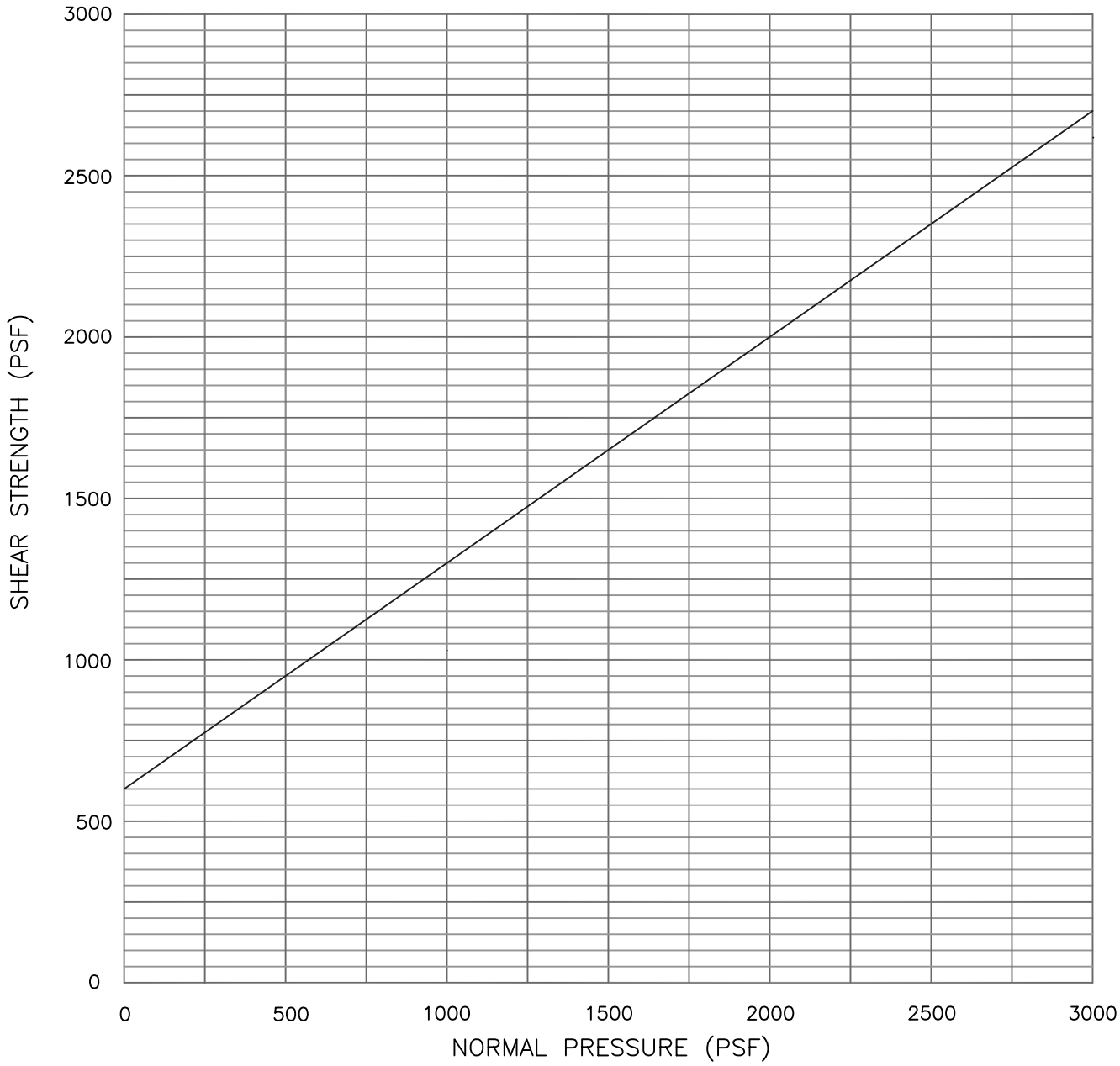


SOIL TYPE	TEST METHOD	MAXIMUM DRY DENSITY (PCF)	OPTIMUM WATER CONTENT (%)	PERCENT OVERSIZE	CORRECTED MAXIMUM DRY DENSITY (PCF)	CORRECTED WATER CONTENT (%)
TP- 17 @ 4' AND TP-23 @ 4'	ASTM D1557A	76.0	42.0	---	---	---

DATE TESTED: 3/2/05

MAXIMUM DENSITY TEST RESULTS

PROJECT NO. 1336.1.1	H.G. SCHLICKER AND ASSOCIATES PROJECT Y042429B	LAB NO. 05-085



SYMBOL	SAMPLE LOCATION	COHESION (psf)	FRICTION ANGLE	REMARKS
———	TP–16 @ 3.5'–4.5'	600	35°	

DIRECT SHEAR TEST RESULTS

PROJECT NO. 1336.1.1	SCHLICKER AND ASSOCIATES LABORATORY TESTING Y042429B	LAB NO. 05-085

Northwest Testing, Inc.
A Division of Northwest Geotech, Inc.
9120 SW Pioneer Court, Suite B • Wilsonville, Oregon 97070 503/682-1880 FAX: 503/682-2753

TECHNICAL REPORT

Report To:	Mr. Christopher Humphrey, P.G., C.E.G. H. G. Schlicker & Associates, Inc. 607 Main Street Oregon City, Oregon 97045	**Date:** **Lab No.:**	3/10/05 05-095
Project:	Laboratory Testing Project No. Y042429B	**Project No.:**	1336.1.1

Report of: Moisture contents, Atterberg limits, and direct shear of soil.

