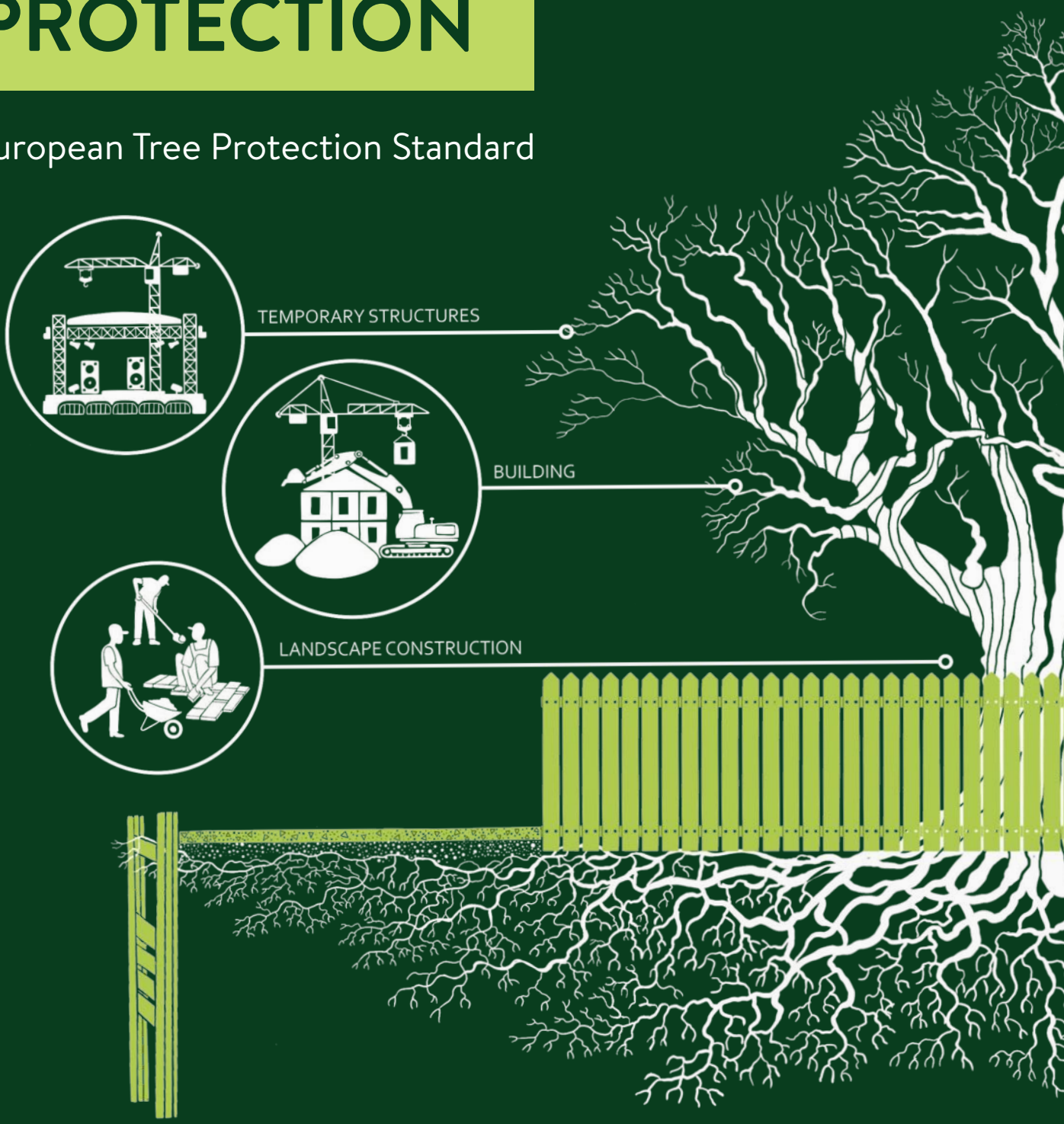
TREE PROTECTION

European Tree Protection Standard



European
Arboricultural
Standards

European Arboricultural Standards

EUROPEAN ARBORICULTURAL STANDARDS

Tree Protection

2025

BG: Защита на дърветата
CS: Ochrana stromů
DA: Beskyttelse af træer
DE: Baumschutz
EL: Προστασία δένδρων
EN: Tree protection
ES: Protección de los árboles
ET: Puude ehitusaegne kaitse
FI: Puiden suojaaminen vaurioilta rakennustyömailla
FR: Protection d'arbre
GA: Cosaint crann
HR: Zaštita stabala
HU: Fák védelme
IT: Protezione degli alberi
LT: Medžio apsauga
LV: Koku aizsardzība
MT: Ħarsien tas-siġar
NL: Boombescherming
PL: Ochrona drzew
PT: Proteção de árvores
RO: Protecția copacilor
SK: Ochrana stromov
SL: Zaščita dreves
SV: Trädskydd
UK: Захист дерев

We are very grateful for all the comments and support from national arboricultural representatives and individual arborists across Europe, who responded to the call for cooperation on the text of this standard.

This standard is intended to define methods of protection of amenity trees during design, construction and demolition works and other activities, including events impacting the tree's environment.

