Treeparker®

STRUCTURAL SOIL CELL SYSTEM

The perfect solution for planting urban trees

tree BUILDERS®

Urban tree solutions

Trees are perfectly suited to create more green in our living areas that today are mostly made of stone. At the human living level, trees consume little space while at the same time trees can span entire roads with their canopy of leaves.
However, we often overlook one fact: trees do grow. We often plant small trees, but only large mature trees are truly functional and profitable. However, the life expectancy of the average urban tree is, unfortunately, only ten years. At TreeBuilders we believe this can and must be changed. This is why our mission is to increase the average life expectancy of our urban trees.
The many factors that determine the growth of a tree but that we are unable to influence, must not be a reason for ignoring the basic principles underlying the healthy and long-term growth of trees.
The basis for this growth is located underground. This is the area in which TreeBuilders specialises; underground planting conditions for trees in paved environments.

Searching together for the best solution to your tree planting space issue.

There are no one-size-fits-all solutions for tree planting space layouts. Every project is different from any other project: the circumstances, quantities, accessibility, tree size, budget, etc. The design objectives are key in relation to the ultimate choice: what is the final result we have in mind and do we link the tree planting space to the rainwater management system or not?
Our objective is to provide you with advice relating to all available options. And, if applicable, the specific option that best suits your project. This way we help you select the right urban tree planting system that meets your specified objectives.
TreeBuilders with its broad product portfolio of tree planting products has successfully enabled many trees to grow into healthy mature trees in the urban environment. The treepit is of essential importance in this process. We are pleased to share our knowledge acquired by implementing more than 1,400 structural soil cell systems throughout the world. We are also pleased to tell you about the differences in insights in various countries.
There are many economic benefits associated with a longer tree lifespan and the creation of larger, healthier urban trees. In addition to the economic benefits, the improved quality of life produced by trees and the landscaped areas in our cities are of major importance. We are pleased to share with you our knowledge in this field of expertise. While we can do this by e-mail, we are also pleased to come and visit you at your location. Alternatively, you can visit our presentation area in Heeswijk Dinther in the Netherlands where all of our products are on display.
We look forward to receiving you there.

"Imagine if trees gave off WiFi signals, we would be planting so many trees and we'd probably save the planet too.
Too bad they only produce the oxygen we breathe."

The importance of trees for our environment

Trees are of much greater importance to the quality of the living environment than you would think at first thought. They not only beautify the surroundings, they can also make a major contribution to improving the often poor living conditions in our cities. Such as trapping fine dust, creating shade, cooling the environment through transpiration, etc.
Maintaining and improving the tree population in a city is a good method of making our living environment healthier. This is important because the hidden costs of poor air quality are enormous. The conclusion drawn from research conducted on behalf of the Health Service is that the effects of air pollution cost society a minimum of 250 euros per resident per year.
The positive effects on air quality is one of the most important reasons for maintaining as many trees as possible within a city. But there are many more benefits associated with a 'green' city.

- Trees play an important role in increasing urban biodiversity, because they provide plants and animals with habitat, food and protection.
- A mature tree is capable of absorbing ***150 kg CO2*** per year. As a result, trees play a key role in limiting the effects of climate change. Trees are able to improve air quality, especially in cities with high pollution, making them a healthier place to live.
- When trees are strategically positioned in a city, they can make the atmosphere ***2 to 8 degrees cooler.*** This reduces the so-called 'urban heat island' effect and enables urban communities to adapt more easily to the effects of climate change.
- Large trees are excellent filters for urban polluting substances and particulate matter. They absorb polluting gases and filter small particles, such as dust, dirt or smoke from the air by trapping them on their leaves and bark. A single tree absorbs ***approx. 500 g PM10, approx. 500 g ozone and approx. 200 g NO2 per year.***
- Research shows that living close to green urban areas and having access to these areas, improves physical and mental health, for example by lowering blood pressure and reducing stress. This in turn improves the well-being of urban communities. ***Save 25 euros per resident per year with 10 percent more green.***
- Mature trees regulate the flow of water and as a result relieve our sewer systems. They also play a key role in reducing the risk of natural disasters and preventing floods. For example, an oak can ***absorb more than 190,000 litres water per year.***
- Trees also help reduce CO2 emissions by storing energy. For example, by placing trees at the right location around buildings the need for air conditioning can drop by as much as 30 percent, while ***heating costs can be reduced by 20 to 50 percent*** in winter.
- Planning urban landscapes using trees ***increases property values by as much as 20 percent*** and attracts tourism and businesses.

The best way of planting trees in the city

No other element has the ability to contribute such a wide range of diverse and long-term benefits to the urban environment than well-established mature urban trees.
To make optimal use of these benefits, the trees must grow into mature large trees. A single large functional mature tree yields more value than 400 small trees. Proper planting conditions are required to allow the newly planted urban trees to grow into such functional trees. Combining technical tree and civil engineering requirements is the major challenge in achieving a proper planting environment. Various planting methods are discussed below.

