

# The Stockholm Solution - Ten Years of Experience of Urban Tree Planning and Management Combined with Local Storm Water Management



**Green Days & Green Techniques**  
**February 11, 2014**  
**Tampere Finland**



# The Project Team



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The subject from an esthetic and a historical point of view









# Inventory of street trees in central Stockholm







Problems for new trees







Access to oxygen in soil is the single most critical factor for the wellbeing of urban trees. Dense surface layers contribute to oxygen deficiency and carbon dioxide poisoning of tree roots.

Lack of water and input of organic matter is a severe problem for urban trees, since they are often surrounded by paved surfaces. Rainwater is diverted away from paved surfaces to stormwater drains and not directed to the root space.







Concrete tile

Sand

Asphalt

Road bed



# Preface and background of the method



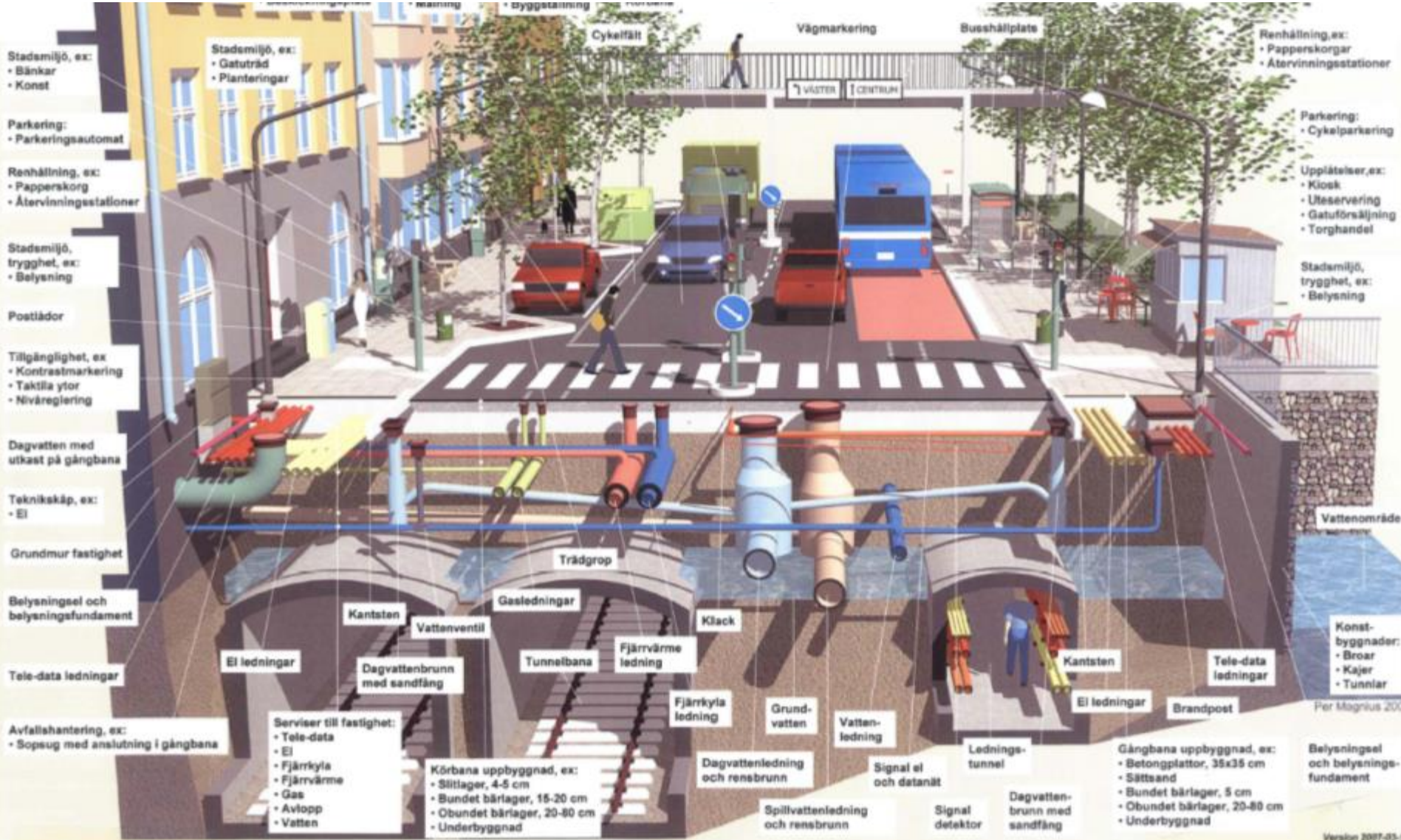