Sample Identification

As requested, NTI determined moisture content, Atterberg limits, and direct shear on samples of soil delivered to our laboratory on March 4, 2005 by a H.G. Schlicker & Associates representative. All testing was performed in general accordance with the methods indicated. Our laboratory's test results are summarized on the following tables.

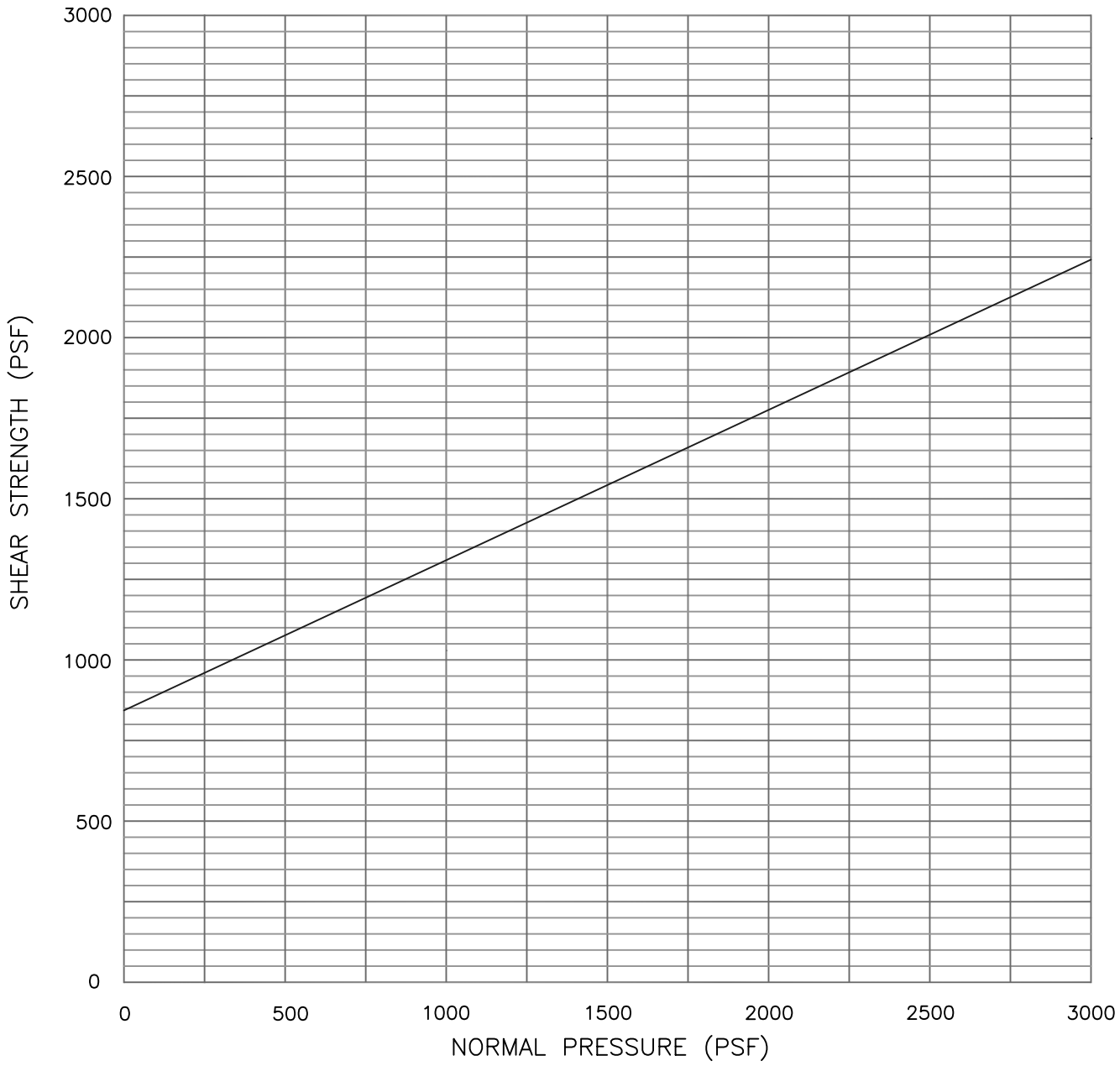
Laboratory Test Results

Moisture Content of Soil and Dry Density of Soil (ASTM D 2216 / ASTM D 2937)		
Sample ID	**Moisture Content (Percent)**	**Dry Density (pcf)**
TP-2 @ 4'	59.5	63.2
B-2 @ 10'-11.5'	51.1	--
B-2 @ 15'-16.5'	51.1	--
B-2 @ 18'-18.3'	36.1	83.2
B-3 @ 4'-6'	60.2	64.2
B-3 @ 10'-11.5'	60.4	--
B-5 @ 10'-11.5'	68.8	--
B-5 @ 12'-14'	90.8	48.6
B-5 @ 4'-6'	51.9	68.5

Atterberg Limits (ASTM D 4318)			
Sample ID	**Liquid Limit**	**Plastic Limit**	**Plasticity Index**
B-2 @ 5'-7'	NP	NP	NP

Attachments: Direct Shear Test Results

Copies: Addressee, (facsimile)



SYMBOL	SAMPLE LOCATION	COHESION (psf)	FRICTION ANGLE	REMARKS
———	B–2 @ 5'–7'	850	25°	

DIRECT SHEAR TEST RESULTS

PROJECT NO. 1336.1.1	SCHLICKER AND ASSOCIATES LABORATORY TESTING Y042429B	LAB NO. 05-095