

# Space and Soil

## What Trees Need!

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With information from

**Deeproot Green  
Infrastructure, LLC**



# Trees and Soils

- ▶ Trees and soils are completely ecologically interdependent
- ▶ Urban development processes disrupt the ecological balance between trees and soils
- ▶ Most tree decline can be attributed to soil stress
- ▶ Health of soil and soil/tree relationship has a major influence on tree health and performance



We have all seen your typical street tree well with not nearly enough soil space or drainage for the trees. This results in the species *Quercus Horizontal-lie*



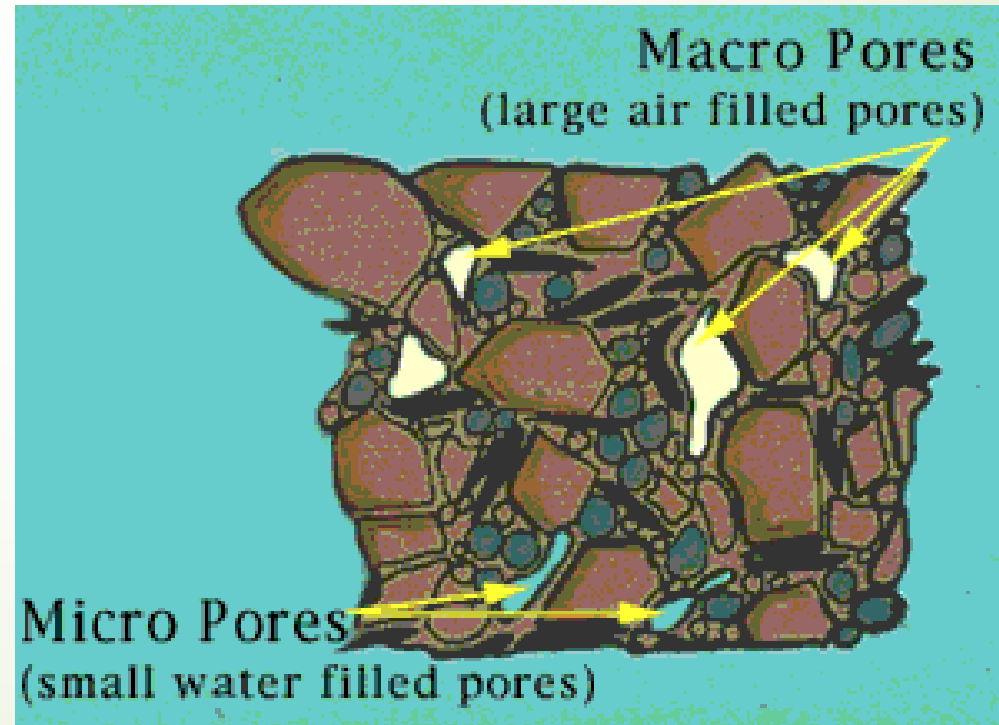
# Root Growth

- ▶ Roots grow where soil conditions are favorable
- ▶ Roots require space, organic materials, essential mineral elements, adequate oxygen, and water
- ▶ Fine, absorbing roots are found in the upper 6 to 10 inches of soil
- ▶ Few roots grow deeper than 3-4 feet
- ▶ Trees can develop much deeper root systems depending on species and environmental conditions