# The Visual City !!!





# The Hidden City !!!





# Tree roots penetrating sewage pipes





THAMES WATER  
13, SPRINGFIELD COTTAGES,  
HOLMWOOD, SURREY  
225mm. VC. FN. 10. 1. 1. 1.  
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POST JETTING

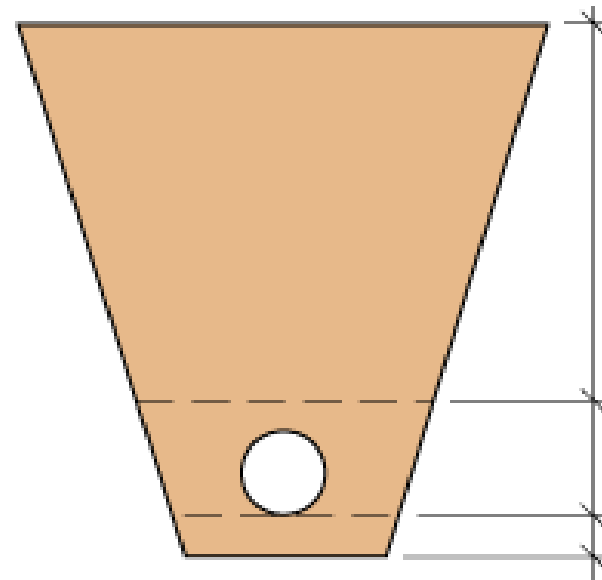
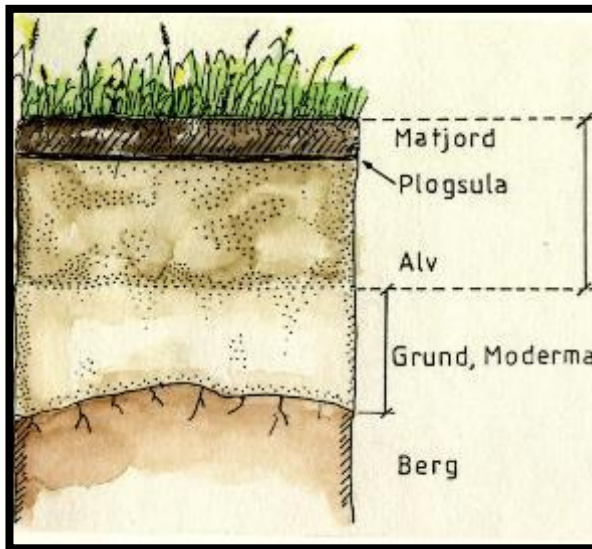


Twenty years of experiences,  
studying root intrusion problems in  
sewer pipes



Are the soils we use for trees in urban environments really the optimal substrate ??

...when roots seem to prefer the condition in pipe trenches and other building materials existing below ground!





The environment for root growth seems very favourable in the filling material in pipe trenches and in railway embankments



Few roots in native soil !

Lots of roots in pipe trench











Massive amount of roots in a railway embankment, Stockholm Sweden.







Photo City of Osnabrück

04/10/28 12:54







Good root environments  
in WW2 concrete  
bunkers...

