ATTACHMENT 14

ABPB CONSULTING

GEOTECHNICAL/EARTH SCIENCES

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February 7, 2011
Project No. 1306

Ms. Tiffiny Brown
Burnstead Construction Co.
11980 NE 24th Street, Suite 200
Bellevue, WA 98005

Subject: Geotechnical Report
and Geological Hazardous Areas Assessment
Strom Property
Approximately 11800 block of 159th Avenue NE
Redmond, Washington

Dear Ms. Brown:

As requested, we have conducted a geotechnical engineering study for the proposed plat to be developed on the Strom property in Redmond, Washington. As part of this study, we have also included an assessment of Geologically Hazardous Areas study as defined by the City of Redmond's Critical Area Code. This report presents our findings and recommendations for the geotechnical aspects of project design along with Geologic Hazards identification; and mitigation measures for development and construction on the property.

SUMMARY

Our field exploration indicates that the area to be developed on the property is generally underlain by medium dense to hard native silts to silts with gravel which are glacial till-like in some of the upper soil zones beneath the site.

No significant areas of fill were found to underlie the gently to moderately sloping site. Although some heavy winter-time seepage was noted, no significant deeper groundwater horizons were noted during our study. We anticipate that perched water develops at a shallow depth over the low permeability silt soils in the wet winter months.

In our opinion, the site conditions encountered are suitable for development of the proposed residential development and other facilities. Existing undisturbed native soils and new structural fills will be suitable for supporting the proposed homes, vault and utilities provided the recommendations presented in this report are incorporated into project design and construction.

The existing general site and slope stability will not be adversely affected by the proposed construction using the buffers and setbacks from slope crests recommended in this report. We have developed appropriate slope setbacks for critical site slopes as discussed in this report.

The site soils are very moisture-sensitive and are not typically suitable for use as structural fill during the wet winter months.

PROJECT DESCRIPTION

Preliminary site plans indicate the Strom property project will include the development of 13 single family residential lots on the property. A preliminary site and grading plan has been prepared by the Core Design Inc. and is dated November 2010. The development of the property will take place on the relatively level plateau area in approximately the east half of the property. The west half includes mostly slopes and the central stream corridor.

The preliminary grading plan indicates that some shallow to moderate fills of up to six or seven feet will be placed in some area of the eastern plateau to create localized benches for home construction. Most of the fills will be in the two to four foot deep range and be placed away from steep slopes. A small wall up to four feet in height might be used to retain some fills near the slope crest in the southern portion of the site. A new roadway which will be an extension of the existing dead end on 159th Avenue NE will be built along the east property line and may tie in with the road system of a plat which might be built in the future to the east and northeast of the site.

Since many of the lots slope down to the north, storm runoff will need to be captured and discharged to the east into a future plat or down to the existing stream, to the west. In addition, a small top-of-slope storm pipe might be needed along the slope crest to collect water from rear lot areas and take flows to a suitable discharge point.

Preliminary plans call for a detention system, such as a vault, to be built in a tract area (Tract A) at the lower northwest corner of the developed area of the plat. No details for this vault are presently available. Some pipe will be needed to carry flows from the vault down the steep western slopes.

The design recommendations contained in the following sections of this report are based on our general understanding of the preliminary design concepts provided to us and discussed above. Once final plans have been developed, they should be reviewed by us so that we may provide supplementary recommendations, if required.

SITE CONDITIONS

Our field exploration was carried out in several phases. Initially, seven test pits were dug at the project site with a tracked backhoe. Two deep borings were then drilled along the slope crest with a tracked drill rig to evaluate the deep subsoil conditions under the steeper slopes located west of the planned house and lot areas of the development.

Using the information obtained from the subsurface exploration, we conducted analyses to develop geotechnical recommendations for project design and construction.

Specifically, this report addresses the following:

- Soil and groundwater conditions
- Site preparation and grading
- Foundation design
- Slabs-on-grade
- Drainage
- Detention Ponds and Vaults
- Slope Stability
- Geologically Hazardous Areas and Mitigation Measures

FIELD EXPLORATION AND LABORATORY TESTING

On December 16, 2010, we conducted our initial site exploration by observing the excavation of seven test pits dug with a tracked backhoe across the wooded site property. The test pits extended to a maximum depth of 10 feet below the existing ground surface. The approximate test pit locations are shown on the Exploration

Location Plan, Figure 2. The test pit locations were approximately determined by pacing from known landmarks. On January 5, 2011, we observed the drilling of two deep test borings located along the western slope crest of the plat area, as shown on Figure 2. These borings were drilled by Davies Drilling of Burien, Washington. The individual test pit and boring logs describing the soil conditions in detail are presented on Figures 4 through 12. A cross section across the steep slope area in the southern part of the site is shown on Figure 3.

An engineering geologist maintained a log of each test pit and the boring as they were excavated and drilled, classified the soil conditions encountered, and obtained representative soil samples. All soil samples were visually classified in accordance with the Unified Soil Classification System.

Representative soil samples obtained from the test pits and the boring were placed in sealed plastic bags and returned to a laboratory for further examination and testing. The moisture content of each sample from the borings was measured and is reported on the individual Boring Logs.

SITE CONDITIONS

Surface

The rectangular shaped project site is located just north of the current dead end of 159th Avenue NE in the 11800 block in north Redmond, Washington. The site location is shown on the Vicinity Map, Figure 1. Single family residences surround the property to the west and south. Undeveloped land lies to the north and east of the site. Most of the site is covered by second growth fir trees along with deciduous woods. An old logging road passes through the property along the slope crest. Heavy brush under the forest canopy exists in some areas of the site. The plateau area to be developed in the eastern half of the site has a low gradient of 5 to 10 percent and slopes gently down to the north between Elevs. 190 and 220 feet. The central and western parts of the property are covered with moderate to steep slopes and a small stream which runs through the western half of the site and flows to the north towards NE 124th Street below and beyond the north site boundary. The slopes and creek area are covered by a dense growth of deciduous and fir forest. Slopes in this area vary from about 40 to 100 percent in gradient.

The top of the slope adjacent to the planned development area is moderately steep in the southern part of the plat and grades to very steep in the central and northern section of the planned plat area.