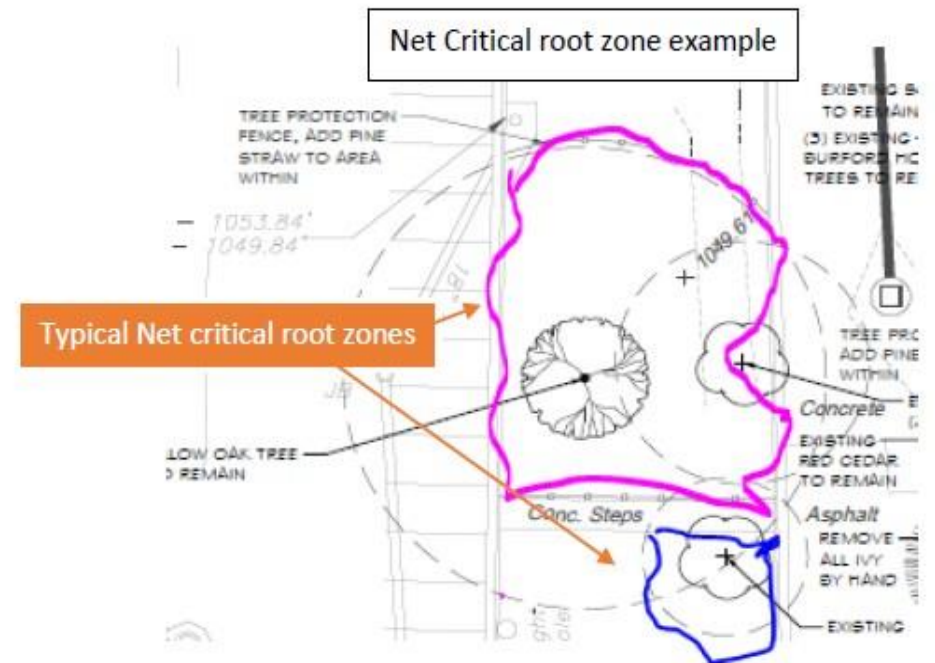
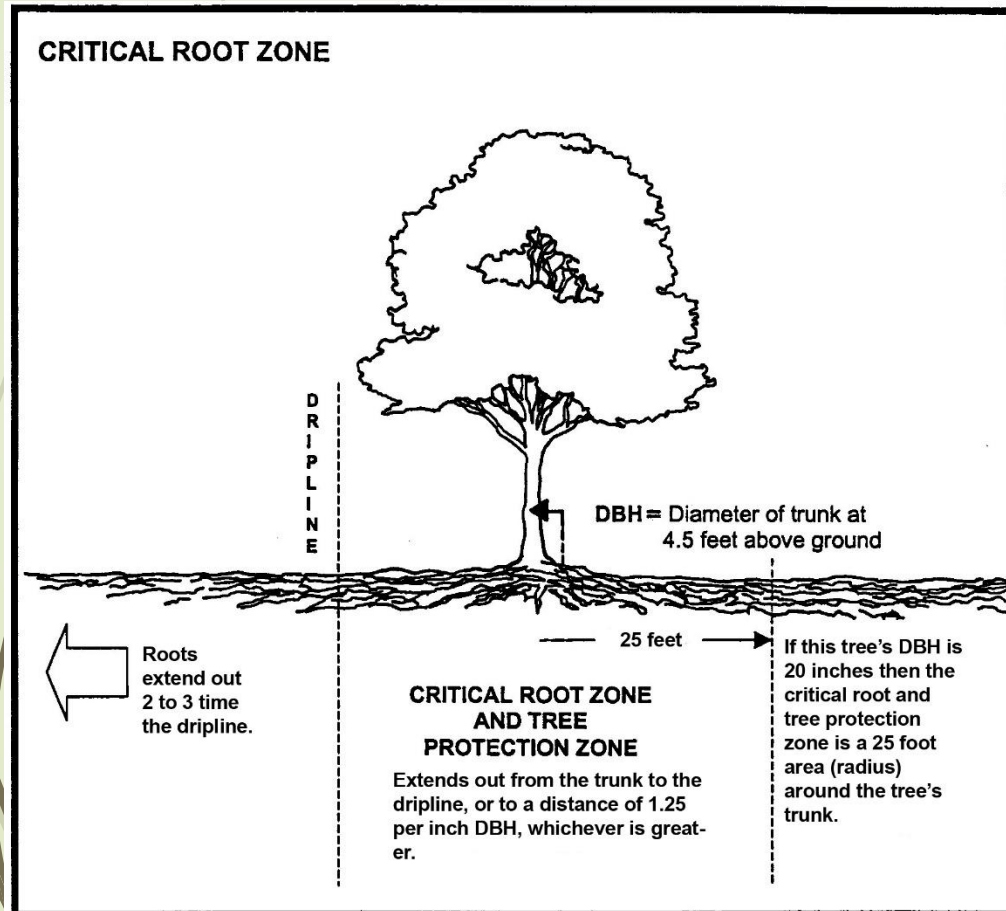


# Soil Structure

- 50% of the soil is **space**, or pores, between soil particles
- **Macropores** are relatively large spaces, between aggregates; they cannot hold water against gravity and once drained they hold air
- **Micropores** retain water and are the source of available water to plants between rainfalls



To **conserve** a **Tree** you must conserve the **soils** the tree's roots are in.