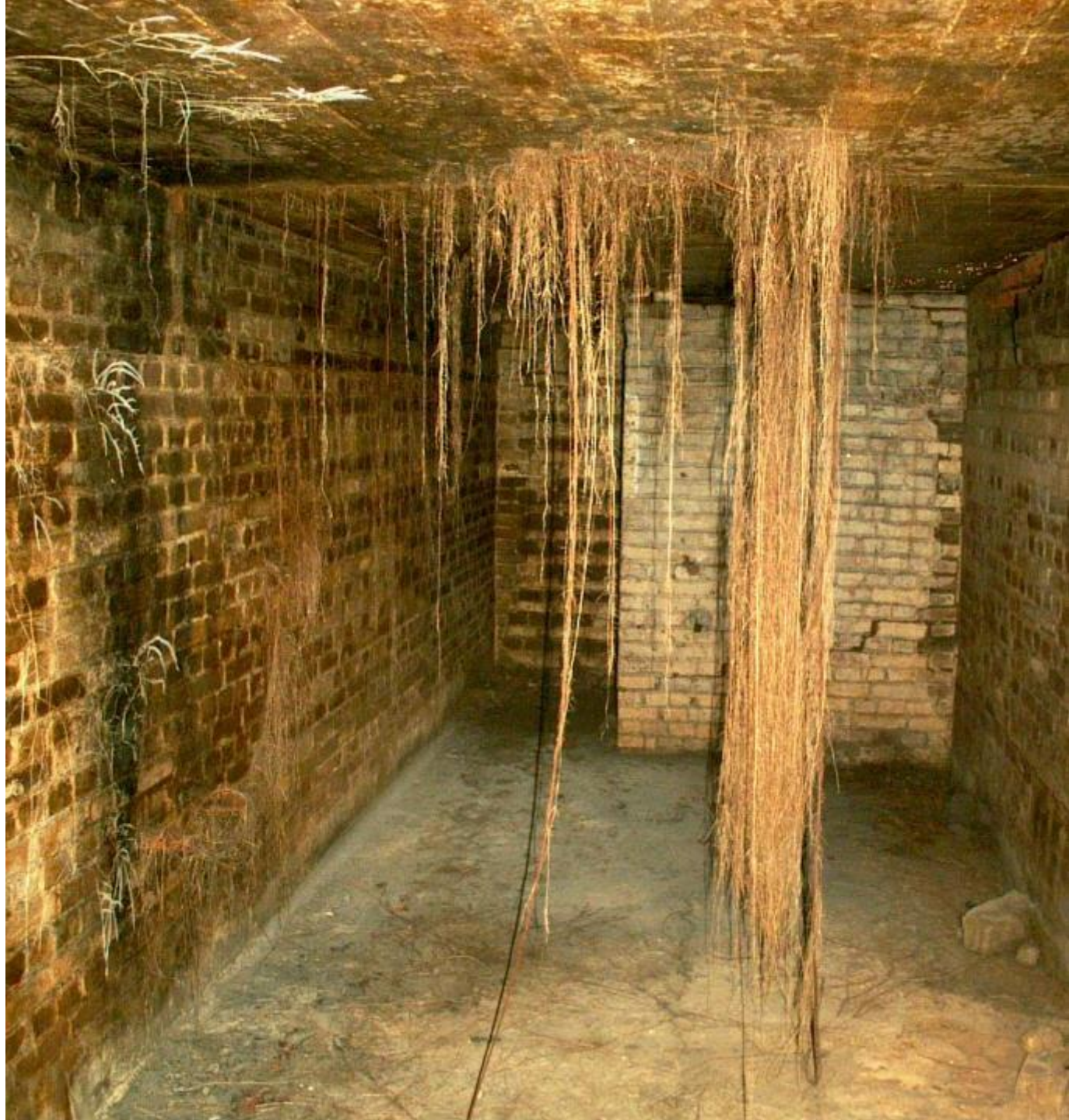


Photo City of Osnabrück





Photo City of Osnabrück



Tree nursery growing method:  
Missouri pea gravel bed







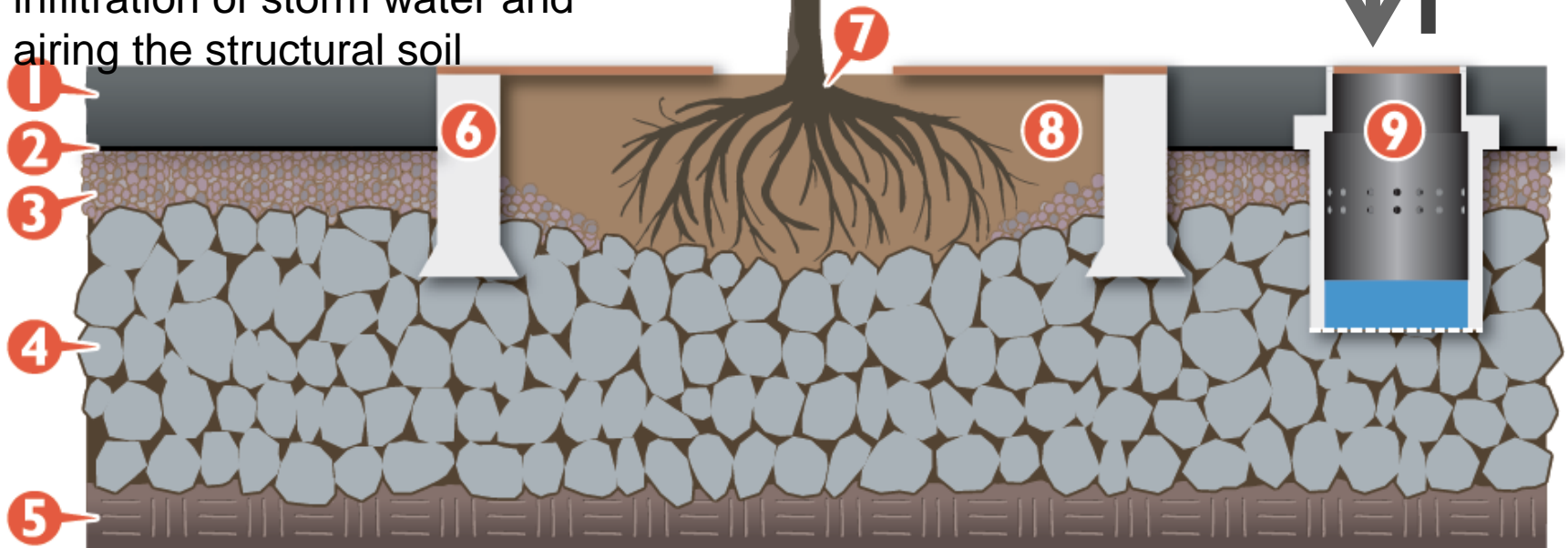






# How to create good growing conditions and taking care of the storm water

1. Pavement, bearing layer
2. Geotextile
3. Layer of crushed rock for infiltration of surface water and airing of the soil
4. Structure of granite stones the space between is filled with soil
5. Terrace or construction
6. Plant box of concrete
7. Tree
8. Planting soil
9. Catchment chamber for infiltration of storm water and airing the structural soil



Inlets Storm water down  
carbondioxide up





# **What is Stockholm's system?**

Plant beds built with granite stone where we infiltrate storm water and ensure that the gas exchange and water supply works.

With a control system for construction work and maintenance program for the establishment of trees.