Gradients of 1:1 (H:V) were noted in some areas below the slope crest next to the area to be developed. No significant wetland or areas of springs were noted below this steep slope area in the mid-slope area above the creek. No other springs or seeps were noted in other slope areas below the lot areas to be developed. The general site area and topography are shown on the Exploration Location plan, Figure 2.

Subsurface

It appears that the site has not been graded in the past. Firm native soils exist over the entire property at shallow depths. The native soils consist of a layer of topsoil varying from six to twelve inches in thickness. Below that level, the majority of the upland eastern area is underlain by a 2 to 3 foot layer of loose silty sand to sandy silt which is immediately underlain by dense glacial till-like soils. The looser near surface soil is a residual material from weathering of the underlying native glacial till-like soils. Most of the test pits encountered a pebbly sandy Silt to pebbly silt at shallow depths. These slightly gravelly soils are indicative of glacially consolidated till-like soils. Typical glacial till has a more sandy matrix that the site soils which are more silty. The high density of the near surface deposits, however, indicates that it is a till-like glacially consolidated material. All of the test pits scattered around the upland area of the property encountered and were terminated in this dense silty material.

The till-like silts have been glacially consolidated by a vast thickness of ice during the last glaciation of the Puget Sound lowland. The entire upper site covering the area to be developed by the plat as well as the top of the western slopes are underlain by these dense materials.

The dense silty glacially cemented soils noted under the area are mapped on the Redmond and Kirkland US Geological Survey quadrangle map, as well as the Soil Survey of King County, as glacial till. These soil units are known as the Alderwood Soil group (till) with varying slope gradients. As noted, the site soils are siltier than typical Alderwood till materials but have been densely consolidated. The Soil Conservation Service mapping and the Redmond quadrangle shows some Kitsap Silt or Transitional Beds further to the north and downslope of the site in the ravine bases. These soils were noted at depth in our holes and in the base of the stream channel is some locations.

Most of the site's near surface soils were deposited during and after the last glacial advance over the area about 12,000 to 15,000 years ago. The surface cover of till-like soils were formed under the leading edge of a 5,000 foot thick sheet of ice descending southward out of the Frasier River Valley in Canada. The thick layer of ice was in place for several thousand years and thus, heavily consolidated all of the soils deposited under the glacier. This includes the deeper sandy Silt and Silt layers which was deposited by pro-glacial streams and ponds in front of the advancing ice sheet.

To explore the deep subsoil conditions at the edge of the steep slopes along the west edge of the development, we drilled two deep borings near the slope crest.

One of the borings (B-2) was drilled above a "cirque" bowl shaped feature along the slope crest. The feature resembles an old area of slope movement. A bench is located about forty to fifty below the crest at this location. We did not observe any lines of "springs" near the bench which might indicate substantial out of slope flow near the base section of the old slide-like feature. The boring near the slope movement feature encountered about 15 feet of dense pebbly till-like materials below the surface, then an additional 15 feet of damp interbedded sandy Silt, some fine silty Sand, and Silt layers. Below about 30 feet, we encountered additional Silt with clay to Silt with few fine sand layers. No significant seepage was noted on the drill rods in the test boring at the time of drilling. These conditions are similar to those found in the deeper test boring (B-1) at the slope crest near the planned vault location in Tract A. The intermediate damp Sandy Silt to very silty Sand layer was somewhat thicker in Boring B-1 than at the topographically higher B-2 location which is about 10 feet higher. Both borings extended to depths of about 45 to 50 feet beneath the surface at the slope crest.

GROUNDWATER

During our field study, we did not observe any significant deep seepage in any of the test pits or the borings drilled across the slope crest of the upper site development area. Typical perched winter-time seepage at depths of about two to three feet was observed in several test pits. This seepage is created by substantial recent rainfall falling on the site and soaking into the ground. The relatively impermeable sandy Silt under the site perches the rainfall runoff and forces it to flow laterally as a perched seepage zone. Some damp soils were noted at depths of about 23 to 30 feet beneath the slope crest. However, no static water level was noted during the drilling in these deposits. Minor fluctuations in the perched seepage water levels at the site can also be expected following periods of heavy precipitation. We anticipate that a deep groundwater level also exists at the site below the creek level far below. Local wells would tap into this water table at potential depths of approximately 100 to 150 feet.

GEOLOGIC HAZARDS ASSESSMENT

Erosion Hazard

Section 20D.140.10-040 of the Redmond Critical Area Code shows Erosion Hazard Maps from the City's Critical Area Code. Other sections contain the definitions of erosion hazard areas. These areas are located on slopes steeper than 15 percent gradients. The site area is not shown as an Erosion Hazard area on the Folio Map in the City's Critical Area Ordinance.

Fifteen percent slopes exist only on the moderate to steeply sloping central and western parts of the property. Under the Code, these hazards include areas underlain by soils that are subject to severe erosion when exposed. Such soils include, but are not limited to, those for which potential for erosion is identified in the King County Soils Survey, by the USDA Soil Conservation Service (SCS). These soils include, but are not limited to, any of the following soil series on slopes 15 percent or steeper:

- Alderwood gravelly sandy loam (AgD)
- Alderwood – Kitsap (AKF)
- Everett (EvD) and Indianola (InD) outwash soils
- Kitsap silt loam (KpD)

The SCS has mapped the soils in the vicinity of the site as generally Alderwood gravelly sandy loam, 5 to 40 percent slopes (AgC and AgD). Our site specific geotechnical exploration generally confirms this classification. The glacial till soil (Alderwood Series) was found to underlie the entire area of the site to be developed. Based on this information, the soil types mapped by the SCS on the 15+ percent slopes on the site constitute moderate to severe Erosion Hazard areas. These hazard areas are only on the slope portions of the site which will not be developed or disturbed by development. Also, it should be noted that the site silty glacial till or Alderwood soils are typically used for grading during the dry season throughout the Puget Sound region.

In our opinion, special mitigation measures beyond standard erosion and sedimentation prevention and use of Best Management Practices (BMPs), required by the City of Redmond, are not needed. No buffer for grading will be needed from the 15 to 40 percent slopes along the margin of the steep slopes of the site. Appropriate control measures will be in place and will be monitored for effectiveness during the construction and grading of the plat.

No construction or development grading activity will occur in the western 40 percent steeper slope areas. It is possible that a Drisco (HDPE) pipe and outfall might be extended down the slope from the vault at the north end of the site down to the creek. This would create minimal disturbance to the slope.