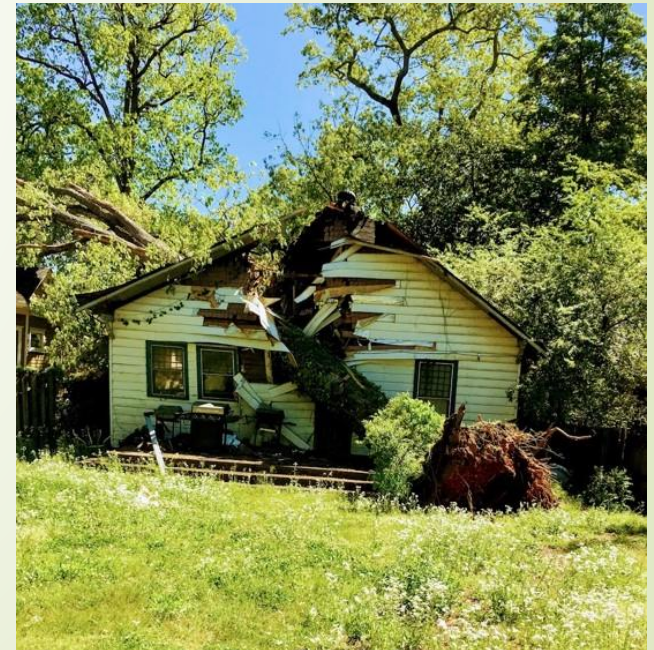
Tree roots do not usually grow into hardened dry compacted soils or beyond cement barriers such as retaining and foundation walls or curbs.

# Naturally existing soils vs urban soils



# Urban Soils

- No organic layer
- Compaction
- Disrupted profile
- Elevated pH
- Altered drainage
- Subsurface barriers
- No biological activity
- May need de-compaction and soil amendments
- Have a soils test done before amending








# So, how do we give trees the space they need?

- ▶ Educate home owners, builders and developers
- ▶ Bring trees needs to the beginning of a project, pre-application meetings before plans are designed with homeowners and designers
- ▶ Make sure Tree Ordinances have the soil space requirements clearly stated
- ▶ Allow modifications to home footprints on the lot, administrative variances to setbacks to allow high value trees **and their soils** to be conserved.



# Add Soil Volume (Soil Rooting Space) to Tree Ordinances

## ➤ **b. Soil Volume**

- Trees planted for tree canopy cover credit shall have a minimum amount of soil volume present at the time of planting to promote health, growth, and the ability to achieve the size potential for the species.
- The minimum depth of soil shall be 36 inches and the minimum open soil surface area, soil volume and planting area dimension for trees by mature canopy size are shown in Table 2.

## Table 2.

**Table 2. Required Minimum Open Soil Areas and Soil Volumes by Mature Canopy Size**

<b>Mature Canopy Size</b>	<b>Minimum Open Soil Area</b>	<b>Minimum Soil Volume</b>	<b>Minimum Planting Area Width for Landscape Strips</b>
<b>Large</b>	400 square feet	1,200 cubic feet	5 feet
<b>Medium</b>	225 square feet	675 cubic feet	4 feet
<b>Small</b>	100 square feet	300 cubic feet	3 feet
<b>Very Small</b>	36 square feet	108 cubic feet	3 feet

# Add Soil requirements!

## a. Soil Quality

- The rooting zone of all trees planted for tree canopy cover credit shall contain quality soil to enhance, and not limit, tree growth. The minimum standards for soil quality include:
  - • Loamy, well-aerated soil that includes topsoil
  - • Approximately 5 percent organic matter, 45 percent mineral matter and 50 percent pore space for holding water and oxygen
  - • A pH (soil acidity) between 5.5 and 7.0

**Without this type of requirement in your tree code you are unable to specify soils types**



# Add Suspended Pavement systems and root barriers in code



- The city arborist may approve the **use of suspended pavement systems, such as structural cells**, to meet soil depth and volume requirements in areas where the soil surface must be covered by pavement for parking lots, driveways and sidewalks.
- The **planting site shall have good drainage from the bottom of the planting hole to ensure root health and tree survival**. Soil compaction shall be avoided within the critical root zone of protected trees.
- Root barriers should be used to redirect root growth away from sidewalks, curbs, driveways and buildings.

