Note:
Some pages in this document have been purposely skipped or blank pages inserted so that this document will copy correctly when duplexed.
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1. INTRODUCTION

The City of Redmond (the City) is engaged in planning for the redevelopment of the Overlake Village South Subarea (subarea). Zoning regulations and goals for the subarea are designed to reward urban density, innovation and sustainability. Redevelopment within the subarea will consist of subdividing large parcels, enhancing the street network, building a shared used pedestrian and bicycle path, raising building height limits, and incorporating low impact development (LID) stormwater development strategies.

In preparation for the redevelopment of the subarea, the City has contracted HDR and Herrera Environmental Consultants (Herrera) to assist in two key objectives:

- Define requirements and options for integrating LID best management practices (BMPs) into the right-of-way.
- Develop a toolkit of LID solutions for developers to use on private parcels.

Herrera’s key roles consisted of background research on the subarea as it pertains to stormwater, development of opportunities and constraints maps for stormwater infrastructure planning, initial selection and modeling of stormwater BMPs, Integration of LID BMPs into the proposed street sections for the subarea, providing input on the City’s current bioretention standard details, developing a toolkit of BMPs for stormwater infrastructure on private parcels, and development of supporting material for public outreach and engagement.
2. BACKGROUND RESEARCH

Background research and a literature review was conducted by Herrera to identify key opportunities and constraints for stormwater management in the subarea. Information from the following sources was reviewed:

- City of Redmond website
- City of Redmond GIS Database
- King County Interactive Mapping Tool
- Washington Geological Survey – Subsurface Geology Information System
- Groundwater Well Logs
- Overlake Planning Documents received from the City of Redmond

Details from the above are discussed in this section of the report.

2.1. PROJECT LOCATION

The subarea is approximately 100 acres in size (approximately 2,000 feet by 1,600 feet) located in the southwest part of the city (see Figure 1). The subarea is bounded by 148th Avenue NE to the west, Bel-Red Road to the south and east, and NE 24th Street to the north.

2.2. SOILS AND INFILTRATION RATE

The subarea has variable soils conditions and infiltration rates. The Redmond-Overlake Basin Geological Mapping Project (Troost 2010) provides extensive discussion on soil mapping efforts carried out within the subarea and immediate vicinity. In general, the subarea consists of soils that include large areas of weathered and unweathered glacial till and recessional outwash deposits (Otak 2010).

Glacial till in its unweathered condition is very dense and relatively impermeable when considering stormwater infiltration. Infiltration rates into unweathered glacial till are generally less than 0.10 inches per hour (Otak 2010). Weathered glacial till is also dense and relatively impermeable when considering stormwater infiltration; however, it is slightly more permeable than the unweathered till. Infiltration rates into weathered glacial till may range from 0.20 to 0.50 inches per hour.
Figure 1.
OVERLAKE VILLAGE SOUTH SUBAREA.

Approximate scale in feet
Recessional outwash deposits consist of sand and gravel with areas of silty sand and silt. The sandy outwash deposits should be relatively permeable with infiltration rates of about 2 inches per hour. Infiltration rates into silty outwash deposits will be much lower (Troost 2010).

2.3. **GROUNDWATER**

Approximately one-third of the city’s drinking water supply comes from a shallow groundwater aquifer located with the city limits. Designing stormwater infrastructure that accounts for groundwater conditions is instrumental in developing the subarea. A summary of groundwater depth, protection and contamination is provided in the subsequent sections.

2.3.1. **Groundwater Depth**

The Washington Department of Natural Resources Subsurface Geology Information System (DNR 2015) was accessed to obtain previously conducted subsurface exploration documents. Of the eight documents available for the subarea, two reports were the most comprehensive for the subarea, and therefore included in Appendix A. An additional investigation was obtained from the Overlake Village Stormwater and Park Facilities Conceptual Design (Otak 2000).

Based on six borings that encountered groundwater in three separate geotechnical investigations and reports, groundwater is typically found at a depth of 13 to 20 feet below surface grade within the subarea. A summary of each document is provided as follows:

- An investigation conducted in 2010 in the parking lot of Overlake Fashion Plaza. Groundwater was observed in this boring at a depth of 18.2 feet below existing ground surface (Otak 2012). Existing finished grade at time of boring is estimated at 301 feet above mean sea-level (amsl).

- An investigation conducted in October of 1992 in the southeast portion of the subarea. Five test boring were drilled, ranging in depth from 6 feet to 15 feet below grade. Groundwater seepage was encountered at 14 feet below existing ground surface (Appendix A). Existing surface grade elevation is at approximately 295 feet amsl, resulting in a groundwater elevation of approximately 281 feet.

- An investigation conducted in August of 1984 in the general vicinity of the area currently occupied by Marshalls and Sears, adjacent to the northeast of the intersection of 148th Avenue NE and NE 20th Street. Ten test borings were drilled, ranging in depth from 13 to 21 feet below grade. No groundwater was encountered in six of the borings. In four of the borings, groundwater was encountered at a depth 13, 17, and, on two occasions, 20 feet below existing ground surface (Appendix B). Existing surface grade elevation at time of boring is at estimated at 300 feet amsl, resulting in a groundwater elevation of approximately 287 to 280 feet amsl.
Groundwater depth typically fluctuates seasonally with higher groundwater elevations in the rainy season (October through May) and lower groundwater elevations in the dry season (June through September).

Additional sources of groundwater data that were researched as part of this report:

- Per the Natural Resources Conversation Service report (NRCS 2015), depth to groundwater is listed as 0 to 37 inches for the four soil types in the study area. This appeared to be inconsistent with field-verifiable geotechnical findings; therefore, these data were not used in this analysis.

- A “depth to groundwater” GIS shape file was received from the City. The limits of data in this file are outside of the subarea limits.

- Per King County Water and Land Services, a groundwater well (Well ID R_473747122080601, owner unknown) is located in the east part of the subarea, north of NE 21st Street and immediately west of Bel-Red Road. The well extends to a depth of 65 feet, but no water level or water quality data are available from it.

2.3.2. Groundwater Protection

The City has designated four zones for wellhead protection: 1, 2, 3, and 4. The subarea falls entirely within wellhead protection zone 4. Per the City of Redmond Clearing, Grading, and Stormwater Management Technical Notebook (Redmond 2012), runoff from pollution generating impervious surfaces can be infiltrated without treatment provided the soil profile provides treatment per Chapter 3.3 of Volume III of the 2005 Ecology Manual. Infiltration of runoff from non-pollution generating impervious areas considered to be clean, including most roofs and sidewalks, is strongly encouraged where feasible.

2.3.3. Groundwater Contamination

No reference to groundwater contamination was discovered during the literature review.

2.4. Environmentally Critical Areas

Per King County iMap (King County 2015), no seismic hazards, landslide hazards, wetlands, or critical aquifer recharge areas are identified in the subarea. The subarea is outside of the FEMA 100-year and 500-year floodplain and is not listed as susceptible to groundwater contamination. Per the Washington Department of Ecology Water Quality Assessment for Washington map (DOE 2015), no water bodies within or immediately adjacent to the subarea area classified as impaired. The tributary area of the subarea, Kelsey Creek, is designated as a Chinook distribution stream.
2.5. **Drainage Complaints**

No drainage complaints from the City or area landowners were obtained as part of our investigation.