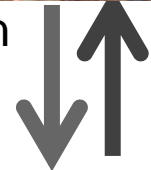


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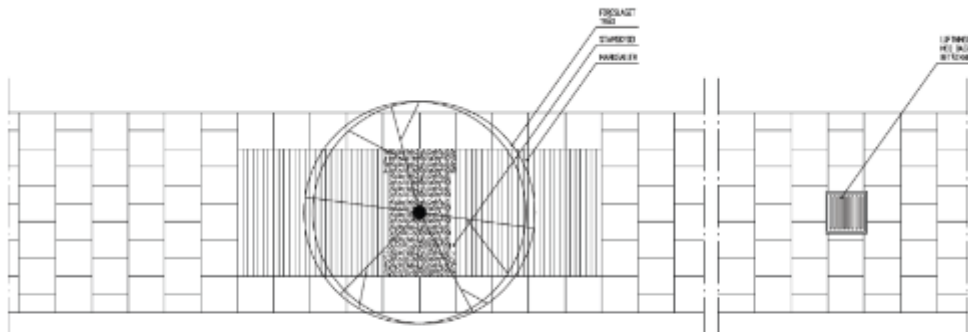
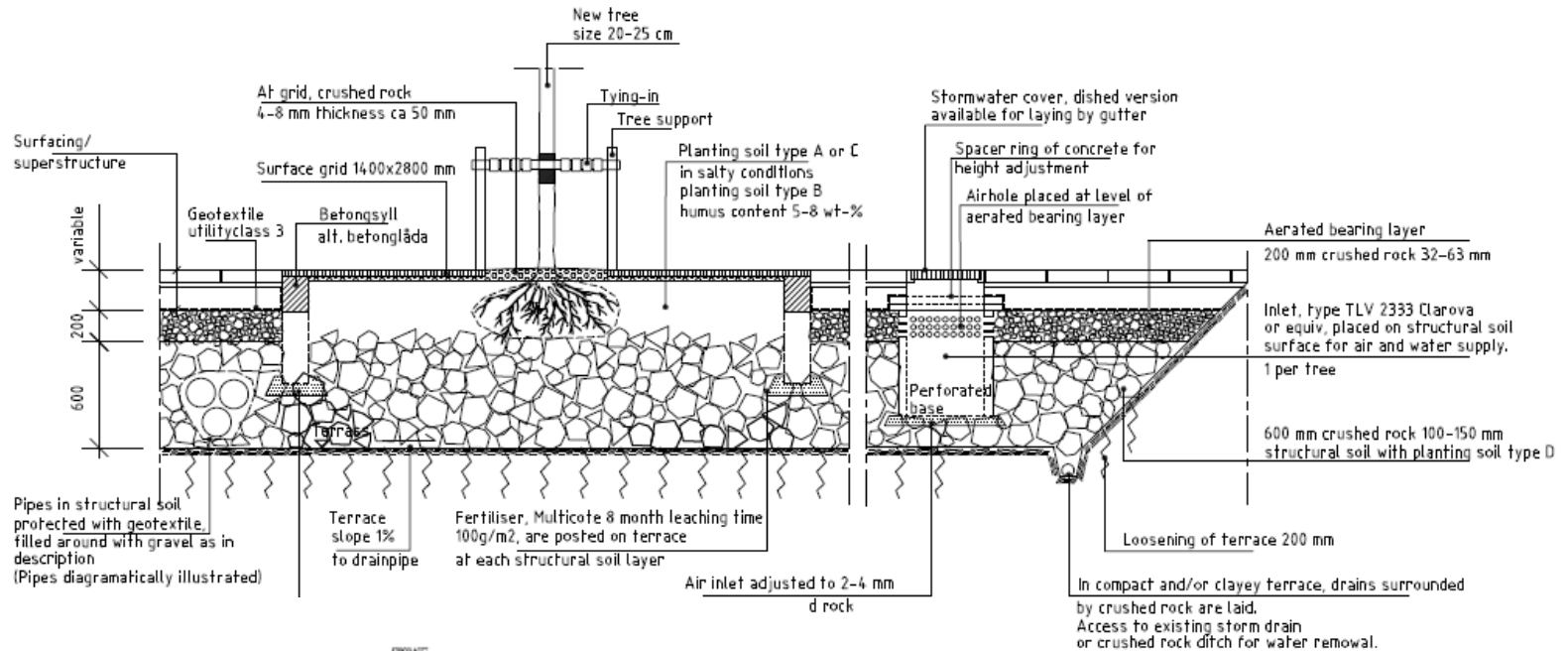