**Without this type of requirement in your tree code you are unable to require Structural soil systems or root barriers**

# Drainage is the key in compacted soils

## Remember:

- No amount of gravel will change the soils ability to drain, you must de-compact the soil

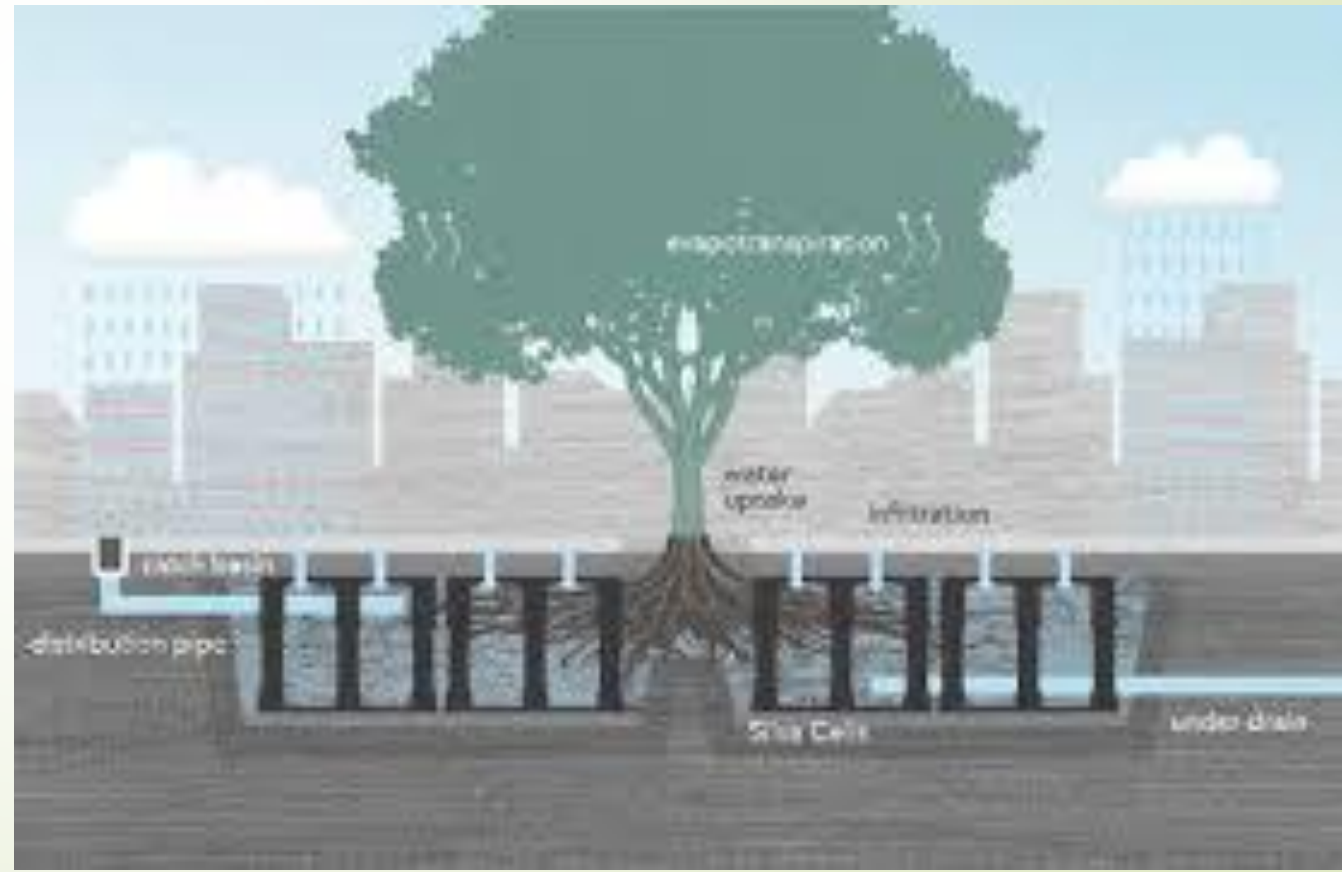


- Potholes are not good planting locations



# Things to consider

Watering, think ahead, make sure watering is scheduled with landscapers. Structural soil cells can be used for some stormwater storage. You can divert storm water into system but must have a drainage outflow pipe so trees don't sit in water (must be designed by professionals)