2.6. **Regional Infiltration Facility**

In 2011, the City adopted an implementation plan for stormwater and park facilities within the Overlake neighborhood. The plan consists of constructing regional infiltration facilities, regional detention facilities, conducting LID retrofits, and an urban pathway with LID facilities. This plan focused on the commercial and employment areas of the neighborhood that are zoned for the highest density of development. The proposed stormwater facilities and some new streets were further defined by the Overlake Village Street Design Guidelines, (Redmond 211).

The Overlake Village South Detention Vault (rendering below), the first large stormwater facility in the plan, was completed in 2015. This regional detention facility, located within the subarea, detains stormwater that has been treated locally within public rights-of-way and private development areas. Once surrounding property develops in the future, park facilities will be constructed on top of the stormwater vault. In the meantime, parking use will continue by the owner of the property.

![Rendering of the Overlake Village South Detention Vault.](image)

**Above: Rendering of the Overlake Village South Detention Vault.**
3. STORMWATER ANALYSIS AND DESIGN

3.1. OPPORTUNITIES AND CONSTRAINTS

Results from the background research and a literature review were incorporated into opportunity and constraints maps (see Appendix B), to be used as guidance in determining where future stormwater facilities can potentially be located. The maps were developed based on findings from Section 2 of this report.

Key research elements incorporated into the opportunity and constraints maps consist of existing soil conditions, anticipated infiltration rates, depth to groundwater, and location of existing and proposed infrastructure.

3.2. STORMWATER MODELING APPROACH AND INPUTS

Stormwater modeling was performed based on requirements set forth in the Department of Ecology Stormwater Management Manual for Western Washington (Ecology 2014) and the Technical Manual (Redmond 2012). MGS Flood version 4.38, a Department of Ecology approved continuous model, was used for the preliminary sizing of stormwater facilities. A summary of MGS Flood inputs are detailed in Table 1.

<table>
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<th>Table 1. MGS Flood Project Location Design Inputs.</th>
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<td>Climatic Region</td>
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<tr>
<td>Computational Timestep</td>
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<tr>
<td>Pre-Developed Conditions</td>
</tr>
</tbody>
</table>

3.3. BIORETENTION DESIGN

Per correspondence with the City, preferred layout options and preferences for bioretention were discussed. To fit into the proposed urban character of the subarea, a vertical wall bioretention configuration was chosen. A typical section of this configuration is shown in Figure 2. A summary bioretention modeling configuration is detailed in Table 2.
**Table 2. Bioretention Typical Configuration.**

<table>
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<tr>
<th>Parameter</th>
<th>Specification</th>
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</thead>
<tbody>
<tr>
<td>Soil Media Thickness</td>
<td>18 Inches</td>
</tr>
<tr>
<td>Soil Porosity</td>
<td>35 to 40%</td>
</tr>
<tr>
<td>Storage Depth</td>
<td>12 Inches</td>
</tr>
<tr>
<td>Bioretention Soil Infiltration Rate</td>
<td>3 Inches/ Hour&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Native Soil Infiltration Rate</td>
<td>Varies, depending on native soils</td>
</tr>
<tr>
<td>Cell Sideslope/Walls</td>
<td>Vertical (0:1)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Selected based on Ecology recommended rate of 12 inches per hour and with a Factor of Safety of 4 applied.

---

**Figure 2. Typical Bioretention Section.**

### 3.4. Bioretention Modeling and Results

Initial modeling efforts were conducted for the subarea to provide a basis of discussion with City staff. Based on these results, additional scenarios were run to develop guidelines for determining required bioretention areas based on a recommended configuration and native soil infiltration rates.
3.4.1. Preliminary Modeling Results

Initial modeling efforts consisted of running sixty modeling scenarios for the subarea, summarized in the sizing graph in Appendix C. The only variable between the scenarios was varying the native soil infiltration rate. Based off the literature review of previous geotechnical investigations, 0.25 to 1.00 inches per hour is a reasonable estimate for the long-term infiltration rate within the subarea. Three native soil infiltration rates were chosen in this range: 0.25, 0.75, and 1.00 inches per hour, and twenty scenarios per modeled for each.

In each scenario, a 40,000-square-foot block subbasin was selected and routed equally to six separate bioretention cells. Each cell was 5 feet wide, with a length ranging from 10 feet up through 200 feet. The total percentage of the subbasin dedicated to bioretention was incrementally increased from 0.75 percent up to 15 percent as the bioretention cells were increased in length.

As shown on the graph, the total percentage of stormwater that is infiltrated in the subbasin increases as the total percentage of bioretention in the subbasin increases. The greatest benefit is achieved early on, as with each increase in bioretention length, there is a diminishing gain in the quantity of stormwater being infiltrated.

Shading is shown in each figure to delineate what flow control performance standard is met. As the bioretention percentage in the subbasin increases, first 50 percent of the 2-year storm event is met, then 50 percent of the 2-year through the 2-year event, and ultimately the 2-year event through the 50-year event. Per the models output, there is a lag in which 100 percent of the modeled runoff is infiltrated and all three performance standards are met (50 percent of the 2-year through the 50-year).

The point where all three duration standards are met are shown on each figure as, after this point, increasing the size of bioretention does not provide any additional performance benefit as 100 percent of the stormwater is being infiltrated and all three performance standards are met.

3.4.2. Final Modeling Results

After preliminary modeling results were reviewed with the City, final modeling was completed to provide sizing guidelines for bioretention within the right-of-way. Bioretention sizing for private parcels is discussed separately in Section 3.7.

The following conclusions were drawn from final modeling:

- Based on guidance from the City, stormwater from major public and private streets should be infiltrated using bioretention systems in areas with outwash soils. Furthermore, these systems should be sized to treat and infiltrate the entire water quality storm. To achieve this goal, the modeling indicates at least 2.5 percent of bioretention area is
needed for every unit of land area infiltrated assuming a native infiltration rate of 1 inch per hour.

• In areas with till soils, the modeling showed bioretention systems would be impractical due to space limitations; therefore, Filterra systems were proposed instead based on guidance from the City. Because they do not infiltrate water in their standard configuration, the Filterra systems would need to be installed in combination with a shallow infiltration facility below the sidewalk to achieve the goal of infiltrating the entire water quality storm.

• Bioretention Configuration: Soil porosity was increased from 35 percent to 40 percent.

3.5. **Assessment of Bioretention Details**

As part of developing stormwater design recommendations for the subarea, a review of existing City-approved standard plans was conducted. The following 2014 standard plans were reviewed:

1. Standard Plan 655 – Bioretention Facility
4. Standard Plan 661 – Bioretention Check Dam
5. Standard Plan 663 – Bioretention In-line Curb Cut
7. Standard Plan 667 – Bioretention Outlet Structure
8. Standard Plan 669 – Bioretention Clean-Out

Comments on these standard plans are included in Appendix D.