PLANTING BEDS IN THE CITY OF STOCKHOLM  
A HANDBOOK

2009.02.23 GH100322







**NOTES**  
 Soil equipment such as gratings, trunk guards, tree support are specifically adapted to the project.  
 Fine crushed rock must not be used in structural soil profile for adjusting air inlet or concrete bunker.  
 In specially constructed tree holes with narrow dimensions tree root diameter must be observed.  
 With increasing trunk circumference clump diameter increases, see Quality regulations for nursery plants, GRS Plantskolektion, 3:e upplagan, augusti 2003.

**NOTESANMÄRKNING**  
 All data in mm unless otherwise specified.

TRÄGGROP I HÄRDGJORD YTA MED MARKGALLER,  
 STAMSKYDD SAMT LUFTHINGSBRUNN  
 PLAN  
 SKALA 1:25  
 TRÄGGROP I HÄRDGJORD YTA MED MARKGALLER  
 2009-02-23

Status: TH-TYPRITNING Datum: 2009-02-23  
 Godkänd: B.ENGREN

**TRAFIKKONTORET**  
 Box 8301, 104 20 Stockholm, Tel 08-666 27 200

TREE IN PAVED AREA  
 WITH SURFACE GRID

SECTION  
 Skida: 1:20(A2)/1:40(A4) Ritning: THVB004 Foto: Reg.







# Stone fraction 100 – 150 mm

















Flushing the soil into the structur with a hard jet and as little water as possible





Slow release fertilizer





Closed top of the concrete box to hold the pavement and bearing layer in place





The stone should fall into the frame/box to get a natural stable repose angle



























TIGERN

TRAILANDER

TRAILANDER

TRAILANDER

TRAILANDER

Widder











10 years of using a combined volume for roots and infiltration of surface water, has shown a very good establishment and very high growth rate for urban trees





The growth of branch shoots are approx. 30 - 50 cm per year





Large amount of roots in both the structural soil and in the layers of bare rocks!





Massive root development in the rock layer!