The grading plan indicates that no significant modifications or grading (greater than two to three feet) will be made within about 50 feet of the crest of the steep western slope on the site.

Based on our review, it appears that there will be no increased surface water disturbance or sediment flow from graded areas over the pre-existing conditions. There will be no significant reduction of slope stability to the site or adjacent properties due to the grading of the subject site. The Critical Areas on the site will not be adversely impacted by the development on the sloping portions of the site.

Landslide Hazard

Section 20D.140.60.010 in the Critical Area Code contains a classification of the Landslide Hazard Areas for the City of Redmond. City folio mapping of the site does not specifically indicate that a critical landslide hazard exists for the area but a small Hazard Area appears in the ravine walls along the north border of the site and extending further northward.

Topographic information indicates that most of the site slopes in the central and northern areas of the ravine exceed 40 percent slope gradients. These slopes meet the Critical Area classification of Landslide Hazard and steep slope areas. No zones of heavy seepage were noted on the slopes along the east bank of creek below the site top-of-slope area. Layers of hard platy silt were found along the creek base in the central and southern sections of the site creek alignment. Bedding planes observed in these silt soils tended to dip slightly to the north rather than have an out-of-slope westerly slope.

Our observations indicate that the curved headwall feature noted below the Lot 7 and 8 area may be an ancient landslide feature. We did not see any indication that this feature is active other than typical creep of soil around some trees on a steep slope face.

We recommend a 50-foot setback buffer from the top of steep slopes for Lots 7 and 8, and a 25-foot buffer for the other lots and the vault on Tract A. No significant grading activity will occur within this setback buffer, based on the current plans. No fills greater than three feet in depth should be placed within any of these buffer setback areas.

In our opinion, no mitigation measures other that the buffer setbacks recommended above are needed for the steep slopes and Landslide Hazard areas. Typically the soils underlying the site slopes do not experience any significant deep-seated landsliding in this area of Redmond.

As noted earlier, no construction is planned near the crest of the steep slope areas within the noted buffer setbacks. The outfall from the vault may be constructed within the setbacks. Also, a small storm line may run across the back of the lots. These utility lines will not reduce the stability of the slope. The exact location of these storm lines near the crest should be reviewed by us prior to construction.

Appropriate erosion control measures will be incorporated into the proposed development to minimize potential adverse impacts to slope stability in this area. Construction of this plat will not increase the risk of occurrence of hazards associated with landsliding, above the pre-existing conditions.

Critical Seismic Hazard

The characteristics of the City of Redmond Seismic Hazard Areas are contained within several sections of the Critical Area Ordinance (20D.140.10) The site area is not mapped on the Critical Area Folio maps as a critical Seismic Hazard areas. Our site specific investigation also confirms this absence of designation is appropriate.

High Seismic Hazard classification areas exist where land is subject to severe risk of ground shaking, subsidence, or liquefaction due to certain combinations of soil and groundwater conditions. Areas susceptible to severe ground shaking might include the following:

- Soft or loose saturated alluvial deposits
- Soils with shallow, fully saturated and high groundwater conditions
- River valley deposits

Based on our study, the dense granular and fine grained soils that underlie the site slopes are not considered High Seismic Hazards areas. These soils are not loose and are densely consolidated by past glacial action. No special mitigation measures will be needed for site development to reduce the seismic hazard other than to design all structures using current seismic codes.

Critical Aquifer Recharge Areas

Critical Aquifer Recharge area hazards are defined in the City Code in Section 20D.140.50-10. Based on the City folio maps, the site area is not located within a Critical Aquifer Recharge zone. The mapping indicates that the site is in a low risk Zone 4 which covers much of the City. Our site specific study confirms this mapping.

The higher risk areas for a Critical Aquifer Recharge Zone are typically located in alluvial river areas of the City where land surface activities can have an effect on permeable soils which extend to depth and may affect wells. These are areas determined to have an important recharge effect on sources of potable water and are deemed vulnerable to contamination from recharge.

Based on our study and these classifications, it is our opinion that the Strom property should be considered a low significance area to aquifer recharge hazards due to the presence of more than 50 feet of dense to hard, nearly impermeable silt and clay soils within all areas of the plat to be developed. The storm water vault will be based within the till-like horizon and should also have no effect on deeper water bearing zones.

As noted above, the development of the subject site should not have any significant effect on the wells in the area due to the presence of the thick glacially consolidated till-like layer and the underlying sandy to clayey Silt layers. No mitigation measures will be needed other than prudent construction techniques using City of Redmond BMP's, primarily those related to erosion control.

GEOLOGIC HAZARD MITIGATION ACTION SUMMARY

Some Geologic Hazards (Erosion and Landslide) were found to be present on the site and are discussed in this report.

In our opinion, the moderate to high erosion and landslide hazard areas located in the steeper western slope areas will not be influenced by adjacent development. Implementation of standard BMPs will adequately mitigate the erosion hazard. Building setbacks, buffers, and other measures provided by detailed engineering design will mitigate impacts to this steep slope.

In our opinion, the risk of damage from development on the site and adjacent to the plat are minimal. These risks are subject to the conditions included in the geotechnical report. The planned development will not increase the risk of occurrence of geologic hazards. Appropriate measures will be adopted and included in plat design to eliminate or reduce these risks.

GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

General

Based on our study, the site is suitable for the proposed development. The new homes and facilities can be supported on conventional spread footings bearing on competent native soils below the topsoil or on compacted structural fill materials placed above competent native soils. If required, spread footings can also be supported on quarry rock fill placed above the competent native soils.

Concrete slabs for garages can be similarly supported on the recompacted subgrade soils present at the site or on new compacted structural fills. Roadway and driveway subgrades may be similarly supported on the recompacted native soil subgrades or on structural fill.

Buildings and other facilities should be constructed with an adequate setback from the top of the 40 percent slopes along the west side of the site. Along most of its alignment, structures, including residences and the proposed detention vault, should be set back at least 25 feet from the top of the 40 percent slope. On Lots 7 and 8, which are located above a possible old slide zone, we recommend that a building setback of at least 50 feet be maintained. We also recommend that no fills greater than three feet in depth should be placed within any of these buffer setback areas.