3.6. **Bioretention Costs**

At a planning level, we estimate bioretention to cost $100 per square foot in the public right of way and $50 per square foot on private parcels. This costs includes all design, materials and constructions costs, but excludes land acquisitions (private parcels only) or permitting. The higher costs in the public right of way are typically caused by utility conflicts and traffic control for construction.
3.7. **Developer Toolbox**

The developer toolbox is a set of stormwater best management practices that can be utilized on private parcel development in the Overlake South Subarea. The toolbox was developed based on research findings, planning-level modeling work and discussions with the City. The best management practices can be used in any combination to meet applicable Washington State and City of Redmond codes governing use of stormwater solutions.

Best management practices in the toolbox consist of the following:

1. Bioretention
2. Green Roof
3. Roof Infiltration to Drywell
4. On-Site Detention
5. Urban Pathway

Sizing information for each BMP is included in the toolkit. A sizing factor of 5 percent of parcel area being devoted to bioretention was based on guidance received from the City.

The developer toolbox is included in Appendix E.

3.8. **Storm Drainage Improvements**

The subarea has an underground storm drainage pipe network designed around the current parcel and roadway layout. As the subarea is redeveloped, we anticipate that most of this network will be demolished and a new storm drainage system will be installed around the reconfigured roadway and parcel layout.

As a safety mechanism in the event of overflow, clogging, or failure, all bioretention cells will need to be connected to the new storm drainage network. The outfall for this network is to be determined, but is anticipated to be either a regional infiltration facility or pipe conveyed out of the subarea.

3.9. **Permeable Pavement**

Permeable pavement is a method of paving that is able to support traffic loads with a durable surface while allowing stormwater to seep into the ground as it falls. This dispersed infiltration approach addresses water quality through filtration and adsorption of pollutants in the pavement matrix and in the soils below the facility and addresses water quantity through
storage in the pavement base and infiltration into the soils below the facility. Per City guidance, permeable pavement is not being considered in the public right of way at this point.

3.10. **PUBLIC OPEN HOUSE**

Preliminary findings and design options from the stormwater analysis effort were presented at a public open house for the subarea on December 17, 2015. The presentation board used at the open house is included in Appendix F.
4. LIMITATIONS

The summary of findings in this report are intended for planning-level decision making. Every best effort was taken in presenting an accurate overview of subarea conditions.
5. REFERENCES


APPENDIX A

Geotechnical Investigations
GEOTECHNICAL ENGINEERING STUDY
PROPOSED TACO BELL RESTAURANT #06
BELLEVUE, WASHINGTON

E-5980

November 17, 1992
PREPARED FOR
TACO BELL, CORP.

Kyle R. Campbell, P. E.
Manager of Geotechnical Services

Donald J. Bruno
Staff Geologist

GEOTECHNICAL ENGINEERING STUDY
PROPOSED TACO BELL RESTAURANT #06-611
BELLEVUE, WASHINGTON

E-5980

November 17, 1992

Earth Consultants, Inc.
1805 - 136th Place Northeast, Suite 101
Bellevue, Washington 98005
(206) 643-3780

222 East 26th Street, Suite 103
Tacoma, Washington 98411-9998
(206) 272-6608
SITE CONDITIONS

Surface

The site of the proposed facility is located southeast of the intersection of 148th Avenue Northeast and Northeast 20th Street in Bellevue, Washington. (see Plate 1, Vicinity Map). The near rectangular shaped parcel encompasses about seven-tenths of an acre and is bounded by Northeast 20th Street to the north, a one level restaurant to the south, a Bellevue Fire Station to the east, and 148th Avenue Northeast to the west. The property is relatively level and is presently occupied by a vacated petroleum service station, located at the central east side of the site. The remaining areas of the site are covered with asphalt pavement and three concrete pump islands, located at the northern half of the site. Extensive cracking of the asphalt pavements was observed during the time of our field exploration. As of the date of this report, it is our understanding that the on-site underground petroleum tanks have not been removed.

Subsurface

The site was explored by drilling five test borings at the approximate locations shown on Plate 2. Refer to the test boring logs, Plates A2 to A6, for a detailed description of the conditions encountered at each location explored. A description of the field exploration methods is included in Appendix A. Below is a generalized description of the subsurface conditions encountered.

During our site study, we encountered three inches of asphalt underlain by three inches of base course material composed of a silty sand with gravel (Unified Classification SM). Underlying the upper pavement section, two to six feet of fill soils, composed predominantly of soft to stiff lean clay and soft elastic silt, (CL and MH) were encountered. Beneath the fill soils, medium stiff to very stiff native lean clay (CL) was encountered to a depth of approximately nine feet below the existing ground surface. Underlying the native clay layer, a dense to very dense sand with silt (SP-SM) was encountered to the maximum exploration depth of fifteen (15) feet below the existing ground surface.

Groundwater

Groundwater seepage was encountered at fourteen (14) feet below the existing ground surface. It is important to note that groundwater seepage levels and volumes are not constant; thus, one may expect fluctuations in the level and volume depending on the season, amount of rainfall, surface water runoff, and other factors. Generally, the groundwater seepage flow is greater during the wetter winter months (typically October through May).
N.E. 20th STREET (NORTHUP WAY)

148th AVENUE N.E.

LEGEND

B-1  • Approximate Location of ECI Boring, Proj. No. E-5980, Oct. 1992

• Proposed Building

Existing Building

Reference:
Site Sketch
By Brown Connally Rowan Arch.
Dated 8/6/92

Boring Location Plan
Proposed Taco Bell #06-0611
Bellevue, Washington
# Boring Log

**Project Name:** Proposed Taco Bell #06-0611  
**Job No.:** E-5980  
**Logged by:** Don Bruno  
**Start Date:** 10-21-92  
**Completion Date:** 10-21-92  
**Boring No.:** B-1

**Drilling Contractor:** Associated Drilling  
**Drilling Method:** HSA  
**Sampling Method:** SPT

**Ground Surface Elevation:**  
**Hole Completion:**
- [ ] Monitoring Well
- [ ] Piezometer
- [ ] Abandoned, sealed with bentonite

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<th>Depth ft. Sample</th>
<th>USCS Symbol</th>
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<td>2</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>cl</td>
<td>FILL: Gray lean CLAY, stiff, moist to wet</td>
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<td>15</td>
<td></td>
<td>4</td>
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<td></td>
<td></td>
<td>5</td>
<td>cl</td>
<td>Gray mottled brown lean CLAY, trace sand, stiff, moist to wet</td>
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</tr>
<tr>
<td>9</td>
<td>32</td>
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<td>7</td>
<td>sm/ sp</td>
<td>Gray fine to medium SAND with silt, dense to very dense, moist</td>
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<td>8</td>
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<td>15</td>
<td></td>
<td>Boring terminated at 15.0 feet below existing grade. Groundwater seepage encountered at 14.0 feet during drilling. Boring backfilled with cuttings and bentonite, concrete plug.</td>
</tr>
</tbody>
</table>