# The Street Scape Project

Hampton Inn Downtown Decatur Georgia

4- 2.5" caliper Willow Oaks





So, What's Below  
The Concrete  
that makes this  
project different?  
**Soil Space!**

- Soil Volume per tree  
450 cf
- Silva Cell 1X system
- Showing the  
Strongbacks before  
adding soil



## Silva Cells structural cells filled with soil

- Strongbacks on and filled with soil then removed and Decks installed



Once the cells are filled, they are covered in geotextile fabric and the sidewalks are poured

- Fabric cut out at tree openings
- Ready for base coarse layer and paving



Then the trees are planted



# Hampton Inn Downtown Decatur

- ▶ Trees Planted in  
Spring 2019



# Hampton Inn Downtown Decatur

- ▶ Trees looking good  
Spring 2021
- ▶ 2<sup>nd</sup> growing season



# Trees in July 2022



# Soil Cells in Three Sizes

## 1x system

**H** System Height: 16.7"

**W** Width: 24"

**L** Length: 48"

Soil volume capacity:  
approximately 10 cubic ft of soil

## 2x system

**H** System Height: 31"

**W** Width: 24"

**L** Length: 48"

Soil volume capacity:  
approximately 20 cubic ft. of soil

## 3x system

**H** System Height: 43"

**W** Width: 24"

**L** Length: 48"

Soil volume capacity:  
approximately 30 cubic ft. of soil

Design Flexibility  
is key when  
working  
on urban sites





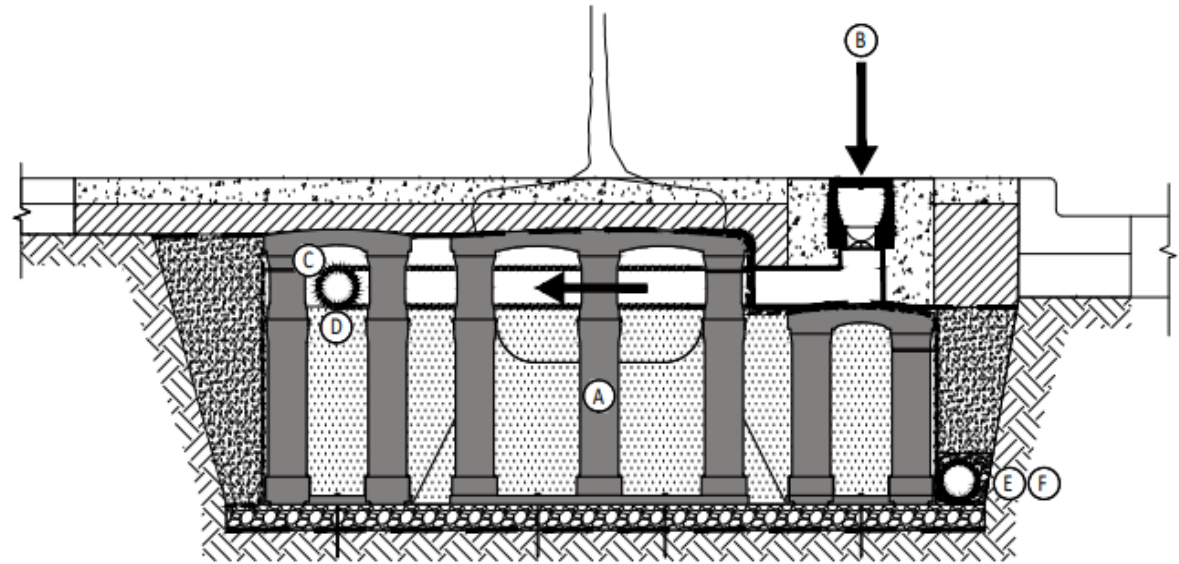
# Soil Cells below Pavement

- ▶ Vehicular Rating means you can have trees and cars plus shade in your parking lots. Permeable pavement makes this into a bio-retention facility providing storage and filtration