Site Preparation and Grading

To prepare the site for construction, any vegetation, organic surface soils, and other deleterious materials should be removed from below footing, slab-on-grade, and pavement areas. Soils containing organic material will not be suitable for use as structural fill, but may be used in non-structural areas or for landscaping purposes.

The on-site soils appear generally suitable for use as structural fill in dry summer weather. All areas should be compacted at the subgrade level prior to placement of new fills or slabs. Any loosened or softened areas should be overexcavated and replaced with drier materials to achieve a stable, non-yielding surface. All of the near-surface soils are silty and will be difficult to compact as structural fill when too wet. The ability to use these silty sands from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions at the time of construction.

All new structural fills should be placed in maximum one foot thick layers and densified with a vibratory roller to a minimum of 95 percent of the soil's maximum dry density as determined by ASTM D-698 (Standard Proctor).

Soils may need to be brought to within a few percentage points of the optimum moisture to enable proper compaction. This may require the addition of water during hot summertime grading operations. If overly wet, the soil layers will need to be aerated to near the optimum moisture for proper compaction.

The siltier site soils can be best compacted with a "sheeps-foot" drum type of roller along with vibratory compaction. Field density testing should be performed during the compaction process to assess that the materials are properly compacted.

If grading activities must take place during wet weather or on a wet subgrade, the owner should be prepared to use wet weather structural fill. Import fills should be predominantly granular with a maximum size of three inches and no more than five percent fines passing the No. 200 sieve.

Temporary cuts made in shallow native soils in trenches and other excavations can be made at a 1:1 (H:V) inclination. Deeper cuts in the consolidated Silt soils can be made at a 0.75:1 (H:V) inclination. These temporary cut configurations can also be used elsewhere on the site for the vault and other excavations. The contractor should use appropriate local and state standards for excavation work to maintain a safe work environment.

Prior to use, ABPB Consulting should examine on-site or imported materials proposed for use as structural fill. Alternatively, railroad ballast or small quarry spalls may be used over wet subgrades as structural fill material.

Foundations

New homes and other structures may be supported on conventional spread footings bearing on competent dense native soils or on compacted structural fill or quarry rock placed above competent native soils. Foundation subgrades should be prepared as recommended in the Site Preparation and Grading section. Perimeter foundations should extend at least 1.5 feet below final exterior grades for frost protection. Interior foundations can be constructed at any convenient depth. We recommend designing house foundations for a net allowable bearing capacity of 2500 pounds per square foot (psf) for the new homes. For wall footings (including the stormwater detention vault) based on the dense glacially consolidated silty till-like soils found at depth, an allowable bearing pressure of 4000 psf may be used for design. For short-term loads, such as wind and seismic, a 1/3 increase in the above allowable capacities can be used.

For designing foundations to resist lateral loads, a friction coefficient of 0.4 can be used. Passive earth pressures acting on the sides of the footings and buried portions of the foundation stem walls can also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 350 pounds per cubic foot (pcf). This value assumes the foundations will be constructed neat against competent soil or backfilled with structural fill as described in the Site Preparation and Grading section. The values recommended include a safety factor of 1.5.

We recommend not including the upper 12 inches of soil in this computation because they can be affected by weather or disturbed by future grading activity.

Based on the soil conditions observed in the test boring and test pits and the local seismicity, the site falls in Site Class D, in accordance with the International Building Code. Also, based on our review of the soil conditions, the potential for soil liquefaction to occur on this site is minimal.

Basement and Retaining Walls (Including Stormwater Vault)

The magnitude of earth pressures developing on any proposed full or partial retaining wall will depend on the quality of backfill. Most of the homes will not require lower level walls.

The storm water detention vault will require structural walls to support the surrounding soils. We recommend placing and compacting wall backfill as structural fill. With wall backfill placed and compacted as recommended and drainage properly installed, we recommend designing unrestrained walls for an active earth pressure equivalent to a fluid weighing 35 pcf. For restrained walls, an additional uniform lateral pressure of 100 psf should be added. All walls should be provided with a drainage layer of clean gravel for the full height of the wall or with a manufactured drainage membrane or board. This drainage layer should be tied in with the lower drain at the footing level.

Settlements

We anticipate that the total settlements for house footings based on the competent native soils or on compacted structural fill will be less than one-half inch. The majority of the settlements should occur during construction.

Slab-on-Grade Floors

We anticipate that the homes will have slab-on-grade garage slabs. These slabs may be supported on the subgrade prepared as recommended in the Site Preparation and Grading section.

The slabs may be supported on the densely recompacted existing subgrade, or on new compacted structural fill materials placed above the recompacted subgrade.

Where moisture is undesirable, we recommend placing a four-inch thick capillary break layer of clean, free-draining pea gravel that has less than three percent fines passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

Where moisture by vapor transmission is undesirable, a durable plastic membrane should be placed below the slab and above the capillary break. This membrane should be covered with one to two inches of clean, moistened sand to protect damage during construction and to aid in curing of the concrete. Other methods are available for preventing or reducing water vapor transmission through the slab. We recommend consulting with a building envelope specialist for additional assistance regarding this issue.

Drainage

Surface

Final exterior grades should promote free and positive drainage away from the new home areas at all times. Water must not be allowed to pond or collect adjacent to foundations or flow over the slope crest or any walls. We recommend providing a gradient of at least three percent for a minimum distance of ten feet from the house perimeters, except in paved locations. In paved locations, a minimum gradient of one percent should be provided, unless provisions are included for collection and disposal of surface water adjacent the structure.

Subsurface

We recommend installing continuous drains along the outside lower edge of the perimeter footings for the homes and any wall foundations. The foundation drains and roof downspouts should be tightlined separately to approved discharge facilities. Subsurface drains must be laid with a gradient sufficient to promote positive flow to a controlled point of approved discharge.

Slope Stability Analysis

As part of our study, we conducted detailed stability analyses at the steepest portion of the western slopes behind the proposed Lot 8 and the detention Tract A.