---

**Earth Consultants Inc.**  
**Geotechnical Engineers, Geologists & Environmental Scientists**

**Boring Log**  
PROPOSED TACO BELL #06-0611  
BELLEVUE, WASHINGTON

**Proj. No. 5980**  
**Dwn. GLS**  
**Date Nov'92**  
**Checked DB**  
**Date 11-4-92**  
**Plate A2**

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

**Project Name:** Proposed Taco Bell #06-0611  
**Job No.:** E-5980  
**Logged by:** Don Bruno  
**Start Date:** 10-21-92  
**Completion Date:** 10-21-92  
**Boring No.:** B-2

**Drilling Contractor:** Associated Drilling  
**Drilling Method:** HSA  
**Sampling Method:** SPT  
**Ground Surface Elevation:**  
- Hole Completion:  
  - [ ] Monitoring Well  
  - [ ] Piezometer  
  - [ ] Abandoned, sealed with bentonite

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<th>No. Blows</th>
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<th>Depth Ft.</th>
<th>Sample</th>
<th>USCS Symbol</th>
<th>Surface Conditions</th>
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<td>35</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>cl</td>
<td></td>
<td>Gray lean CLAY, medium stiff, wet to saturated -with fine sand, grades to very stiff</td>
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<td>14</td>
<td>22</td>
<td>8</td>
<td>9</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>mh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FILL: Dark brown elastic SILT, soft, saturated, trace organic rootlets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-grades to gray</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>cl</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Gray lean CLAY, medium stiff, moist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>-medium stiff to stiff, trace sand and gravel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Boring terminated at 9.0 feet below existing grade. No groundwater encountered during drilling. Boring backfilled with cuttings and bentonite, concrete plug.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Project Name: Proposed Taco Bell #06-0611

Job No.: E-5980  Logged by: Don Bruno  Start Date: 10-28-92  Completion Date: 10-28-92  Boring No.: B-4

Drilling Contractor: Associated Drilling  Drilling Method: HSA

Ground Surface Elevation:  Hole Completion:

<table>
<thead>
<tr>
<th>W (%)</th>
<th>No. Blows</th>
<th>Graphic Symbol</th>
<th>Depth Ft</th>
<th>Sample</th>
<th>USCS Symbol</th>
<th>Surface Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>5</td>
<td></td>
<td>1</td>
<td>cl</td>
<td></td>
<td>FILL: Gray and brown lean CLAY, soft, wet</td>
</tr>
<tr>
<td>39</td>
<td>4</td>
<td></td>
<td>5</td>
<td>mh</td>
<td></td>
<td>FILL: Gray and brown clayey SILT, soft, wet to saturated -grades to gray</td>
</tr>
</tbody>
</table>

Boring terminated at 6.0 feet below existing grade. No groundwater encountered during drilling. Boring backfilled with cuttings and bentonite, concrete plug.
**Boring Log**

**Project Name:** Proposed Taco Bell #06-0611

<table>
<thead>
<tr>
<th>Job No.</th>
<th>Logged by</th>
<th>Start Date</th>
<th>Completion Date</th>
<th>Boring No.</th>
</tr>
</thead>
</table>

**Drilling Contractor:**
Associated Drilling

**Drilling Method:**
HSA

**Sampling Method:**
SPT

**Ground Surface Elevation:**

<table>
<thead>
<tr>
<th>W (%)</th>
<th>No. Blows</th>
<th>Depth Fl.</th>
<th>Surface Conditions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td></td>
<td></td>
<td>3&quot; asphalt, 4&quot; base course</td>
</tr>
<tr>
<td></td>
<td>mh</td>
<td></td>
<td>FILL: Brown elastic SILT, soft, wet, trace organics</td>
</tr>
<tr>
<td>33</td>
<td>8</td>
<td></td>
<td>cl</td>
</tr>
<tr>
<td>23</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>62</td>
<td></td>
<td>sm-sp</td>
</tr>
</tbody>
</table>

Boring terminated at 8.5 feet below existing grade. No groundwater encountered during drilling. Boring backfilled with cuttings and bentonite, concrete plug.
A Report Prepared for

G & D Centers, Inc.
18425 Burbank Boulevard, Suite 414
Tarzana, California 91356

REPORT
GEOTECHNICAL INVESTIGATION
OVERLAKE PLAZA
REDMOND, WASHINGTON

AGI Report No. 14,860.001/B

by

Glen Mann, P.E.
Principal Engineer

APPLIED GEOTECHNOLOGY INC.
300 120th Avenue NE, Building 4, Suite 215
Post Office Box 3885
Bellevue, Washington 98009
206/453-8383

September 17, 1984

RECEIVED
OCT 13 1985
RUSH, ROED & HITCHINGS INC.
I. INTRODUCTION

A. General

This report presents the results of our geotechnical investigation for design and construction of your proposed series of one-story retail buildings at Overlake Plaza in Redmond, Washington, located approximately as shown on Figure 1, Site Plan. Our scope of services was developed through conversations with Mr. Joseph Kurily, your structural engineer, and from the Soils Investigation Checklist he provided on July 13, 1984. It was submitted for your review and approval on July 18, 1984, and we received your written authorization to proceed on July 31, 1984.

B. Project Description

We understand that you propose to construct a series of one-story buildings with plan areas ranging from approximately 2,500 to 35,000 square feet. The buildings are to consist of masonry walls with wood framed or possibly light steel roof systems and concrete slab-on-grade floors at, or close to, existing site grades. Wall and column loads are estimated to be on the order of less than 2 kips per linear foot or 100 kips, respectively, for all dead and live loads. Floor loads are not expected to exceed 150 pounds per square foot.

No deep excavations or significant construction fills, buried basement walls, retaining walls, or rockeries are contemplated.

Paved access roads and parking areas around the completed new construction will be provided.
LEGEND

10 • BORING NUMBER AND APPROXIMATE LOCATION

F PROPOSED BUILDING LOCATION AND DESIGNATION

EXISTING BUILDING LOCATION

REFERENCE: SITE PLAN, TITLED "OVERLAKE PLAZA, REDMOND, WASHINGTON", SHEET A, HERBERT NADEL AIA, AND PARTNERS, DATED 5/30/84.
NO SURVEY DATA AVAILABLE.