# Getting Water Into the System

- ▶ Channel Drain
- ▶ Trench Drain



2

## SILVA CELL SYSTEM + TRENCH DRAIN

NOT TO SCALE

### KEY PLAN

A SILVA CELL SYSTEM (DECK, BASE, AND POSTS)

B TRENCH DRAIN

C OPTIONAL PONDING SPACE

D DISTRIBUTION PIPE

E COLLECTION PIPE

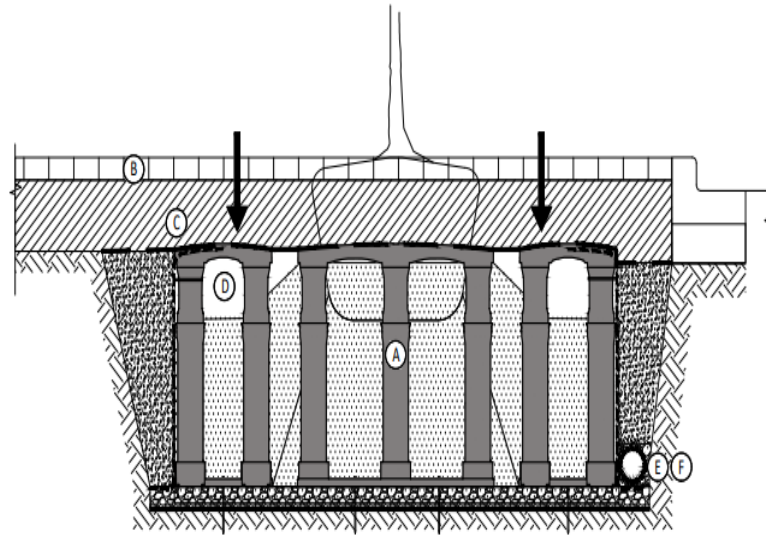
F CONNECTION TO MUNICIPAL STORM SYSTEM

DIRECTION OF WATER FLOW



# Getting Water Into the System

## ➔ Permeable Pavers

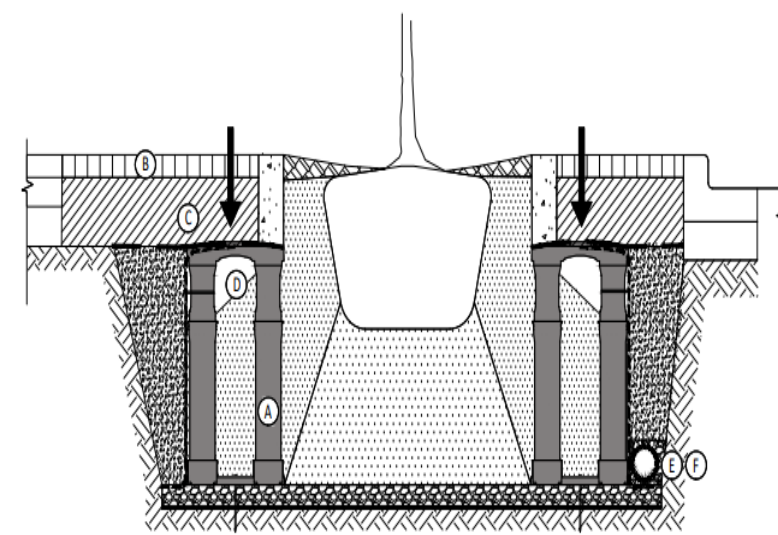


2 SILVA CELL SYSTEM + PERMEABLE PAVEMENT

NOT TO SCALE

KEY PLAN

- A SILVA CELL SYSTEM (DECK, BASE, AND POSTS)
  - B PERMEABLE PAVEMENT
  - C AGGREGATE STORAGE LAYER
  - D OPTIONAL PONDING SPACE
  - E COLLECTION PIPE
  - F CONNECTION TO MUNICIPAL STORM SYSTEM
- DIRECTION OF WATER FLOW ➔