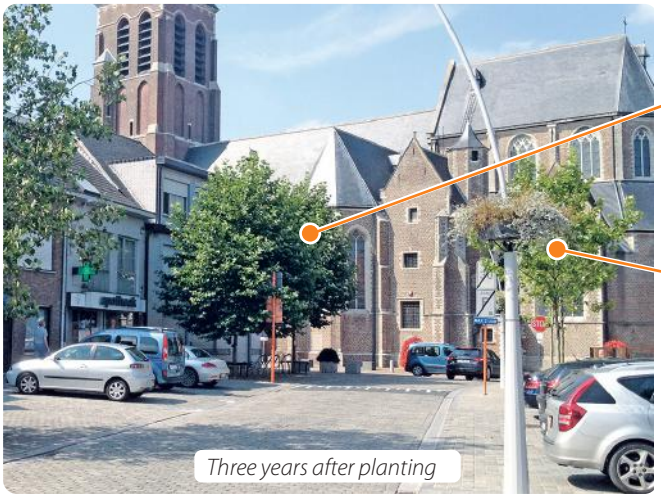
Research: Comparative research for tree planting solutions in hardened areas, Bartlett Tree Laboratories, Dr Tom Smiley 2015.
Following the construction of various tree planting solutions in an arbitrary arrangement, six Liriodendron trees were planted for each solution. The provisional results show that the trees in the most efficient solution perform best. From this it is possible to assume that soil volume calculations must always be based on soil efficiency (net available soil) instead of surface area or product volume alone.

Structural soil — *20% efficient*

Amsterdam tree soil — *50% efficient*

Structural soil cell — *93% efficient*

Loamy topsoil — *100% efficient*



Comparison of urban tree planting solutions in actual practice. Brecht, Belgium.

Plane trees of the same size planted on both sides of the street in the same year.

Photo above:
Five years after planting

Photo below:
Five years after planting

Research on why roots lift up pavement

Research: Randrup, McPherson and Costello 2003
Their research focused on factors that affect damage caused by roots. What conditions can be expected to cause more or less damage. Because street repaving costs are substantial, the original research also included a cost summary.

Conclusions: Pavement lifting increases as the roots become thicker. The fact that roots increase in thickness as the tree grows is unavoidable. The ground mass increases as the trees grow. Thick roots that grow deeper into the profile cause less visible pavement damage.

Pressure dispersing tree planting solutions
These solutions use foundation materials that can be penetrated by roots. As such they constitute a compromise between load-bearing capacity and root growth. A cellular confinement system (CCS) like sandwich construction provides for additional pressure dispersion. Despite the fact that pressure dispersing solutions can help avoid many problems, root upheaval is unavoidable over the longer term. But they do reduce the visual pavement damage caused by root growth.

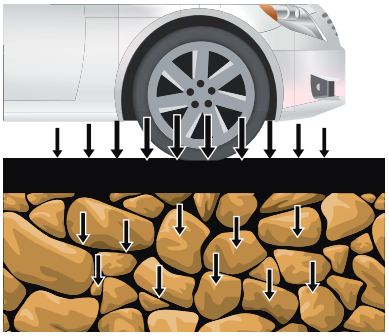
Suspended pavement system
This is comparable to a cellar that carries the traffic loads. The soil within the cellar is completely released from traffic loads. The soil can expand within the air layer present, thus avoiding pavement lifting caused by rootgrowth.

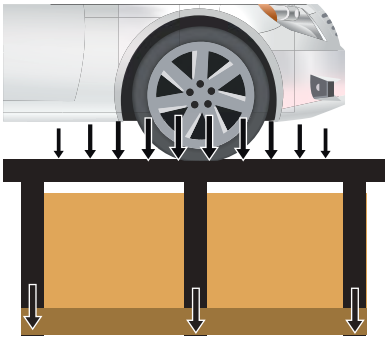
Rock based Structural soil (RBSS)
Viewed from the perspective of the tree this is a load-bearing stone-based growth medium.
From a civil engineering perspective this is a foundation material penetrable by roots.
The RBSS consists of crushed stone of equal size (70 to 80 percent). The pressure on a single stone is distributed across multiple stones, thus dispersing the pressure throughout the material. The LA value of the stones is important in terms of their load-bearing capacity. It is possible to provide for sufficient load-bearing capacity for heavy traffic.
The pores between the stones are filled with soil, in which the roots can grow. Approximately 20 percent of structural soil is real soil. Tree growth is dependent on the quality of this soil. Depending on the stone size, the RBSS allows for thicker roots.

Amsterdam tree soil (Sandbased structural Structural soil, SBSS)
The effectiveness of SBSS is comparable to that of RBSS. However, SBSS uses uniform sand as its basis.
The load-bearing capacity of SBSS is only suitable for light traffic loads. The advantage of SBSS is that is can be applied on and around cables and pipes in contrast to RBSS.