SITE PLAN
Overlake Plaza
Redmond, Washington

FIGURE 1
Laboratory Tests

<table>
<thead>
<tr>
<th>Blows/foot</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Depth (ft)</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>7.7</td>
<td>108.8</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>BROWN SILTY SAND (SM) loose, moist, with gravel (Fill)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>GRAY BROWN SILTY SAND (SM) very dense, moist with gravel and broken cobble (Weathered Glacial Till)</td>
</tr>
<tr>
<td>60/6&quot;</td>
<td></td>
<td></td>
<td>15</td>
<td>no recovery, driving on rocks driving on rocks. hard drilling.</td>
</tr>
<tr>
<td>128/3&quot;</td>
<td></td>
<td></td>
<td>20</td>
<td>Boring terminated at 13.0 foot depth on 8/3/84. No groundwater encountered.</td>
</tr>
</tbody>
</table>

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

### Laboratory Tests

<table>
<thead>
<tr>
<th>Blows/foot</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Depth (ft)</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>11.2</td>
<td>118.6</td>
<td>0</td>
<td>Asphalt Concrete</td>
</tr>
<tr>
<td></td>
<td>BROWN SILTY SAND (SM) loose, moist with gravel (Fill) the becomes dense at 3 feet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>GRAY SANDY SILT (ML) stiff, moist with some gravel, trace of clay (Weathered Glacial Till)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>GRAY SILTY SAND (SM) very dense, wet with some occasional cobble (Glacial Till)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boring terminated at 13.5 foot depth on 8/3/84. No groundwater encountered.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes

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---

**Applied Geotechnology Inc.**

Geotechnical Engineering

Geology & Hydrogeology

**Overlake Plaza**

Redmond, Washington

---

**JOB NUMBER:** 14,860.001  
**DRAWN:** R.J.T.
Laboratory Tests

<table>
<thead>
<tr>
<th>Bows/foot</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Depth (m)</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>14.3</td>
<td>115.3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>121/6&quot;</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Equipment: Mobile B-61

Elevation: 307 feet  Date: 8/3/84

Asphalt Concrete

BROWN/GRAY SILTY SAND (SM)
- dense, moist
- with gravel,
- note dark brown organic silt mixed in sample (Fill)

BROWN/GRAY SILTY SAND (SM)
- medium dense, moist
- with some gravel
  (Weathered Glacial Till)

- hard drilling
- becomes gray, very dense

Boring terminated at 13.0 foot depth on 8/3/84.

No groundwater encountered.

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

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Laboratory Tests

<table>
<thead>
<tr>
<th>Bows/foot</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>4.8</td>
<td>106.5</td>
</tr>
</tbody>
</table>

Equipment: Mobile B-61

Elevation: 300.5 feet
Date: 8/3/84

Asphalt Concrete

BROWN SILTY SAND (SM)
loose, moist
with gravel (Fill)
becomes very dense at 3 feet

LIGHT GRAY SANDY SILT (ML)
very stiff, moist
with some gravel, little clay
(Weathered Glacial Till)
decreasing sand, increasing clay content
becomes medium stiff at 12 1/2 feet

21
10
19

becomes stiff at 15 feet

56
20
25

LIGHT GRAY SILTY SAND (SM)
dense, moist
with gravel and cobble
(Glacial Till)
Boring terminated at 21.0 foot depth on 8/3/84.

No groundwater encountered.

Notes
Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI cannot be responsible for the interpretation by others of the information presented on this log sheet.
Laboratory Tests

<table>
<thead>
<tr>
<th>Bows/foot</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Depth in</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td></td>
<td></td>
<td>0</td>
<td>Asphalt Concrete</td>
</tr>
<tr>
<td>9 41.3 79.8</td>
<td></td>
<td></td>
<td>5</td>
<td>BROWN SILTY SAND (SM) loose, moist with gravel (Fill)</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>10</td>
<td>BROWN GRAY SILTY SAND (SM) very dense, moist with gravel (Weathered Glacial Till)</td>
</tr>
<tr>
<td>36</td>
<td></td>
<td></td>
<td>20</td>
<td>GRAY CLAY (CH) stiff, wet with peat flecks (Lacustrine Deposit) becomes sandy at 13 feet</td>
</tr>
<tr>
<td>91</td>
<td></td>
<td></td>
<td>25</td>
<td>GRAY SILTY SAND (SM) very dense, wet with some gravel (Glacial Till)</td>
</tr>
</tbody>
</table>

Decreasing silt content, becomes medium dense
Boring terminated at 21.0 foot depth on 8/3/84.

NOTE: Sample at 20 foot depth saturated.

Notes
Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

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Laboratory Tests

<table>
<thead>
<tr>
<th>Blows/foot</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Depth (ft)</th>
<th>Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Asphalt Concrete
- BROWN SILTY SAND (SM)
  - loose, moist
  - with gravel (Fill)
- BROWN GRAVEL (GW)
  - loose, moist
  - (Fill)
- BROWN GRAY SILTY SAND (SM)
  - loose, moist
  - with gravel, occasional cobble
  - (Fill)
- GRAY SILTY SAND (SM)
  - very dense, moist
  - (Weathered Glacial Till)
  - becomes medium dense and wet at 8 feet
- GRAY CLAY (CL)
  - stiff, moist
  - with peat flecks and sand partings
  - (Lacustrine Deposit)
  - hard drilling
- GRAY SILTY SAND (SM)
  - very dense, wet
  - with some gravel (Glacial Till)
  - 2 feet of water in hole noted during drilling
- GRAY COARSE SAND (SP)
  - very dense, saturated (Sand)
  - Boring terminated at 23.5 foot depth on 8/2/84.

Notes:
Subsurface conditions depicted are for the time and location of the individual exploration hole only; they should not necessarily be considered representative of conditions at other times or locations.

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# Laboratory Tests

<table>
<thead>
<tr>
<th>Blows/foot</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Depth (ft)</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>135</td>
<td>7.6</td>
<td>96.7</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

**Equipment** Mobile B-61  
**Elevation** 299 feet  
**Date** 8/3/84

- **Asphalt Concrete**
- **BROWN SILTY SAND (SM)**
  loose, moist with some gravel (Fill)
- **GRAY SILTY SAND (SM)**
  very dense, moist with gravel (Weathered Glacial Till)
- **MOTTLED BROWN AND BLUE GRAY CLAY (CL)**
  stiff, moist, with peat flecks (Lacustrine Deposit)
- **GRAY SILTY SAND (SM)**
  medium dense, moist with gravel and cobble (Glacial Till)

Boring terminated at 13.5 foot depth on 8/3/84.

No groundwater encountered.

**Notes:**
- Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.
- AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

---

**Applied Geotechnology Inc.**  
Geotechnical Engineering  
Geology & Hydrogeology

Overlake Plaza  
Redmond, Washington

**JOB NUMBER** 14,860.001  
**DRAWN** BJT  
**APPROVED**  
**DATE**  
**REVISED**  
**DATE**
### Laboratory Tests

<table>
<thead>
<tr>
<th>Blows/ft</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Depth (ft)</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BROWN SILTY SAND (SM)</td>
<td>loose, moist with gravel (Fill)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GRAY SILTY SAND (SM)</td>
<td>very dense, wet with gravel and cobble (Weathered Glacial Till)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 20.5 107.4</td>
<td></td>
<td>very stiff, moist with organics, occasional gravel (Lacustrine Deposit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GRAY SILTY SAND (SM)</td>
<td>dense, saturated some gravel and cobbles (Glacial Till)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>57</td>
<td></td>
<td></td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

Boring terminated at 13.5 foot depth on 8/3/84.

No groundwater encountered.

### Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

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---

**Applied Geotechnology Inc.**

Geotechnical Engineering

Geology & Hydrogeology

**Log of Boring 8**

Overlake Plaza

Redmond, Washington

**PLATE 9**
### Laboratory Tests

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Mobile B-61</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation</td>
<td>297.5 feet</td>
</tr>
<tr>
<td>Date</td>
<td>8/3/84</td>
</tr>
</tbody>
</table>

**Asphalt Concrete**
- BROWN SILTY SAND (SM)
  - loose, moist
  - with some gravel (Fill)

**Gray/Brown Silty Sand (SM)**
- very dense, moist
- with gravel and cobbles
  - (Weathered Glacial Till)

**Gray Sandy Silty (ML)**
- hard, moist
- with some gravel, trace of clay
  - (Glacial Till)
- no recovery, driving on rock

**Gray Sand (SP)**
- very dense, saturated
  - (sample dropped out of sampler)
  - (Sand)
- Boring terminated at 18.0 foot depth on 8/3/84.

Sample saturated at 17 foot depth.

---

### Notes

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Laboratory Tests

Blows/foot | Moisture Content(%) | Dry Density(lbf/ft²) | Depth (ft) | Sample
---|---|---|---|---
63 | 3.0 | 119.2 | 0 | Asphalt Concrete

BROWN SILTY SAND (SM)
loose, moist
with gravel (Fill)

DARK BROWN SILT (ML)
hard, moist
with organics (Old Topsoil)

72

BROWN/GRAY SILTY SAND (SM)
very dense, with some gravel
(Weathered Glacial Till)

GRAY COARSE SAND (SP)
medium dense, saturated
with trace silt (Sand)

40

Boring terminated at 13.5 foot depth on 8/3/84.

Sample saturated at 13 foot depth.

Notes
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APPENDIX B
OVERLAKE VILLAGE
SOUTH SUBAREA
Soils and Groundwater Depth

LEGEND
- SUB-AREA LIMITS

SOIL TYPE
- Ql: Lake Deposits
- Qvr: Vashon Recessional Outwash Deposits
- Qvrl: Vashon Recessional Lacustrine Deposits
- Qvt: Vashon Subglacial Till
- wQvt: Weathered Vashon Glacial Till

BORING/MONITORING WELL
- Park and Facilities Design (2010)
- Taco Bell (1992)
- Overlake Plaza (1984)

GROUNDWATER
- Observed Groundwater Elevation
Approximate scale in feet

APPENDIX B
OVERLAKE VILLAGE
SOUTH SUBAREA
Site Infiltration Potential

LEGEND
- SUB-AREA LIMITS
- SECTION CUT
- REGIONAL STORMWATER FACILITY
- GLACIAL TILL
- OUTWASH
- ESTIMATED INFILTRATION RATE

NOTES:
1. SECTION CUTS IN PROFILE EXTEND PAST SUB-AREA LIMITS.
2. SOILS INFORMATION IN SECTION CUTS PER REDMOND-OVERLAKE BASIN GEOLOGICAL MAPPING PROJECT (TROOST, 2010.)
APPENDIX B
Groundwater Sections
Notes

1. Groundwater levels shown on cross sections (blue triangles and blue lines) based on measurements provided on boring logs and are from different times of the year. Fluctuations from that shown are expected.

2. This cross section depicts a geologic interpretation based on limited borehole information. Actual conditions will vary from those depicted.

3. The interpreted continuity of geologic units expressed on this cross section is based on standard geological practice and experience with Puget Lowland geologic conditions. Actual conditions will vary.

4. The interpretation shown on this cross section is based, in part, on the lithologies described on the boring logs. Although, the interpretations provided on the boring logs were not used verbatim.

5. Refer to the description of the geological materials, Table 4.

6. The cross section is intended for regional use only; site-specific evaluations require geotechnical and geological investigations.

Borehole Lithology Key

- Asphalt/Concrete
- Fill
- Debris
- Topsoil/Vegetation
- Peat
- Volcanic Ash
- Gravel
- Silty Gravel
- Clayey Gravel
- Clayey Sand
- Clay
- Gravelly Clay
- Gravelly Sandy Clay
- Sandy Clay
- Silty Clay
- Sedimentary Bedrock
- Volcanic Bedrock
- Plutonic/Metamorphic Bedrock
- Unidentified Rock
- Unknown
- Undeveloped

Geologic Unit Key

af = fill
Qa = alluvial (river) deposits
Qv = lacustrine (lake) deposits
Qr = recessional outwash (from rivers at warming of last glaciation)
Qv = ice contact deposits
Qv = Vashon till (at base of ice)
wQv = weathered Vashon till (fractured, less compact than Qv)
Qp = advance outwash (deposited when ice was advancing)
Qp = pre-Fraser nonglacial deposits (on the landscape when Vashon glacier advanced)
APPENDIX D

Comments on Bioretention Standard Details
Provide allowed slope range (2.5:1 up to x:1)

Rain garden shapes will vary. Shape and plants shown in diagram are for illustration purposes only.

Max spacing between clean outs is 250 linear feet.

Average seasonal groundwater elevation?

Planting zones:
- Zone 1: Area with frequent standing water
- Zone 2: Area with occasional standing water, and extended drier period.
- Zone 3: Area with drier conditions.

7. Avoid compaction of existing subgrade below planter during construction.

General comments:
- Include vertical config detail
- Maximum bottom slope of cell is 0.5%
- Overflow point shall be at least 6" below any adjacent pavement area.
- Install streambed cobble (1" - 4") at inlet to dissipate runoff.
- If optional underdrain is used:
  - 0.5% min slope
  - Provide a clean out every 250-300 feet
- Minimum 3' depth between underdrain (if present) or bottom of bioretention soil mix (BSM) and water table.
- Minimum setback of 5' from top of bioretention cell to building structures and property lines. Do not locate immediately upslope of building structures.
THE FOLLOWING LIST INCLUDES NATIVE AND NON-NATIVE PLANT SPECIES COMMONLY AVAILABLE IN PUGET SOUND, AND SUITABLE FOR BIORETENTION CELLS AND SWALES. SITE CHARACTERISTICS AND PROJECT GOALS MAY REQUIRE MODIFICATIONS TO PLANT PROPOSED HERE (PER APPROVAL BY THE ENGINEER).

ZONE 1: AREA OF PERIODIC OR FREQUENT STANDING OR FLOWING WATER. ZONE 1 PLANTS SHOULD ALSO TOLERATE SEASONAL DRY PERIODS UNLESS IRRIGATION IS AVAILABLE.

ZONE 2: AREA PERIODICALLY SATURATED DURING LARGER STORMS. PLANTS LISTED UNDER ZONE 2 MAY ALSO BE APPLICABLE IN ZONE 3.

ZONE 3: AREA WITH DRIER SOILS INFREQUENTLY SATURATED. THIS AREA CAN BE USED TO TRANSITION OR BLEND WITH THE EXISTING LANDSCAPE.