3 SILVA CELL SYSTEM + PERMEABLE PAVEMENT

NOT TO SCALE

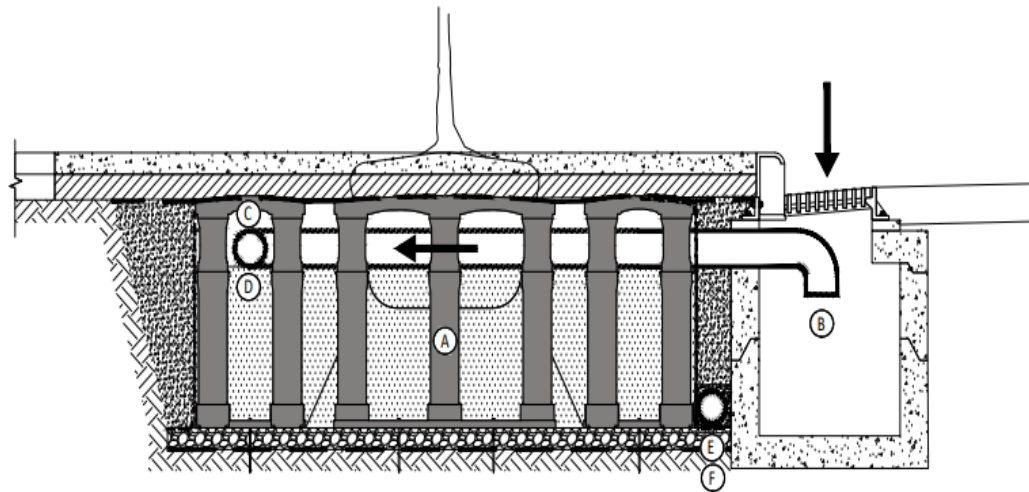
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# Getting Water Into the System

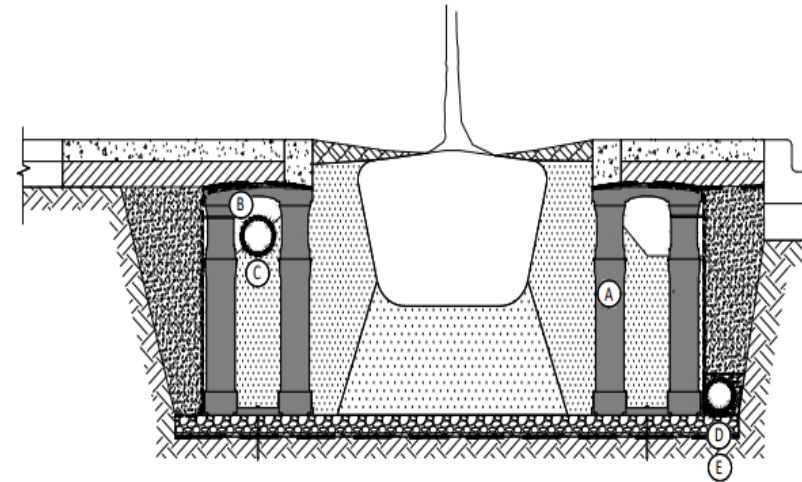
- Catch Basin
- Distribution Pipe




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# Before and After Results

Adequate Soil Builds Resilient Trees that can Withstand Drought and Disease



# 100 Peachtree Plaza

- 800 CF of Soil per Tree in this urban plaza
- Open system for filling soil
- Amended Site Soil