The analyses were conducted using the computer program STABL and the boundary conditions shown on the existing topographic map, the proposed grading plan and our test pit and test boring data. We conducted analyses for existing conditions as well as for post-construction conditions. Post construction conditions assume up to three feet of fill placed in the buffer setback areas at the top of the 40 percent slope. The results are as follows:

Condition Analyzed	Minimum Safety Factor
Below Lot 8 – Near surface Failures	2.2
Below Lot 8 – Near surface Failures - 0.25g seismic	1.4
Below Lot 8 – Deep Failures	1.9
Below Lot 8 – Deep Failures - 0.25g seismic	1.1
Below Proposed Vault - Near surface Failures	2.0
Below Proposed Vault - Near surface Failures-0.25g seismic	1.2
Below Proposed Vault – Deep Failures	2.0
Below Proposed Vault – Deep Failures - 0.25g seismic	1.2

All of the above results indicate safety factors well above what is considered adequate for these conditions. Based on our analysis, it is our opinion that the stability of the critical areas of the slopes analyzed is adequate in its existing and post construction conditions. The critical failure surfaces are all well within the proposed buffer and setback areas. As shown by the analyses, the proposed construction will not adversely impact the existing stability.

Pavements

Pavements should be constructed on stable subgrades prepared as described in the Site Preparation and Grading section. The subgrade should be proofrolled with heavy construction equipment to verify this condition. If needed, subgrade improvement may also be achieved by use of soil additives such as cement or cement kiln dust.

The appropriate pavement section depends upon the supporting capability of the subgrade soils and the traffic conditions to which it will be subjected. We expect that traffic will mainly consist of light passenger and commercial vehicles with occasional heavy traffic in the form of trash removal and some house construction vehicles.

Based on this information, with a stable subgrade prepared as recommended, we recommend the following pavement sections for light automobile traffic:

- Two inches of asphalt concrete (AC) over six inches of crushed rock base (CRB)
- Two inches of AC over 4.5 inches of asphalt treated base (ATB)

If any part of the pavement will be subjected to heavy truck traffic, the following sections are recommended:

- Three inches of AC over six inches of CRB
- Three inches of AC over 4.5 inches of ATB

The paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for Class B asphalt concrete, ATB, and CRB.

Long-term pavement performance will depend on surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils and reducing their supporting capability. To improve pavement performance, surface drainage gradients of no less than two percent are recommended. Also, some longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

ADDITIONAL SERVICES

Geotechnical and testing laboratory services should be provided during construction in order to observe compliance with the design concepts, specifications, and recommendations. This will also allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

The analyses and recommendations presented in this report are based upon data obtained from the test pits and borings excavated on-site. Variations in soil and groundwater conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, ABPB Consulting should be requested to reevaluate the recommendations in this report prior to proceeding with construction.

We also recommend that ABPB Consulting be retained to provide geotechnical observation services during construction. This is to observe compliance with the design concepts, specifications and recommendations. It will also allow expedient design changes in the event subsurface conditions are encountered that differ from those anticipated. It is requested that we be given two working days notice to provide any of the above services.

The following figures are included and complete this report:

Figure 1	Vicinity Map
Figure 2	Exploration Location Plan
Figures 3	Cross Section A – A'
Figure 4 through 10	Test Pit Logs
Figure 11 and 12	Boring Logs

We prepared this report in accordance with generally accepted geotechnical engineering practices. This report is the property of ABPB Consulting and is intended for specific application to the Strom Property plat project in Redmond, Washington. This report is for the exclusive use of Burnstead Construction Company and their authorized representatives. No other warranty, expressed or implied, is made.

We appreciate the opportunity to be of service during this phase of the subject project and look forward to working with you during the construction phases. We trust the information presented in this report is sufficient for your current needs. If you have any questions or need additional information, please call.

Sincerely yours,

ABPB CONSULTING, INC.

Paul K. Bonifaci, P.E.G.
Project Engineering Geologist

Anil Butail, P.E.
Geotechnical Engineer

ANIL BUTAIL
STATE OF WASHINGTON
17005
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 12/9/12

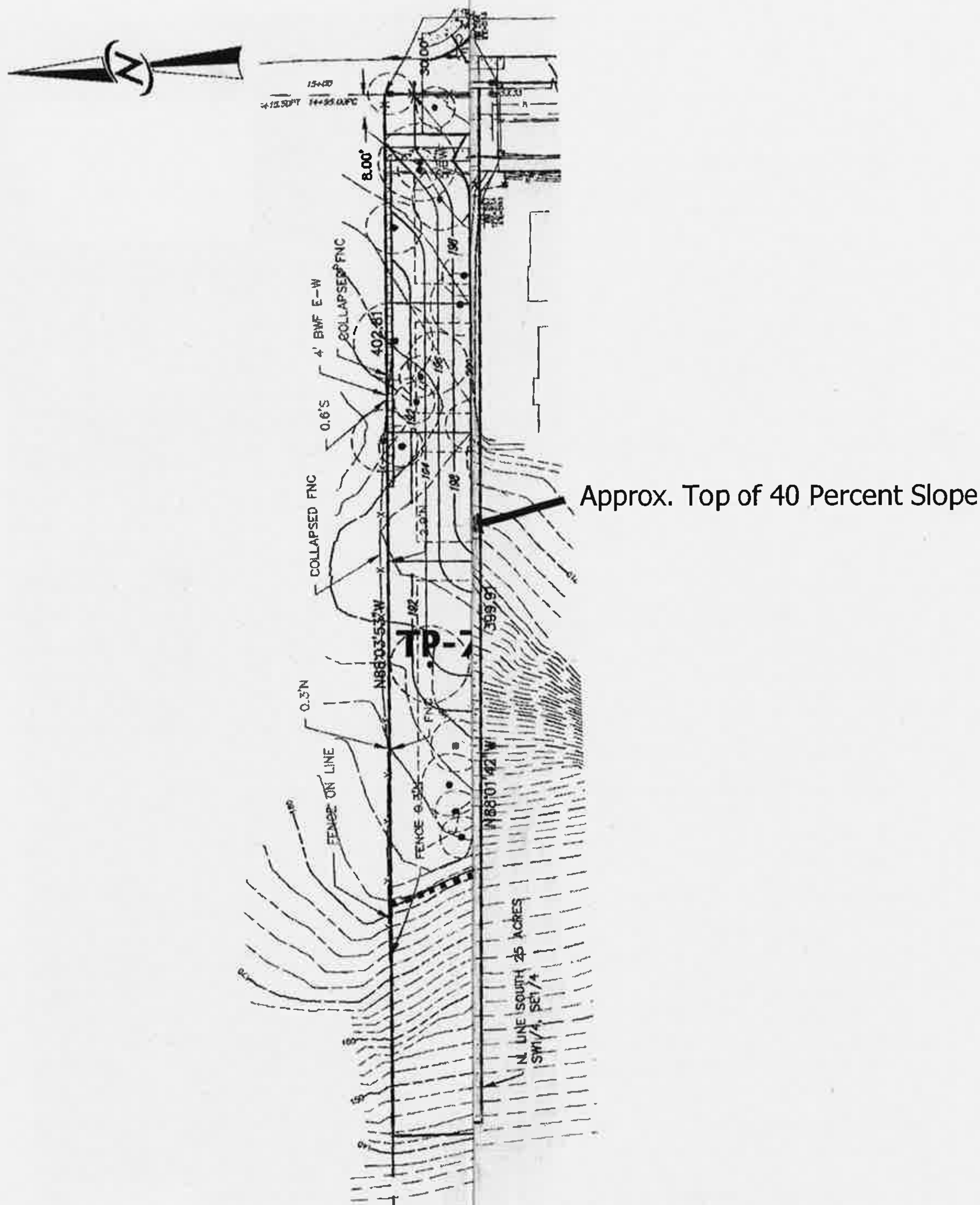
Cc: Mr. Jim Olsen, P.E., Core Design, Inc.