ZONE 1 EMERGENT PLANTS
CAREX APERTA / COLUMBIA SEDGE
CAREX OBNUPTA / SLOUGH SEDGE
CAREX ROSTRATA / BEAKED SEDGE
CAREX STIPATA / SAWBEAK SEDGE
DESCHAMPSSIA CAESPITOSA / JUINUS TENUUS / SOFT SEDGE
JUNCUS ENSIFOLIUS / DUGGER-LEAF RUSh
SCIRPUS ACUTUS / HARDSTEM BULRUSH
SCIRPUS MICROCARPUS / SMALL-FRUITED BULRUSH
SPARGANUM SP. / BURREED

ZONE 1 SHRUBS
CORNUS SERICEA / RED-OSEIR DOGWOOD
CORNUS S. KELSEYI
DWARF RED-OSEIR DOGWOOD
SALIX PURPUREA NANA/DWARF ARCTIC WILLOW
SPIRAEA DOUGLASII / HARDHACK
SPIRAEA JAPONICA /

ZONE 2 HERBACEOUS PLANTS
AQUILEGIA SP. / COLUMBINE
ARUNCUS SYLVESTER / GOAT’S BEARD
ATHYRIUM FELIX-FEMINA / LADY FERN
IRIS DOUGLASSIANA / PACIFIC IRIS
IRIS SIBIRICA / SIBERIAN IRIS

ZONE 2 SHRUBS
CORNUS SERICEA / RED-OSEIR DOGWOOD
CORNUS S. KELSEYI
DWARF RED-OSEIR DOGWOOD
LONICERA INVOLUCRATA / BLACK TWINBERRY
OEMALARIA CERASIFORMIS / INDIAN PLUM
SPIRAEA JAPONICA
SYMPHORICARPUS ALBA / SNOWBERRY

ZONE 3 HERBACEOUS PLANTS & GROUNDCOVER
ARCTOSTAPHYLOS SP.
FESTUCA OVA 'GLAUBA' / BLUE FESCUE
GAULTHERIA SHALLON / SALAL
HEMEROCLIS VARS. / DAYLILY
HEUCHERA VARS. / ALUMROOT
LAVANDULA ANGUSTIFOLIA / LAVENDER
MAHONIA REPENS / CREEPING MAHONIA
POLYSTICHUM ACROSTICHOIDES / CHRISTMAS FERN
POLYSTICHUM MUNITUM / SWORD FERN
RUDBECKIA HIRTA / BLACK-EYED SUSAN

SPECIAL CONSIDERATIONS: IN ADDITION TO SOIL MOISTURE ZONES, PLANTS SHOULD BE SELECTED TO FIT EXPOSURE, AESTHETICS AND SAFETY ISSUES.

EXPOSURE: CAREFUL CONSIDERATION SHOULD BE GIVEN TO SELECTING PLANTS FOR SUN / SHADE EXPOSURE AT THE SITE.

DUGOUT TOLERANCE: THIS LIST EMPHASIZES NATIVE PLANTS, WHICH ARE GENERALLY WELL ADAPTED TO WET WINTER AND DRY SUMMER CONDITIONS. HOWEVER, SEVERAL ZONE 1 PLANTS WILL REQUIRE IRRIGATION. IN GENERAL, ALL PLANTINGS REQUIRE WATER DURING ESTABLISHMENT.

TREE CLEARANCE: ENSURE ADEQUATE SIGHT DISTANCE FOR ALL USERS PER CODE.

TREES: TREES MAY NOT BE APPROPRIATE IN ALL BIORETENTION CELLS, AND PLACEMENT MUST BE APPROVED BY THE ENGINEER. CONSIDER HEIGHT, SPREAD, AND EXTENT OF ROOTS AT MATURITY. USE CAUTION IN TREE SELECTION FOR AREAS WITH UNDER-DRAIN PIPES OR OTHER STRUCTURES. SEE APPENDIX 1: STREET TREES FOR MORE INFORMATION ON TREE SELECTION AND PLACEMENT SUGGESTIONS.

NOTES:

USE A MINIMUM OF 3 DIFFERENT SHRUBS AND 3 EMERGENT/GROUNDCOVER SPECIES IN EACH ZONE.

MINIMUM PLANT QUANTITIES ARE 80 PLANTS PER 100 SQ. FT. TREATMENT AREA, INCLUDING 4 SHRUBS MIN.

BIORETENTION CELLS MUST CONTAIN PLANTING ZONES 1, 2 AND 3.

EMERGENT PLANTS SHALL BE 4" POTS OR 10 C.I. PLUGS, PLACED IN CLUSTERS OF 7-15 PLANTS AT 9" O.C.

SHRUBS SHALL BE 1-GALLON, PLACED IN CLUSTERS OF 3-7.

NO TURF GRASS SHALL BE USED IN BIORETENTION CELLS.

REVISE FOR VERTICAL BIORETENTION CELLS

NATURAL RESOURCES/StormWATER ENGINEERING MANAGER

STANDARD DETAILS

BIORETENTION PLANT PALETTE

FILE NAME: SD657.DWG
DETAIL NUMBER: 657

REVISION DATE: JULY 01, 2015
NOTES:

1. SIDEWALK ELEVATION MUST BE SET ABOVE CHECK DAM AND INLET ELEVATIONS TO ALLOW OVERFLOW TO DRAIN TO STREET BEFORE SIDEWALK.

2. EXISTING UTILITY LINES MUST BE SLEEVED OR RELOCATED. PROPOSED UTILITY LINES TO BE LOCATED OUT OF FACILITY.

3. LONGITUDINAL SLOPE OF PLANTER MATCHES THE ROAD.

4. SPECIAL REQUIREMENTS FOR WATER LINES, METERS, AND FIRE HYDRANTS.

5. CHECK DAMS SHALL BE PLACED

- ELABORATE
- PROVIDE MINIMUM WIDTH
- PROVIDE ENERGY DISSIPATION/STREAMBED COBBLES
- SHOW CURB CUTS FOR DRAINAGE
- REMOVE "POROUS" AND DETAIL TYPE, SIDEWALK CAN BE ANY TYPE

OUTLET CURB CUT SEE STD DETAIL 663

R15' TYP

OUTLET SEE STD DETAIL 667

R15' TYP

INLET SEE STD DETAIL 663

R15' TYP
"SWALE BOTTOM VARIES"

SECTION A-A
NTS

A

8 CF OF HAND PLACED
2" - 6" QUARRY SPALLS

B

B

TOP VIEW
NTS

6"

12"

SWALE BOTTOM

SECTION B-B
NTS

30"

12"
SIDE CURB CUT DETAIL A
NTS

CURB CUT TYPE 2 SECTION A-A
NTS

SIDE CURB CUT SECTION B-B
NTS
OUTLET STRUCTURE

NOTES:
1. ALL FITTINGS TO BE RUBBER GASKETED.

2. ALL PVC RISERS AND FITTINGS INSTALLED ABOVE GRADE SHALL HAVE PROTECTIVE ULTRAVIOLET COATING, OPAQUE LATEX WATER BASED PAINT OR APPROVED EQUAL.

3. OUTLET RIM 3" MIN BELOW ADJACENT PAVEMENT OF SIDEWALK
NOTE:
LOCATE CLEANSOUTS IN PAVED AREAS ADJACENT TO BIORETENTION WHERE POSSIBLE.
CEMENT CONC. BARRIER CURB PER COR STD DETAIL 304A PAVER AND UPLAND PLANTING SURFACE TO BE FLUSH WITH TOP OF CURB, PROVIDE 6" MAX REVEAL WHEN CURB IS ADJACENT TO RAIN GARDEN.