Sandwich construction
When a sandwich construction or other CCS is used, the SBSS is better resistant to traffic loads and is less prone to rutting. Another advantage is that the air layer in the sandwich construction inhibits root upheaval because it prevents roots from growing directly below the pavement. (asphalt, pavers etc.)

Structural soil cell
This is comparable to a cellular rainwater attenuation system. But with the difference that a soil cell can be filled with a high-quality growth medium. The system (only 5 to 25 %) relocates the pressure loads to below the rooting volume, as a result of which the growth medium is completely relieved from compaction due to heavy traffic. The soil/root volume can expand without any pavement damage due to the variable air layer present between the soil and the system.
The system's effectiveness depends on the percentage soil that is actually present in it; 75 to 95 % soil volume.
The quality of the soil used determines the tree's growth to a large extent. The trees preference is loamy soil.

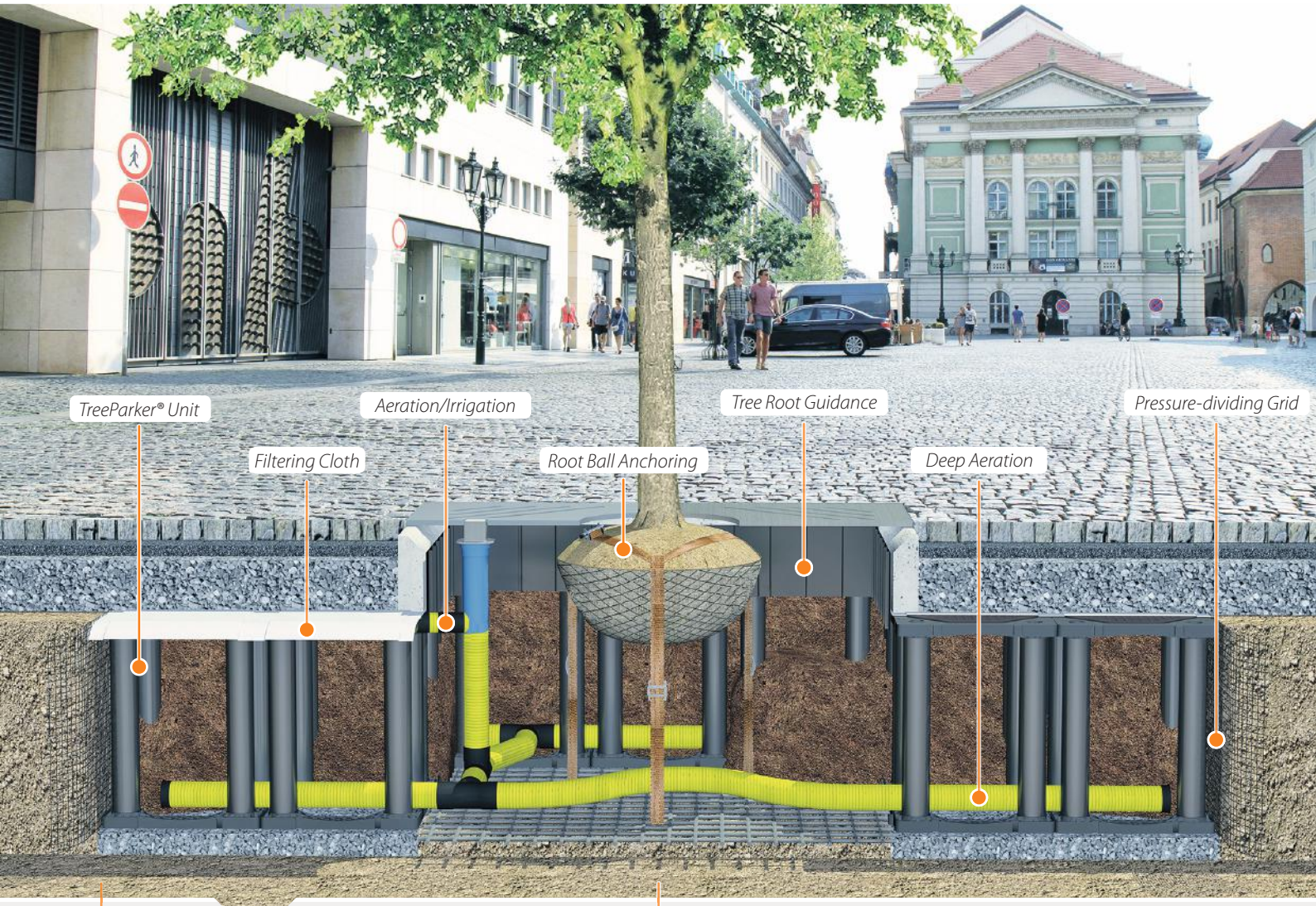




Treeparker®

A structural soil cell system with superior functionality

TreeParker® is the renovated generation of structural soil cells developed by Treebuilders. TreeParker® was developed as a result of the experience gained through trials, projects and cooperation with various disciplines, such as tree specialists, water managers and civil engineers.