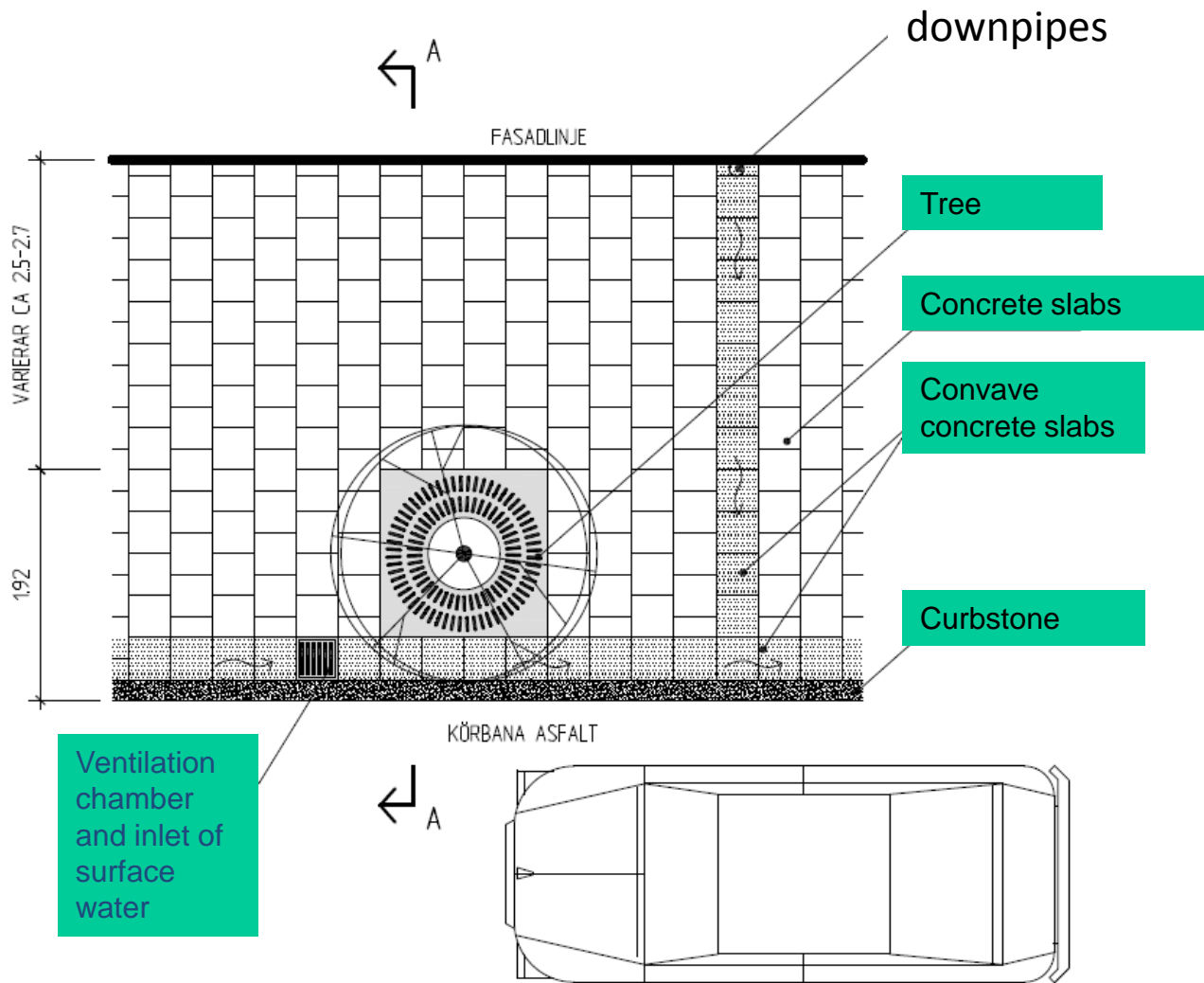


- We take water from roof and pavement and by inlets lead it down to the aerated bearing layer and the structural soil.

- In one block Roof and pavement surface is 4600kvm  
Rainfall is 600mm year (2 ft) in Stockholm  
Approximately 2.3 million liters of water every year  
Saved cost for the treatment of stormwater = 4000 Euros  
Reduced load on the Baltic Sea / and lakes at torrential rains







PLANDETALJ, PRINCIP

Ritning: Tyréns







Rainwater from 2 500 M<sup>2</sup> of roofs and sidewalks leads in to the soil pit of 12 trees and in the airy layer and the structural soil beneath the sidewalk.





Tree at the left are the original tree approx 100 years old. Tree at the right planted six year ago!!





An area with bad functions for aesthetics values and stormwater management!





The same area after replanning and reconstruction. All roof and surface water are infiltrated into rooting area of the trees!!