PROPOSED THICKENED CURB AND GUTTER SEE DETAIL THIS SHEET

8" X 8" RUNNING BOND ECO-PRIORA PERVERS PAVER INSTALL PER MANUFACTURER RECOMMENDATIONS

MATCH SIDEWALK ELEVATION

"BIORETENTION"

PROPOSED UPLAND PLANTING OR RAIN GARDEN (WIDTH VARIES PER PLANS)

"BIORETENTION"

"BIORETENTION"

NOTES:
1. THIS DETAIL IS TO BE USED WHEN RAIN GARDENS ARE ON BOTH SIDES OF THE STREET, OTHERWISE LOCATE FIRE HYDRANT ON OPPOSITE SIDE OF THE STREET FROM THE RAIN GARDEN

EXISTING HYDRANT

PLAN NTS
APPENDIX E

Developer Toolkit
WHAT IS THE VISION OF THE OVERLAKE SOUTH SUB-AREA?
Overlake is designed to help meet community shopping, recreation, civic, cultural, entertainment and employment needs; provide attractive and safe places to live close to urban amenities; and be oriented towards pedestrians and bicyclists and served by local and regional bus and rail transit. Zoning regulations for Overlake Village reward urban density, innovation, and sustainability.

WHAT IS THE DEVELOPER TOOLBOX?
The developer toolbox is a set of stormwater best management practices that can be utilized on private parcel development in the Overlake South Sub-Area. The best management practices can be used in any combination to meet applicable Washington State and City of Redmond codes governing use of stormwater solutions.
WHAT ELEMENTS ARE IN THE TOOLBOX?

Five best management practices are available to developers in the toolbox. The rendering above details how each of the elements could potentially be situated in a typical block development.

The adjoining fact sheets in the toolbox provide additional guidance in utilizing these best management practices.

ADDITIONAL REFERENCES:


Legal disclaimer: this toolbox should not be used as a substitute for codes and regulations. The applicant is responsible for compliance with all current code and rule requirements.
**What Is Bioretention?**
Bioretention is an engineered facility sized for specific water quality treatment and flow control objectives that includes a storage component, plants, and designed soil mixes. Bioretention can come in a variety of configurations (typically cells, swale or planters) and provides a green amenity to the surroundings.

**How Much Space Is Required?**
Each property in the sub-area must provide the functional equivalent of routing the entire roof to a bioretention cell equal to 5% of roof area. This area is of the wetted footprint, and excludes side-slopes of the facility. If other tools are used in conjunction with bioretention, this requirement is reduced.

**How Much Does It Cost?**
Bioretention typically costs $25 to $50 per square foot. This includes design and construction, but excludes land acquisition.

**What Is A Typical Configuration?**
Bioretention can vary in shape to accommodate site conditions and developers preferences. Side-slopes typically are either vertical or 3 feet horizontal to 1 foot vertical or a combination of the two, depending on side.
**WHAT IS A GREEN ROOF?**
A green roof is a roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane.

Green roofs create green space for tenants, reduce stormwater runoff volume through evapotranspiration, provide peak flow rate attenuation, increase building insulation, increase the roof lifespan, create wildlife habitat and provide an aesthetic amenity.

Typical soil depths for green roofs range from 3-inches to 12 inches.

**HOW MUCH SPACE IS REQUIRED?**
There are no minimum or maximum green roof space requirements. The greater the roof area that can be green roof, the greater the benefit is provided.

**HOW MUCH DOES IT COST?**
Green roof costs depend on several factors such as soil media thickness and additional structural loading requirements. As a general rule, a green roof will cost in the range of $10 to $25 per square foot.

**WHAT IS A TYPICAL CONFIGURATION?**
Typical components of a green roof are as shown:

1. Grasses/Plants
   The plant growth portion of the roof.
2. Soil/Growing Medium
   Soil for growing plant media.
3. Filter Fabric
   Keeps vegetation and growing medium intact.
4. Drainage Layer
   Prevents saturation of the soil.
5. Insulation
   Additional insulation for the building.
6. Waterproofing Membrane
   Keeps water off of the roof deck.
7. Protection Board
   Additional protection.
8. Roof Deck
   Roof of the building.
**What Is Drywell Infiltration?**
A dry well is an underground structure that infiltrates stormwater runoff. Stormwater is routed through pre-treatment then routed into the dry well itself. Water is stored within the dry well, with perforations throughout the body of the dry well allowing water to seep out and infiltrate into native soil.

**How Much Space Is Required?**
Dry wells are located entirely underground. The drywell’s diameter and depth dictate how much contributing area they can dispose of. Typically, a vertical separation distance is required between groundwater and the bottom of dry well, dictating maximum depth of the dry well.

**How Much Does It Cost?**
Typically, costs for a dry well range from $3,000 to $7,000, per each.

**What Is a Typical Configuration?**
A typical drywell configuration consists of a concrete manhole with an open bottom and perforated holes throughout the manhole. The drywell is commonly filled with drain rock and has a frame and solid lid at the finished grade.
**What Is On-Site Detention?**

On-site detention is a stormwater storage and release system. Water is piped into a vault or chamber and a flow restrictor in the system restricts flows to specifically engineered levels. Stormwater is subsequently discharged into the public storm drain system.

**How Much Space Is Required?**

Normally, the entire system is located underground, so no surface area is required. Up to 0.5 cubic feet of storage volume per square foot of contributing land area may be required per current stormwater code.

**What Is A Typical Configuration?**

The typical detention vault section from the City of Redmond Standard Plans is shown below. The structure is constructed of concrete and is installed underground.

**How Much Does It Cost?**

Typically, underground on-site detention costs $15 to $30 per cubic foot of storage.
**What Is the Urban Pathway?**
The urban pathway will be a shared-used path that will be constructed in the sub-area as part of the reconfigured street grid network. The pathway will serve as a regional facility, for public and private stormwater. Underneath the pathway, stormwater chambers will be constructed to provide storage volume and infiltration into the native soil.

**How Much Does It Cost?**
City to advise on this text. Potential wording:

*The urban pathway will be paid for and constructed by the City of Redmond. Developers connecting into the pathway for stormwater use will pay a fee to the City.*

**How Much Space Is Required?**
The pathway stormwater storage component will be part of the public right-of-way and will be located entirely underground. Except for access points and cleanouts, the stormwater component will be not visible.
APPENDIX F

Open House Presentation Board
In most communities, a development project is required to construct a large detention vault onsite to manage large storms along with smaller scale infiltration facilities that manage smaller storms onsite. Redmond’s regional stormwater facilities program is constructing large regional detention and infiltration vaults that allow developers to pay a fee to the City in lieu of building their own onsite detention vaults. This frees up property for development and is a more efficient and effective use of space within this urban center. The large City vaults also are a good opportunity to collocate park facilities like the future green space shown above. While the City’s regional vaults manage the large storms, each public and private development is still required to provide some small onsite stormwater facilities to manage small storms. Developers get credits against their stormwater connection fees if they exceed the minimum onsite stormwater requirements described below. This project team is developing a tool box of equivalent technologies to help developers select their preferred method of providing onsite stormwater management.