Able to withstand loads of up to 550 kPa

Suitable for heavy traffic.

Utility friendly

The system can be adjusted on-site to accommodate the presence of new and exsisting utilities

Suitable for growing large trees

Smallest rooting opening is larger than Ø 30 cm and no need to make any concessions relating to the growth medium.

Every variable height up to 150 cm

The system's height can be adjusted to suit the maximum required height.

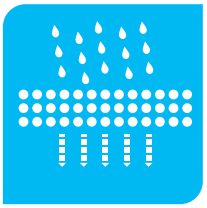
Combining root and watermangement

The system absorbs rainwater which is then filtered in a natural way.

A smart combination of Green, Grey and Blue

Root-friendly
Maximum soil volume
Water and air capacity
High soil quality

Axle load of up to 15 tonnes
Utility-friendly
Pavement-friendly



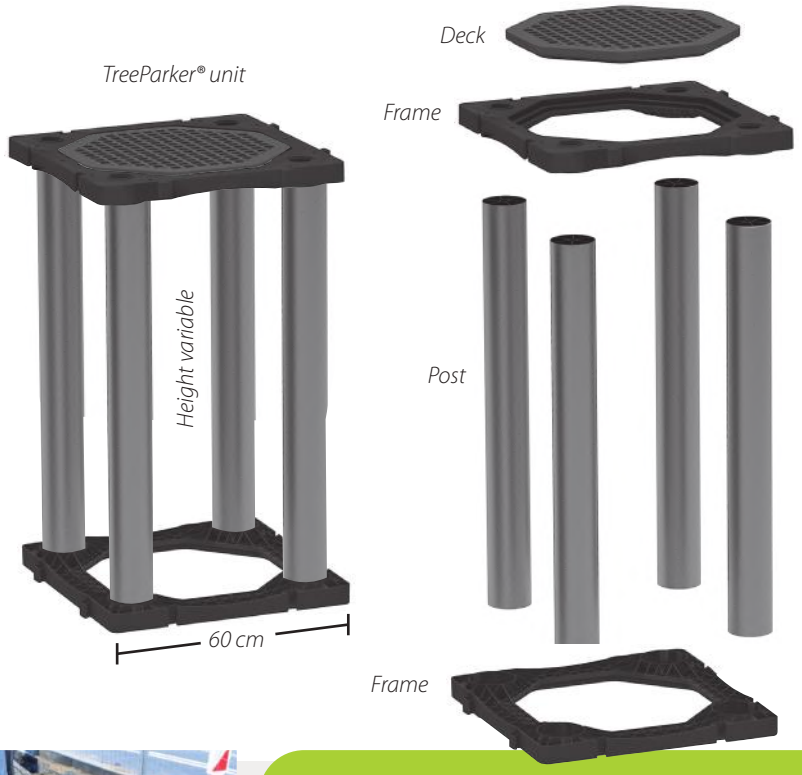
Stormwatermanagement
Biological filtering
Maintenance-free

Many cities throughout the world are already familiar with our systems; from cold Nordic countries (Scandinavia) to the tropic area (Middle East). Not only the main cities but also small villages are integrating TreeParker in their public space.

Most challenges are everywhere the same; integrating utilities, traffic loads, pavement lifting by roots, etcetera. We have been facing these challenges many times and adapted solutions in our TreeParker product. Best advice we can give you is to get all departments involved in urban tree planting.

Available throughout the world:
Because of efficient transport costs TreeParker is available at affordable and competitive pricing throughout the world. For references in your region please contact info@treebuilders.eu. We will be pleased to contribute making your city /project greener.

Simplicity is its strength
Simplicity characterises the system. Through a simple and smart design the TreeParker® system can be installed in any tree planting space.
It is easy to customize your tree pit design to your needs. Each independent unit has sufficient load-bearing capacity, which means that the units do not need to be linked. Just shift the units into position with a maximum spacing of 75 mm. Variable heights are available. We recommend that you use the maximum depth for reduced space requirements (sqm)and lower costs



Denmark, unforeseen obstacles underground.
"In the drawing everything looking good" according the contractor. But the city heat system was not in the drawing. "We were happy that we could adapt the TreeParker® system to the right height. That's the only reason we could plant a tree and still respect the function of the utility.

TreeParker® offers the right solution for any challenge within the city

Little underground space

Unfortunately, there is little space for tree roots in urban areas. The underground space is limited by other infrastructural works, structures, etc. The tree's ultimate size is generally limited by the available rooting volume and the soil quality.