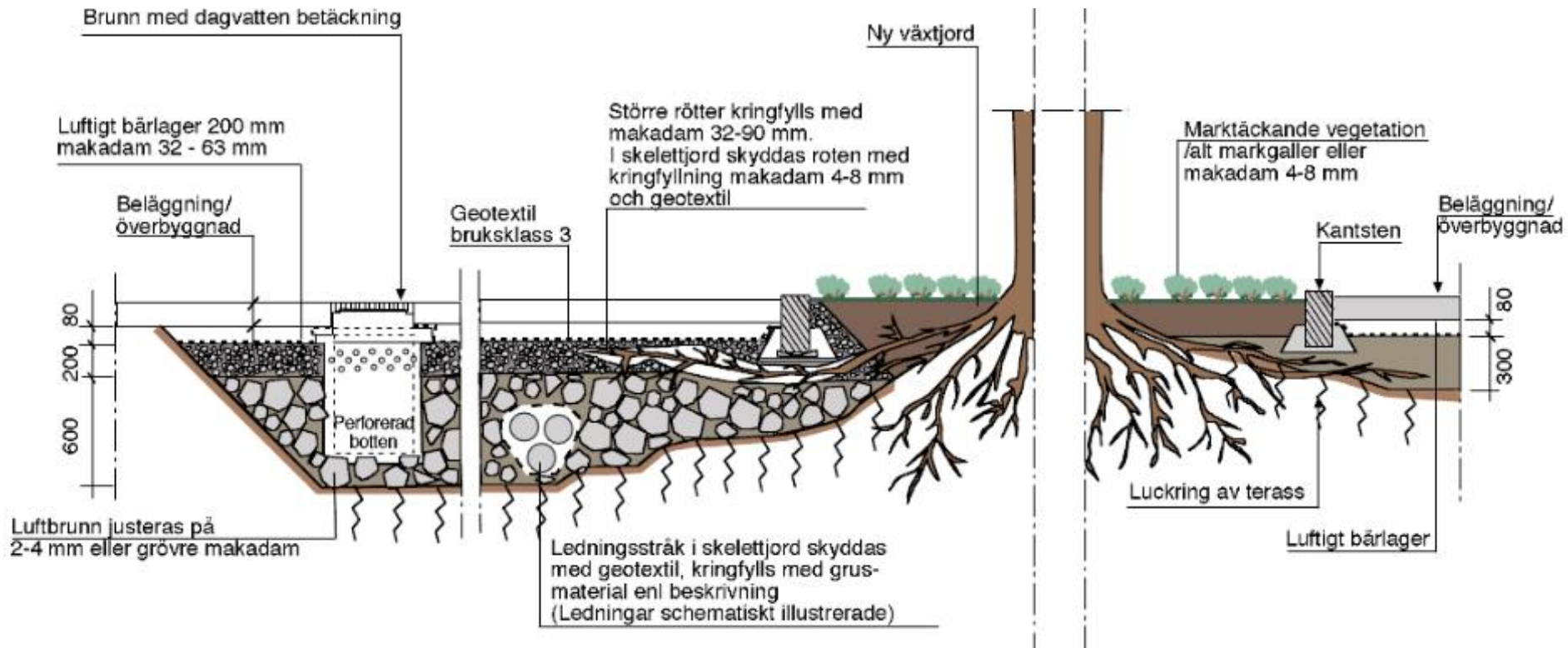


Improving root environment for mature trees which give urban trees a significantly extended life length and at the same time changing stormwater from a problem to a valuable resource





# Infiltration and retention of stormwater in plant beds close to mature trees









Linden trees  
Summer 2004





Linden Trees  
Summer 2013







Tegelbacken 2010





Tegelbacken 2012



# Tilia Kungsbroplan left 2002 right 2010





Approximately 2 000 planting beds have been rebuilt





Want to know more about how we work with plant beds in Stockholm, so check our handbook

<http://international.stockholm.se/>

write handbook in the search field

1. Search

[Planting beds in the City of Stockholm. A \*\*handbook\*\*.](#)



Adobe Reader

7337kB

PLANTING BEDS IN THE CITY OF STOCKHOLM - A **HANDBOOK** - 2009.02.23 - GH100322 - 2009.02.23 GH100322 - FOREWORD - This **handbook** was produced on the initiative of the City of Stockholm - through Björn Embrén. The aim of the **handbook** is to communicate infor-

...

<http://www.youtube.com/watch?v=S7kbSnnJwDI>





Thank you for your attention and if you are passing, welcome to Stockholm we would be happy to show our projects.