N

NTS

Ref: Windows Live Maps

ABPB Consulting **Geotechnical Consultants** **Kirkland, Wash.**	**Vicinity Map** **Strom Property** **Redmond, Washington**		
	Proj. No. 1306	**Date : 1-11**	**Figure 1**



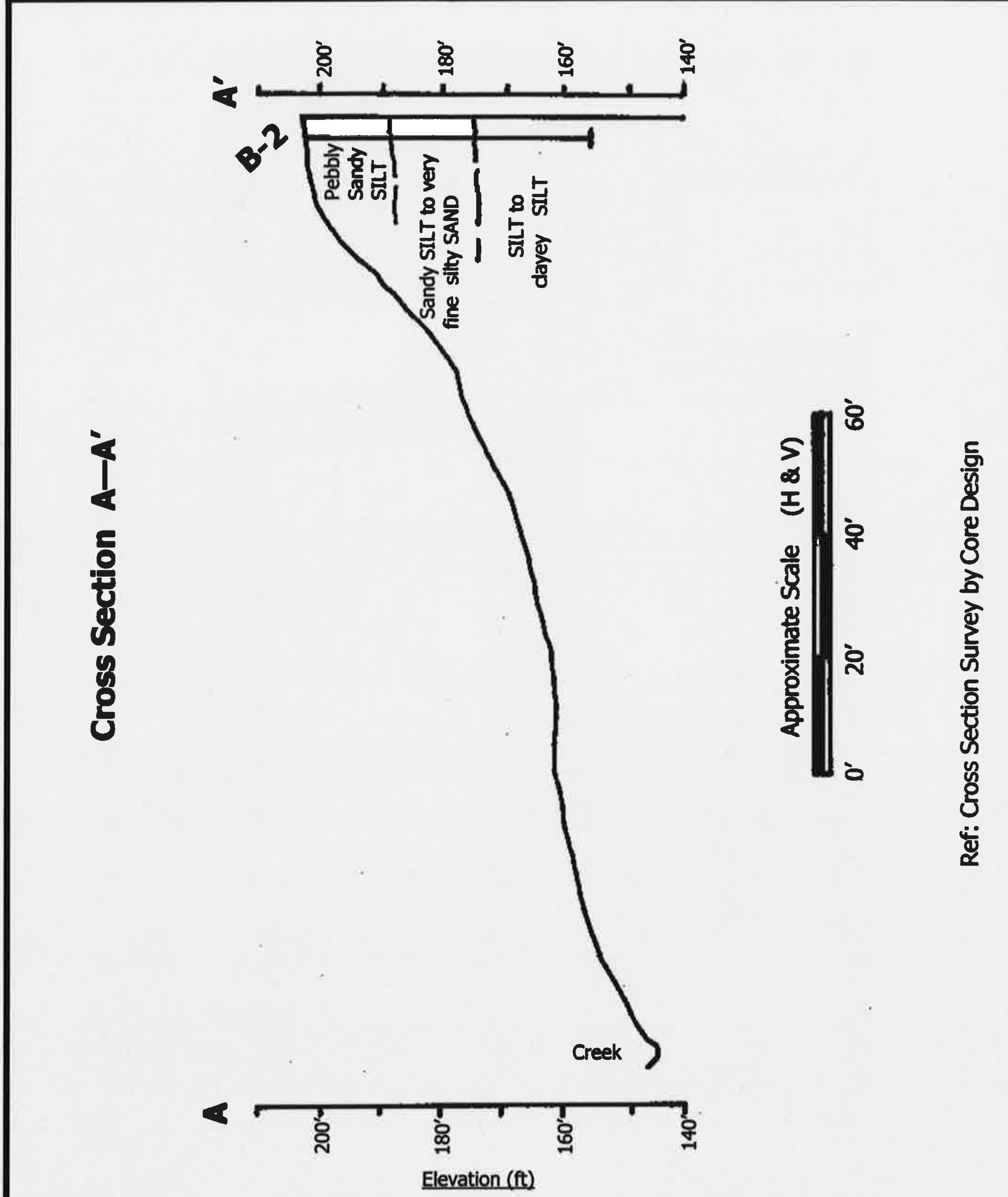
re Design, Inc. dated November 2010

'B Consulting
echnical Consultants
Kirkland, Wash.

ration Location Plan
Strom Property
mond, Washington

Date : Feb. 2011	Figure 2

ATTACHMENT 14



ABPB Consulting Geotechnical Consultants Kirkland, Wash.	Cross Section A - A' Strom Property Redmond, Washington

Proj. No. 1306	Date: 1– 11	Figure 3

ATTACHMENT 14

Test Pit TP - 1

Project :	**Strom Property**		
Project No.	1306	**Date :**	12-16-10
Client :	Burnstead	**Elevation**	210 feet
Location:	Redmond	**Logged By:**	PKB