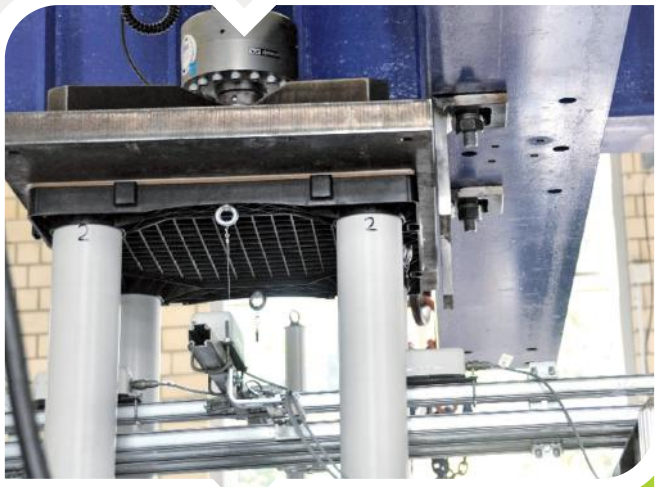
Civil engineering requirements and trees

To prevent the subsidence of our roads and squares, the soil is heavily compacted. This compaction limits the growth of roots. The result: trees die off prematurely. The trees that do survive often cause pavement damage because the roots grow bigger and/ or just below the pavement looking for oxygen, nutrients and water.

Optimising the tree pit

TreeParker® provides additional rooting space below pavements subjected to heavy traffic loads. The system does not impose any limitations on the growth medium to be used. The applied growth medium forms a continuous soil volume with natural water and air management. The soil within the system is in contact with the surrounding soil, the so-called side effect, which is important in extreme situations.
TreeParker is the most effective structural soil cell system. Up to 95 percent of the system is filled with the best available soil for the tree. This way, with a small volume, a large tree can be provided with sufficient water and nutrients.

Dimension the tree pit with the future size of the tree in mind.



Tested for the heaviest traffic loads

TreeParker® consists of modular units that are strong enough to bear trucks. The forces are transferred by the road's foundation to the underlying foundation via the system. This way the system meets the civil engineering requirements. The open space in the system is filled up with soil that is suitable for the tree. Root growth is not limited due to heavy compaction. Because the system is not completely filled with soil, there is room for the soil to expand as the root mass becomes larger. With TreeParker® damage to pavement caused by roots is history.

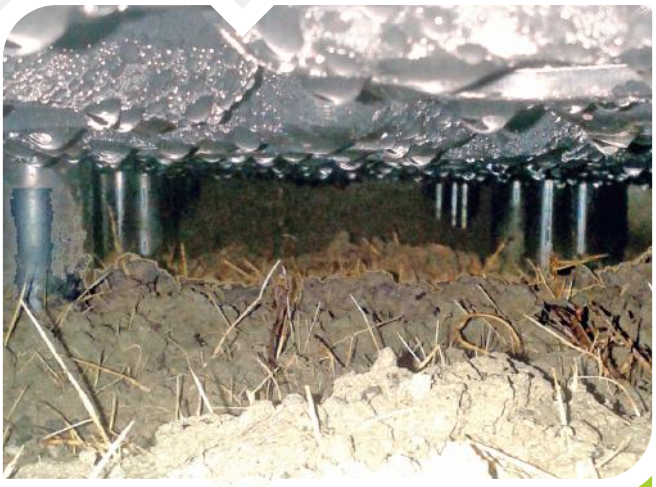
Tested in Germany, University of Münster, Civil Engineering department. Suitable for trucks.

Climate change – more extreme weather

This year too it is clear: we are increasingly more often faced with longer periods of drought and more severe downpours. The weather is becoming increasingly extreme. The largest problem in cities is water. Our discharge systems are not sized for these heavy downpours, resulting in a great deal of damage and disruption.

Underground infrastructure

Unfortunately, the lack of space for planting trees is a major problem in our urban environment. And the space that is available is crisscrossed by all kinds of utilities. There is therefore a need for combining the green infrastructure (eg. trees) with the grey underground infrastructure.



Combined rainwater intake and bioretention system

Current systems discharge rainwater, while the trees in the city dry out. It is more logical to first enable the tree to benefit from the rainwater and only then discharge it. This requires an integrated approach and an infiltration system that is suitable for tree roots as well as rainwater infiltration. TreeParker® is designed to combine these two functions. The system for the most part operates as a water intake system, but then filled with a self-cleaning filtering material; trees, tree soil and soil life. A so-called bioretention system. The larger the tree becomes, the better the system functions.

A look inside the system. Projects are regularly tested in terms of operation and soil samples are also regularly taken.

Possibility of integrating new and existing utilities

TreeParker® is designed for the urban environment with its many underground utilities. During installation it is possible to flexibly adjust the system to the underground circumstances. No longer any surprises. The contractor adjusts the system as the work progresses, in terms of length, width and/or height. A key factor here is that it is not necessary to interlink the individual units to comply with load-bearing requirements. In approximately 80 percent of our projects existing as well as new pipelines are integrated into the system. Ask for our manual concerning the integration of utilities.

One of the many projects in which cables and pipelines are integrated into the system.

