



low impact development technical workshop series

urban trees

Topics

Integrating stormwater management and healthy trees

Above and below ground growing space

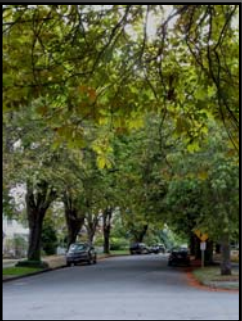
Stormwater flow control and trees

WASHINGTON STATE UNIVERSITY
EXTENSION



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Integrating stormwater management and trees



Multiple benefits

- Energy conservation.
- Air quality.
- Carbon sequestration.
- Aesthetics and increased property value.
- Stormwater flow reduction.

trees and stormwater management

Integrating stormwater management and trees



Stormwater context

- Larger mature trees provide more benefit than smaller trees.
- Evergreen better than deciduous.
- Adequate soil volume and quality critical.
- Proper drainage design critical...too much water can kill trees faster than too little.

trees and stormwater management

Integrating stormwater management and trees



Site assessment

- Available above and below ground growing space.
- Soil type and available water.
- Vehicle and pedestrian sight lines.
- Proximate utilities and structures.
- Sun exposure and prevailing wind.
- Maintenance.

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Key decisions

- Plant in the best/appropriate places with highest quality soils and adequate soil volume.
- Design for larger growing spaces.
- Do not restrict trunk flare of mature tree...plan ahead
- Use permeable surfaces for hard surfaces surrounding tree.
- Protect the tree from surrounding activities.
- Drainage.

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Drainage

- If not directing flow to tree area and seasonally high GW below tree pit subgrade then likely no under-drain needed.
- If directing flow to tree area careful consideration of soils, tree species and under-drain.
- Generally planting pit above rooting zone (18-24 in.) should drain down within 48hrs.
- If under-drains used, incorporate an accessible control structure if possible.
- SilvaCell has GULD for WA.

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Reducing compaction (construction)

- Clearly mark protection and staging areas on plans and in the field.
- Review plans and coordinate throughout construction with foreman and crew.
- Robust fencing and clear signage declaring protection objectives and penalties.
- If access unavoidable.
 - Foot access: 6" layer of arborist wood chips.
 - Vehicle: 1" steel plate or 4" thick timber with 2-3" AWC or ¾" ply with 6-8" AWC.

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Reducing compaction (long-term)

1. New trees

- Mulch tree planting bed with 2-4" of AWC. Keep chips 1' back from trunk. Replenish 1-3 yrs.
- Barriers.
 - Wheel stops.
 - Low fences.
 - Curbs.



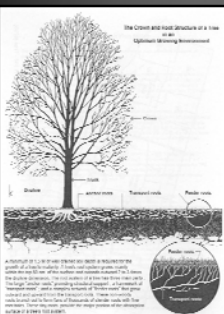
- Tree grates...poor option.

2. Existing trees

- Mechanical.
- Soil amendments (compost and other biological).

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Soil depth

- 30-48" extended for a 10' radius around tree in lawn areas.

Soil volume

- Recommendations vary.
 - Urban: 0.38 m³ soil per 1 m² canopy projection for loam, no irrigation with 30" annual rainfall.
 - Lindsey and Bussuk: 0.24 m³ per 1 m² canopy projection.
- Structural Soils require volume for structural component => less available soil. CU Structural Soil™ has ~ 20% available soil.

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Soil and rooting volume strategies



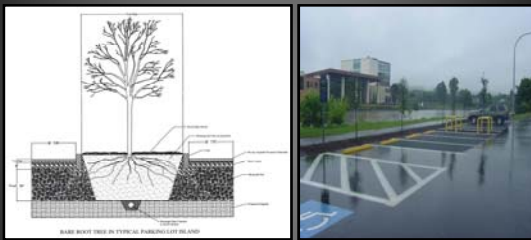
- ## 1. Rigid cell systems

- Modular frames.
- Support high loads.
- Most volume available soil for trees



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Soil and rooting volume strategies

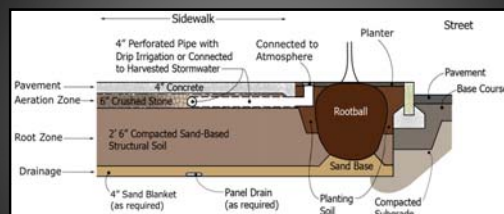


- ## 2. Structural soil

- Crushed aggregate (typ. 0.75-1.5" fine grained soil and polymer.
- Good porosity (25-30%) and permeability(>20in/hr), load bearing. Lower soil availability (~20%).

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Soil and rooting volume strategies



- ### 3. Sand based structural soil

- Medium to coarse uniformly graded sand with compost (2-3% by volume) and 2-4in/hr Ksat typical.
- Typically 30" deep
- Non-proprietary.

Performance



Infiltration

- Bartens (2008)
 - Black oak (course root structure) and red maple (finer root structure).
 - Both penetrated soils in containers with bulk densities of 1.3 and 1.6 g/cm³.
 - Infiltration rates were 63% higher in lower compaction soil and 153% higher in higher compaction soil compared to control with no plants.

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