Depth (ft)	SUBSURFACE PROFILE: Soil Description	SAMPLE: Water Level	SAMPLE: Sample	SAMPLE: USCS	Field Strength Tests	Laboratory Results: Moisture Content
0 to -2	Fill: Mixed old Topsoil and silty Sand FILL, loose, damp to wet			SM		
-2 to -4	Silty Sand: Red tan to tan, very silty fine Sand with gravels and roots, loose to medium dense, wet to saturated	▼ (at ~2 ft)		SM		
-4 to -10	Silty Sand: Tan to grey tan, very silty fine Sand to sandy Silt, with occasional pebbles, (Till-like), wet to damp, medium dense grading to very dense and cemented Heavy perched seepage at 2 to 3 feet			SM ML		

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Date : Jan. 2011	Project Name : Strom Property	Figure 4

ATTACHMENT 14

Test Pit TP - 2

Project :	**Strom Property**		
Project No.	1306	**Date :**	12-16-10
Client :	Burnstead	**Elevation**	212 feet
Location:	Redmond	**Logged By:**	PKB

SUBSURFACE PROFILE			SAMPLE			Field Strength Tests	Laboratory Results
Depth (ft)	Soil Lithology	Soil Description	Water Level	Sample	USCS		Moisture Content
0 to -2		Fill: Tan, silty gravelly Sand, Pit Run Fill, loose, wet			SM		
-2 to -4		Silty Sand: Red tan to tan, very silty fine Sand with gravels and roots, loose to medium dense, wet to saturated	▼ (-3)		SM		
-4 to -8		Sandy Silt: Tan to grey tan, sandy Silt, with clay and occasional pebbles, some fine Silty Sand (Till-like), wet to damp, medium dense grading to very dense and cemented Heavy perched seepage at 3 to 4 feet			SM ML		

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Date : Jan. 2011	Project Name : Strom Property	Figure 5

Project :	**Strom Property**		
Project No.	1306	**Date :**	12-16-10
Client :	Burnstead	**Elevation**	205 feet
Location:	Redmond	**Logged By:**	PKB

ATTACHMENT 14

Test Pit TP - 3

SUBSURFACE PROFILE			SAMPLE			Field Strength Tests	Laboratory Results
Depth (ft)	Soil Lithology	Soil Description	Water Level	Sample	USCS		Moisture Content
0 to -2		Silty Sand: (12 Surface Sod and Roots) Red tan, very silty fine Sand with gravel and roots, loose, wet to very wet	▼ (at -2)		SM		
-2 to -8		Silt: Tan grading to tan grey, Sandy SILT with pebbles (Till-like) grading to SILT and clayey SILT with depth, medium dense grading to hard, massive and non-bedded, moist to damp Heavy perched seepage at 2.5 feet			ML		

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Date : Jan. 2011	Project Name : Strom Property	Figure 6

Project :	**Strom Property**		
Project No.	1306	**Date :**	12-16-10
Client :	Burnstead	**Elevation**	205 feet
Location:	Redmond	**Logged By:**	PKB

ATTACHMENT 14

Test Pit TP - 4

Depth (ft)	Soil Lithology	Soil Description	Water Level	Sample	USCS	Field Strength Tests	Laboratory Results: Moisture Content
0 to -3		Sandy Silt: (12 Surface Sod and Roots) Red tan, Sandy SILT with gravel and roots, loose, wet to very wet	▼ (-3)		SM		
-3 to -6		Sandy Silt: Tan grading to tan grey, Sandy SILT with pebbles with Till-like lenses, medium dense grading to dense, massive and non-bedded, moist to damp			ML		
-6 to -9		Silty Sand: Tan grey, very silty fine SAND, with gravels, damp to wet, dense to very dense, (Till-like) Heavy perched seepage at 3 feet			SM		

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Project :	Strom Property		
Project No.	1306	Date :	12-16-10
Client :	Burnstead	Elevation	200 feet
Location:	Redmond	Logged By:	PKB

ATTACHMENT 14

Test Pit TP - 5

SUBSURFACE PROFILE			SAMPLE			Field Strength Tests	Laboratory Results
Depth (ft)	Soil Lithology	Soil Description	Water Level	Sample	USCS		Moisture Content
0 to -2		Sandy Silt: (12 Surface Sod and Roots) Red tan, Sandy SILT with gravel and roots, loose, wet			ML		
-2 to -8		Sandy Silt: Tan grading to tan grey, Sandy SILT with pebbles and Till-like lenses, grading to SILT, massive and non-bedded, hard, moist to damp No perched seepage			ML		

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Date : Jan. 2011	Project Name : Strom Property	Figure 8

Project :	**Strom Property**		
Project No.	1306	**Date :**	12-16-10
Client :	Burnstead	**Elevation**	193 feet
Location:	Redmond	**Logged By:**	PKB

ATTACHMENT 14

Test Pit TP - 6

SUBSURFACE PROFILE			SAMPLE			Field Strength Tests	Laboratory Results
Depth (ft)	Soil Lithology	Soil Description	Water Level	Sample	USCS		Moisture Content
0 to -2		Sandy Silt: (12 Surface Sod and Roots) Red tan, Sandy SILT with gravel and roots, loose, wet			ML		
-2 to -9		Sandy Silt: Tan grading to tan grey, Sandy SILT with pebbles and Till-like lenses, grading to SILT, massive and non-bedded, hard, moist to damp No perched seepage	▼ (approx. -2.4)		ML		

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Date : Jan. 2011	Project Name : Strom Property	Figure 9

Project :	**Strom Property**			ATTACHMENT 14
Project No.	1306	**Date :**	12-16-10	**Test Pit TP - 7**
Client :	Burnstead	**Elevation**	192 feet	
Location:	Redmond	**Logged By:**	PKB	

SUBSURFACE PROFILE			SAMPLE				Laboratory Results
Depth (ft)	Soil Lithology	Soil Description	Water Level	Sample	USCS	Field Strength Tests	Moisture Content
0 to -2.3		Sandy Silt: (12 Surface Sod and Roots) Red tan, Sandy SILT with gravel and roots, loose, wet			ML		
-2.3 to -4		Sandy Silt: Tan grading to tan grey, Sandy SILT with pebbles, loose to medium dense, non-cemented, moist to damp			ML		
-4 to -8.5		Sandy Silt: Tan grey, cemented, lenses of pebbly sandy SILT (till-like) and sandy clayey SILT, hard, moist, massive and non-bedded No perched seepage			ML		