A stormwatermanagement system that is suitable for tree roots as well as rainwater

Current systems discharge rainwater, while the trees in the city dry out. This principle is frequently applied. It is more logical to first enable the tree to benefit from the rainwater and only then discharge it. This requires an integrated approach and an infiltration system that is suitable for tree roots as well as rainwater infiltration.
Trees in the vicinity of rainwater intake and infiltration facilities are often considered a problem during the design phase. Yet it is precisely such trees that offer more opportunities than you might think at first glance. Why do trees cause problems for an infiltration facility?

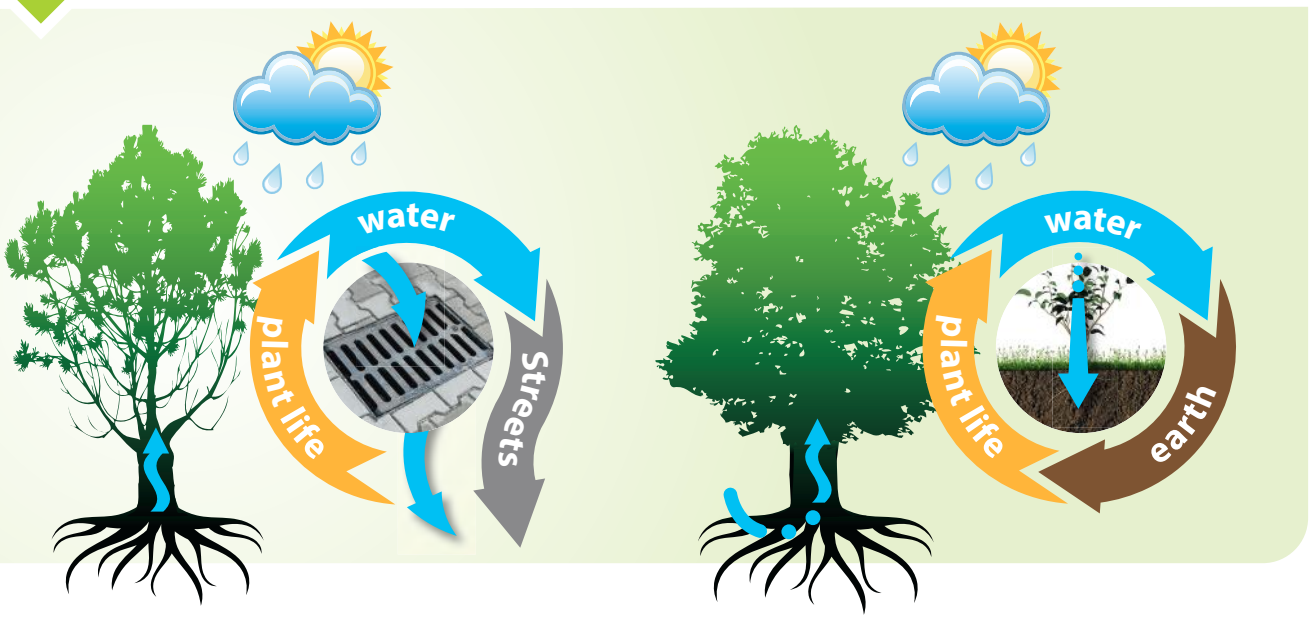
From threat to opportunity

Trees offer many benefits and are an indispensable element in our urban infrastructure. Trees are even planted in fully paved surfaces, and for more reasons than one. These costs of the tree pit and planting the tree are already included in the plans. The future maintenance of these trees is also assigned to management departments at this stage. It is therefore not surprising that increasingly more often the tree planting space is combined with rainwater intake, infiltration and filtration. With little additional cost, the standard tree pit can be transformed into an underground bioretention system. TreeParker® is designed to combine these two disciplines, thus creating a healthy water cycle in the city. The water is first channelled to the tree pit where it infiltrates the non-compacted soil. Pollutants are broken down by nature – the soil life – so that only clean water flows into the groundwater. Trees are no threat to rainwater infiltration facilities. When applied the right way, the trees, in combination with a bioretention system, ensure that the water intake system functions increasingly better, year over year.

The soil in TreeParker® has two key functions: making it possible to grow large trees and treating rainwater on-site.

Additional benefits of the TreeParker® bioretention system for liveable cities include the following:
- Improved water quality
- Reduced peak rainwater discharge
- Maintenance-free
- Ability to use any type of soil
- Efficient use of scarce space

