HOW AND WHERE DOES INFILTRATION WORK?

- Context: Summary of Geologic History
- Constraints/benefits for different geologic units
- Key geologic and groundwater flow parameters critical to site planning/engineering
- Subgrade preparation
TYPICAL PUGET SOUND STRATIGRAPHY

- Recessional outwash: Bedded and sorted sand, gravel. River deposits during wasting and retreating ice.
- Till: Unsorted mixture of clay, silt, sand, gravel, cobbles - approximately 0.3 to 3.0 feet thick on average. Compacted beneath ice sheet.
- Advance outwash: Bedded and sorted gravel and sand at top; deposits flowing from advancing ice; well-bedded clay and silt at base; deposits of lakes (or salt water) farthest from the ice.

CONCEPTUAL STRATIGRAPHY:

- Recessional outwash
- Till
- Advance outwash
- Transitional / non-glacial deposits

Constraints:
- Thin
  - Removed during grading
  - Shallow groundwater
  - Downslope impacts (slope stability, springs, wetland hydrology)

Benefits:
- High permeability
- Dispersed infiltration options

LODGEMENT TILL

- Thin weathered horizon removed during grading
- Very low permeability parent material
- Good for earthen dams/berms
- In-situ amendments not feasible
- Groundwater reworking
- 1 to 3/4 inches/month of recharge through till
- 0.001 to 0.002 inches/hour

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**SITE ASSESSMENT OVERALL PROJECT LEVEL CONSTRAINTS**

- Geology/soil characteristics
- Ground water conditions
- Infiltration potential
- Water balance issues
  - Wetlands
  - Springs
  - Water supply
- Final Site Use
  - Commercial
  - Residential
  - Industrial

**SITE ANALYSIS**

- Exploration
  - Exploration pits
  - Deep exploration boring
- Testing
- Modeling
READILY AVAILABLE RESOURCES

- USGS and DNR Geologic Maps
- USDA Maps
- In-House Previous Work

RECEPTOR SOILS

- Organic Content
- Infiltration rate of native soils
- Cation Exchange Capacity
- Grain Size Distribution

INfiltration RATE TESTING

- Infiltration rate of native soils
- Cation Exchange Capacity
- Grain Size Distribution

OUTDATED:

- Percolation Test (Single Standpipe)
- Double Ring Infiltrometer

PREFERRED:

- Large Diameter Single Ring
- Pilot-Scale PIT
INFLTRATION RATE DETERMINATION


US STANDARD SIEVE NOS.

<table>
<thead>
<tr>
<th>Grain Size, mm</th>
<th>Percent Finer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>100</td>
</tr>
<tr>
<td>0.1</td>
<td>90</td>
</tr>
<tr>
<td>1</td>
<td>80</td>
</tr>
<tr>
<td>10</td>
<td>70</td>
</tr>
<tr>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

USDA METHOD, ECOLOGY 2005 REMOVED FROM ECOLOGY 2012

Table 3.7—Recommended Infiltration Rates based on USDA Soil Textural Classification

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Short-Term Infiltration Rate (in/hr)</th>
<th>Correction Factor</th>
<th>Estimated Long-Term (Design) Infiltration Rate (in/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean sandy gravels and gravelly sands</td>
<td>20</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Sand</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Loamy Sand</td>
<td>4</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>4</td>
<td>0.5</td>
<td>0.25</td>
</tr>
<tr>
<td>Loam</td>
<td>0.5</td>
<td>0.5</td>
<td>0.13</td>
</tr>
</tbody>
</table>

OLD SCHOOL INFILTRATION

Falling Head Test (FHT)
Double Ring Test (DRT)
### SMALL SCALE INFILTRATION

**Pilot Infiltration Test (PIT)**

- Modified PIT Test
- [www.aesgeo.com](http://www.aesgeo.com)

### LARGE DIAMETER RING INFILTRATION TEST (AESI)

**LARGE DIAMETER RING INFILTRATION TEST (AESI)**

- Modified PIT Test
- [www.aesgeo.com](http://www.aesgeo.com)

### TESTING FREQUENCY | 2012 ECOLOGY MANUAL

- **Commercial Sites**
  - 1 test per 5,000 sq. ft.
  - Groundwater thru wet season
- **Residential Sites**
  - 1 Test per 200 feet of road and every lot
  - Groundwater thru wet season

- [www.aesgeo.com](http://www.aesgeo.com)
MODELING ANALYSIS

- Depth to water table
- Infiltration rate of native soils
- Hydrographs
- MODRET

STORMWATER INFILTRATION - SUMMARY

- Characterization of Receptor Soils - Hydraulic Parameters - water quality characteristics
- Infiltration Rate - Laboratory/Field Measurements
- Depth to Water Table - Thickness of Unsaturated Zone
- Groundwater Flow Direction - Impacts to Environment/Wells
- Depth of Aquitard - Aquifer Capacity
- Design Storm Event - Peak Flow Rate/Total Volume

SUBGRADE PREPARATION

- Stripping depth - know where receptor soils are
- Uniformity of subgrade support - Look for soft spots
- Proof Roll - use a fully loaded dump truck
- Firm and Unyielding
- Geotextile - only for separation - not always advisable
CONSTRUCTION
- Track traffic to a minimum, establish haul routes
- Erosion control
- Finished product protection
- Siltation from other areas
- Truck Traffic
- Concrete washouts

SECTION PLACEMENT
- Ballast placement – push forward without tracking on subgrade
- Static Roll – or minor vibratory rolling, minimize compaction to the receptor soils