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Date : Jan. 2011	Project Name : Strom Property	Figure 10

Project :	Strom Property		
Project No.	1306	Date :	1-5-11
Client :	Burnstead	Elevation	191 feet
Location:	Tract A Area	Logged By:	Paul Bonifaci

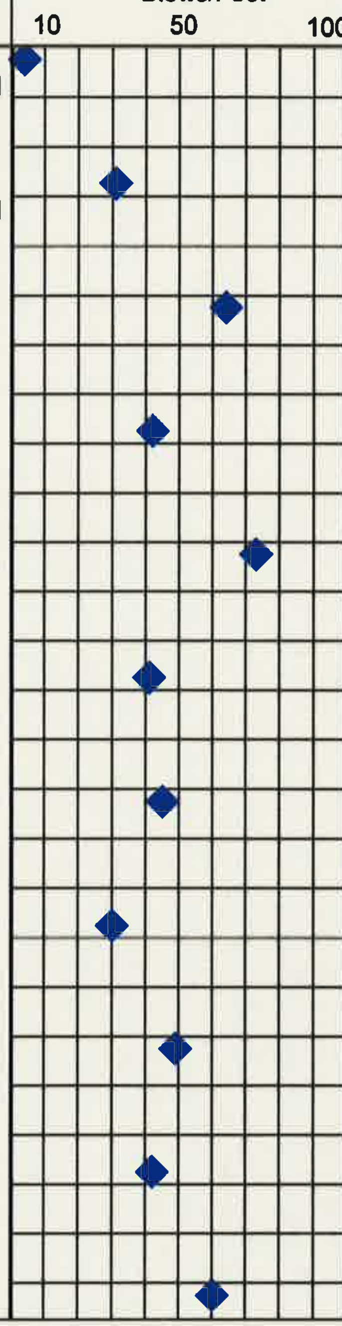
ATTACHMENT 14

Boring No. B-1

Depth (ft)	Soil Description	USCS	Moisture Content
0 to -6	Silty Sand: (12inches of Sod and topsoil at surface) Mottled to red tan, silty Sand with some roots and gravel, loose to medium dense, moist to wet	SM	17.9%
-6 to -14	Silty Sand: Tan grey, sandy SILT with pebbles to very silty pebbly SAND, medium dense grading to very dense, moist to damp (Till-like lenses)	SM ML	16.7%, 14.9%
-14 to -39	Sandy Silt: Tan to mottled tan grey, layers of very silty fine Sand and sandy SILT, moist to damp, massive to slightly bedded, non-plastic, grades to damp to wet below 30 feet	ML	23.1%, 20.0%, 23.1%, 23.5%, 26.9%
-39 to -51	Silt: Blue grey, SILT to clayey SILT, horizontal to sub-horizontal partings, non-plastic to slight plasticity, hard, moist No free seepage noted at time of drilling	ML	22.6%, 24.3%, 26.7%

△ Standard Penetration Resistance (SPT)

Blows/Foot



Laboratory Results — Moisture Content

Depth (ft)	Moisture Content
-1	17.9%
-6	16.7%
-11	14.9%
-16	23.1%
-21	20.0%
-26	23.1%
-31	23.5%
-36	26.9%
-41	22.6%
-46	24.3%
-51	26.7%

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Date : Jan. 2011	Project: Strom Property	Figure 11

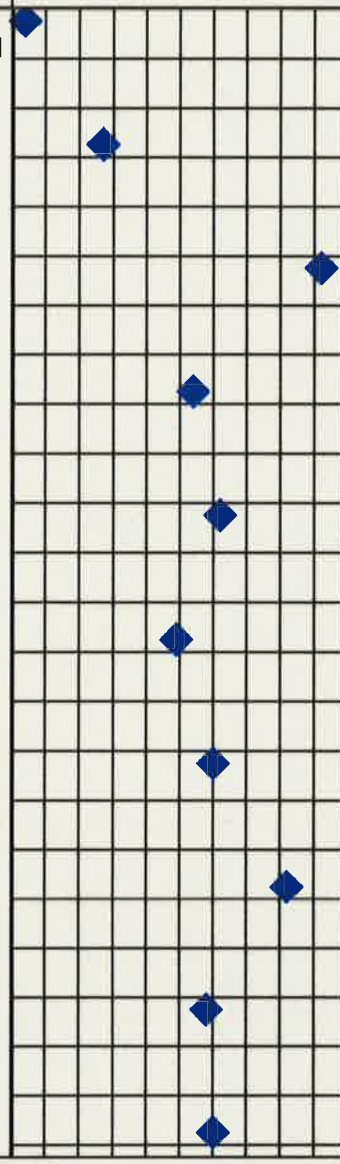
Project :	**Strom Property**		
Project No.	1306	**Date :**	1-5-11
Client :	Burnstead	**Elevation**	202 feet
Location:	Lot 8 Area	**Logged By:**	Paul Bonifaci

ATTACHMENT 14

Boring No. B-2

Depth (ft)	Soil Description (SUBSURFACE PROFILE)	USCS (SAMPLE)	Laboratory Results: Moisture Content
0 to -4	Silty Sand: (12inches of Sod and topsoil at surface) Mottled to red tan, silty Sand with some roots and gravel, loose to medium dense, moist to wet	SM	17.9%
-4 to -14	Sandy Silt: Tan grey, sandy SILT with pebbles, with SILT layers, medium dense grading to very dense, moist to damp (Till-like lenses)	ML	22.6%, 11.6%
-14 to -28	Sandy Silt: Tan to mottled tan grey, layers of very silty fine Sand and sandy SILT, moist to damp, massive to slightly bedded, non-plastic, horizontal to sub-horizontal partings, grades to damp to wet below 23 feet	ML	20.3%, 20.7%, 26.3%
-28 to -46	Silt: Blue grey, interbedded sandy SILT to clayey SILT, horizontal to sub-horizontal 5 degree dips, some non-bedded layers, non-plastic to slight plasticity, hard to very dense, moist to damp No free seepage noted at time of drilling	ML	25.0%, 23.8%, 23.8%, 25.%

△ Standard Penetration Resistance (SPT)



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Date : Jan. 2011	Project: Strom Property	Figure 12