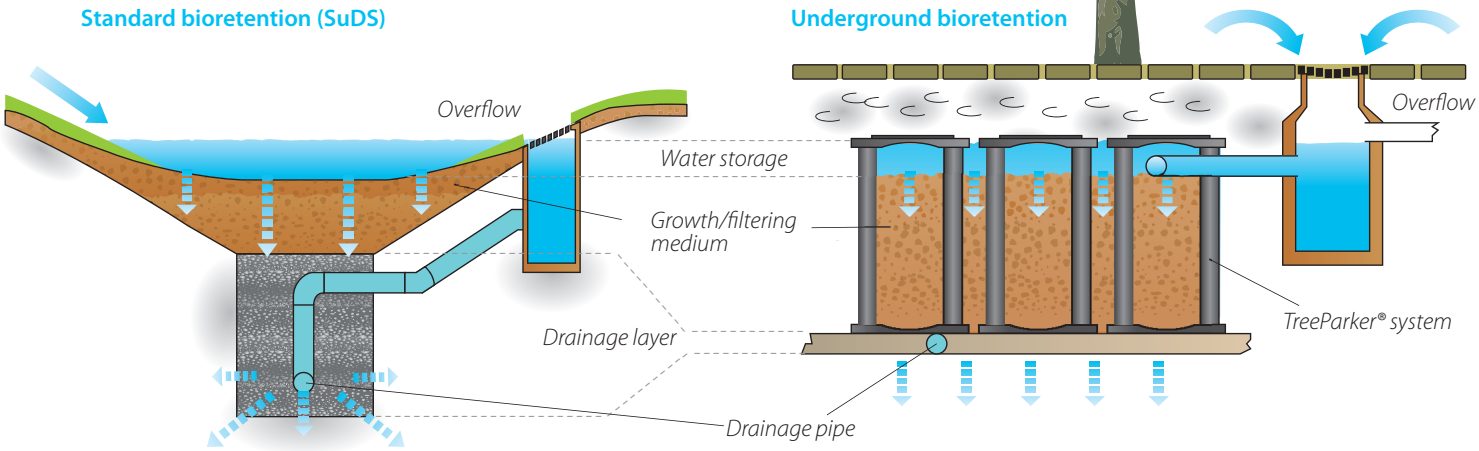
If you would like to know more about the possibility of using tree pits to help address your rainwater problems, contact our specialists for more information..



Bioretention Definition

Bioretention is the process that removes polluting substances from rainwater discharge using physical, biological and chemical treatment processes. The direct use of green living plants and trees to clean up contaminants is referred to as phytoremediation.

This process stabilises or reduces contaminants in soil and groundwater. The different forms of phytoremediation are phytoextraction, rhizofiltration, phytostabilisation, phytodegradation and phytovolatilisation. In a bioretention system, natural processes are activated above as well as underground to improve our living environment.

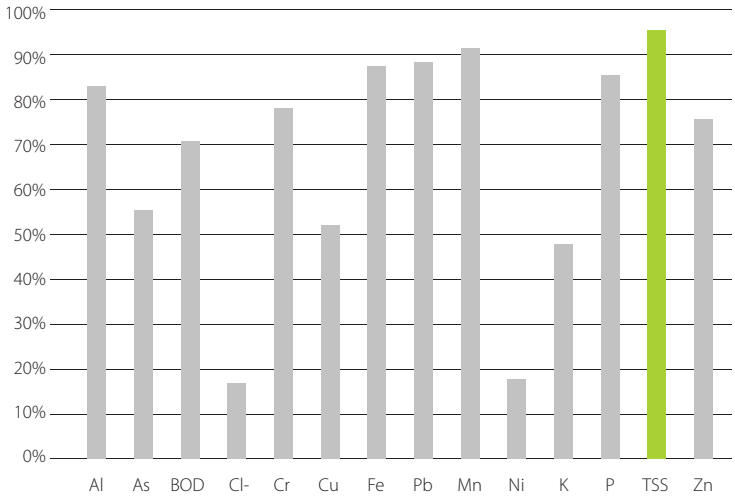


Interception and evapotranspiration: large trees intercept and evaporate significantly more rainwater than small trees. A healthy forty-year-old tree processes fourteen times more water than a ten-year-old tree. (McPherson et al. 2006).

Long-term infiltration: when roots grow and die, they leave behind open channels within the soil that restore and/or improve porosity and infiltration speeds. Various studies confirm improved operation with plants/trees versus without (e.g. Lucas and Greenway 2011).

Water quality benefits: phytoremediation is crucial to achieving many water quality benefits, including the removal or storage of dissolved nutrients, hydrocarbons and Total Suspended Solids (TSS).

Table: Absorption of pollutants in an underground bioretention system planted with trees.



Installation of the TreeParker® system

Despite the many design and layout options, the system is easy to design and install. It works just like a LEGO system. Immediately after the system has been installed, the pavement can be constructed. Ask for our comprehensive manual.

A key consideration is the excavation and the underground preparation; in many cases this is the most time-consuming task.

The frames are installed in accordance with the layout drawing. The units can be installed with a spacing of up to 75 mm; this means that curved installations and deviating dimensions are also possible. Operating dimension: max. 675 x 675 mm.

After the frames are placed in accordance with the drawing, the posts and the closing frames are installed. The posts are available in any height. Furthermore, the height can even be adjusted as the work is in progress to deal with unexpected circumstances.

After all units have been installed and the cables and pipelines have been integrated, the system is enclosed by a vertical wall. This wall can be water permable or root-resistant.

The system is not completely filled; a variable air layer is required to prevent pavement lifting caused by rootgrowth. The air layer is provided with an aeration/irrigation system, which is needed for the supply of oxygen and water.