# 100 Peachtree Plaza

Trees planted  
in Fall 2015



# 100 Peachtree Plaza

- 3<sup>rd</sup> Growing Season
- 2018





North Avenue  
Park  
Historic 4<sup>th</sup> Ward

Trees planted in 2014



# North Avenue Park Historic 4<sup>th</sup> Ward

2019-plaza in full shade  
after just four years



# North Avenue Park Historic 4<sup>th</sup> Ward

2020



# Historic 4<sup>th</sup> Ward Park

Trees Planted in 2011  
Bridging with Silva  
Cells



# Historic 4<sup>th</sup> Ward Park

2018

These trees  
Look like they  
Are 15 years old





# [Decaturga.com/trees](http://Decaturga.com/trees)

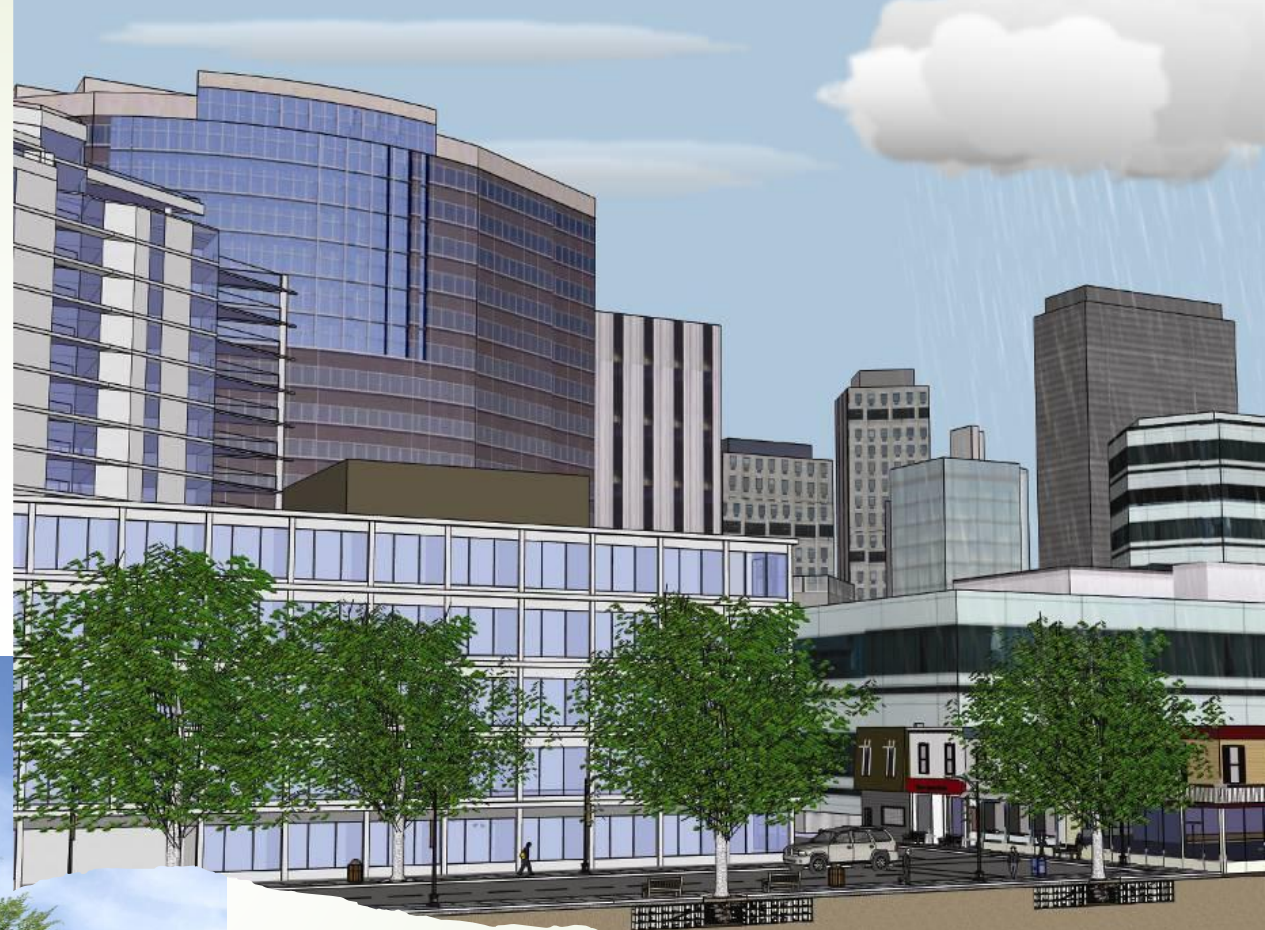
Decatur's Tree Information Page

Tree Protection Ordinance and Administrative Standards

Building Checklists etc...

# Silva Cell Information

[www.deeprooot.com](http://www.deeprooot.com)



Questions?



Thanks!!!!

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