The system is now ready to be filled. Maximum compaction around the system is important. The soil within the system is only slightly compacted by foot to ensure that the maximum volume of soil is available to the tree.

When everything is installed, the system can be sealed. The system is also suited underneath water-porous pavement; the rainwater infiltrates down to the soil through the porous covers.

Before the pavement is finished it is important to construct the treepitcurbing. Any type of shape or finish on top of the TreeParker® system is possible. However, we recommend that you make the open treepit as large as possible.

Frequently Asked Questions

How many cubic metres do I need for a tree?
Rules of thumb, such as 1 m3 (qm) per year of growth or 0.75 m3 per m2 of crown projection are often used.
We are noting that these rules of thumb are still often used without further interpretation of the underlying assumptions. TreeBuilders is pleased to perform the necessary calculations to respond to your question. We use the calculation standards published by the Dutch National Tree Institute for this purpose.
When we are asked 'How many cubic metres do I need?', we will ask you the following questions in return. The more answers we receive, the better our estimate.

- Tree species (or if not yet known, tree size and crown shape)
- Tree's cycle time, lifespan (or the tree's prevered size height and /or diameter)
- Availability of water. Groundwater, pendulate water profile or irrigation system.
- Is any rainwater able to reach the root zone, and if so, how? (Water-porous pavement or diversion of rainwater to the tree pit, etc.)

Note: what is 1 m3?
The m3 we calculate is the m3 soil actually put into our structural soil cell system.
The system volume consequently is somewhat larger, namely: soil volume + system volume + air volume in the system.
We also assume that the soil is slightly compacted. This is because it is important that the fill-in soil is slightly compacted (1-1.5 MPa penetration resistance). This is furthermore the soil's natural compaction; under these conditions, the soil structure recovers immediately. A system filled with loose soil contains less soil after natural settlement than initially assumed. Loosely deposited soil can settle by up to 25 percent.

Our response:
Various assumptions were made below on the basis of the answers we received.
On the basis of the requested cycle time or the expected final result (crown diameter) you can use this table to look up how much m3 soil you need in a structural soil cell system.

Your data (site information)

Climate zone	CFB (mild marine climate)
Tree species/size	Platanus x hispanica | Plane tree | (Class 1 tree)
Water management	Pendulate water profile (no contact with groundwater level)
Tree planting solution	Structural soil cell filled with tree soil 7-10% org. matter

Calculation information

Life cycle	20	40	60	80	year
Crown spread	10	15	20	25	m

Required rooting space (m3)

(Target level) Optimal	20	30	40	50	m3
(Target level) Standard	16	24	32	40	m3
(Minimum level) Marginal	12	18	24	30	m3

obstacles free space aboveground	6	9	12	15	m
obstacles free space underground = minimum excavation distance	1.6	1.9	2.3	2.9	m
Open treepit	1.6 x 1.6	1.9 x 1.9	2.3 x 2.3	2.9 x 2.9	m

Why we use plastics

Due to new techniques and improved production changes, now plastic exceeds the performance of concrete. Plastic has already exceeded the application possibilities of its concrete and steel variants in the world of suspended pavements for some time. Also in terms of durability (lifetime), plastics last longer than the concrete systems. The plastics used are inert in underground conditions. Microplastics only arise under the influence of UV light.

We only use reclycled plastics

We're closing the loop: high value plastics, less energy.
Recycled plastics save over 80% of the energy needed to produce virgin from petrochemicals, saving enormous amounts of greenhouse gases. Using recycled plastic means less waste will end up in the oceans. And you can help, just by collecting your plastic waste for recycling. At the recycling plant, we first separate polymeric materials from highly complex waste products. Secondly, we clean, sort and purify the resulting plastics by type and grade until they're ready for re-use in demanding applications. New techniques make it possible to separate different kind of plastics, good separated plastics can be re-used many times in the same application (cradle to cradle concept) .
Because of different colours in the recycled plastics, the colour of our products may vary per production batch. Colour differences do not affect quality.

TreeParker® most sustainable system

NL Greenlabel

Based on the assessment in combination with expert judgement by specialists.
Stabilitas awards the following score to this product:

NL Greenlabel A+

This sustainability score is valid from March 2017 until March 2020

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Our specialists stand ready to assist you.

We will provide you with the following services:

- Investigate the use of various urban tree planting solutions for your project.
- Perform soil volume calculations so that your targeted result in fact becomes reality.
- Develop a complete design of the tree pit layout.
- Review your drawings and specifications, optimise your tender documents sent to contractors.
- Design rainwater intake by urban trees, bioretention.
- Provide assistance during implementation.

We are pleased to share this knowledge with you in various ways:

- Presentation on tree pit design options: from structural soil to suspended pavement systems.
- Presentation on stormwater management by trees; underground bioretention.
- Standard detailed drawings for various solutions and associated tender documents.
- Product training and/or installation training.

View our website for our comprehensive portfolio of solutions and tree planting designs.
www.treebuilders.eu

Urban tree solutions