Co-funded by the Erasmus+ Programme of the European Union

Editorial:

Standard text:
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Recommended reference:
European Tree Protection Standard (2025). EAS 06:2025. European Arboricultural Standards (EAS), Working group “European Consulting Standards in Tree Work (ECoST).

EAS 06:2025 (EN) – European Tree Protection Standard.

If you want to translate text of the standard to other languages, please contact the project leader on info@arboristika.cz

Contents

1. Purpose and content of the standard

1.1. Purpose

1.1.1 This standard was published by the working group of the ECoST project (European Consulting Standards in Tree Work) in cooperation with the EAC (European Arboricultural Council) and was released in January 2025.

1.1.2 In the text of the standard, the following formulations are used:

- where the standard says 'can', this refers to possible options,
- where the standard says 'should', this refers to a recommendation,
- where the standard says 'must', this refers to mandatory activities.

1.1.3 The objective of this standard is to demonstrate contemporary methods for safeguarding trees during development projects and other activities (events) which affect trees and their growing conditions. This standard embodies common practices adopted throughout European countries.

1.1.4 This standard provides operational guidance designed specifically for individuals engaged in arboricultural consulting and those involved in planning, designing, and overseeing or carrying out development activities and other events that are in the vicinity of trees and have the potential to substantially change their conditions.

1.2 Main objectives

1.2.1 Green infrastructure encompasses a network of natural and semi-natural areas, including parks, gardens, greenways, urban forests, and water bodies, strategically planned and managed to provide a range of ecosystem services and enhance the overall quality of life.

1.2.2 In urban environments, it plays a crucial role in mitigating the heat island effect, enhancing air and water quality, and providing recreational spaces for inhabitants. Rural green infrastructure also supports biodiversity, underpins agricultural productivity, and maintains ecological connectivity between habitats.

1.2.3 By integrating green spaces into urban design, cities can enhance resilience against climatic extremes, offering natural solutions for flood mitigation through permeable surfaces and vegetation. In rural settings, green infrastructure contributes to soil conservation, water resource management, and preserving the rural character of the landscape.

1.2.4 Trees are immensely important in our environment, so it is essential to either avoid or, at the very least, minimize the impact of construction and other human activities on them. It is crucial to adopt strategies that prioritize the protection and preservation of trees, recognizing their vital role in urban and rural landscapes. Implementing sustainable practices and careful planning in development projects is essential to ensuring the well-being of these natural assets.

1.2.5 To proactively address and minimize any future negative influences on trees, it is essential to establish comprehensive planning strategies. This involves integrating arboricultural considerations into the early stages of project design and development. The goal is to balance developmental needs with environmental stewardship, ensuring that our actions today do not adversely affect the health and vitality of trees in the future.

1.2.6 This standard specifically encompasses guidelines and measures for construction, development, building and infrastructure repairs, and demolition. Additionally, it is crucial in the context of organizing large events in parks and similar areas where trees and green spaces are present.

1.2.7 Establishing a common platform for different stakeholders aims to foster open communication and mutual understanding among all parties involved. This approach facilitates the creation of more holistic and effective tree protection strategies while also promoting a sense of shared responsibility and collective action in safeguarding our natural arboricultural assets.

1.2.8 The planning, design, and management of green infrastructure, therefore, must be a collaborative effort involving urban planners, environmentalists, local communities, and policymakers.

1.3 Stakeholders

1.3.1 In the process of safeguarding trees while significant alterations are made to their surroundings and in order to implement subsequent management measures, each participant plays a unique and vital role in achieving a positive outcome while minimizing the physiological stress on the trees. For details, refer to Appendix 1.

1.3.2 Refer to national annexes for situations regulated by national and regional laws. These include understanding the legal obligations to protect trees and greenery during construction projects, complying with environmental regulations, and following best practice for sustainable development.

2. Normative references

2.0.1. This standard is complementary to the other European Arboricultural Standards, international standards and national/regional regulations. It serves as a guide to ensure a consistent approach to the protection of trees, while recognizing the diversity of practices internationally.

2.0.2 To address the variability in practices across member states, national annexes have been attached to this standard. These annexes provide detailed insights into the specific practices, regulations, and guidelines followed by individual countries in Europe. Users of this standard are encouraged to consult the relevant national annex to gain a comprehensive understanding of the tree protection practices in a specific country.

2.1 Links to general documents

2.1.1 Under the EU's **Environmental Impact Assessment (EIA)**[1], major building or development projects in the EU must first be assessed for their impact on the environment. This assessment is compulsory for projects like nuclear facilities, extensive railway systems, motorways, expressways, hazardous waste disposal sites, and dams with a specified capacity.

2.1.2 For other undertakings, such as urban or industrial developments, roads, tourism ventures, and water management projects, it falls to each EU Member State to determine the necessity of an EIA, either on a project-by-project basis or through established criteria concerning the project's location, scale, or nature.

2.1.3 The EIA comprehensively examines both the direct and indirect substantial impacts of a project on a broad spectrum of environmental factors. These include the population, human health, biodiversity, land, soil, water, air, climate, landscape, material assets, and cultural heritage.

2.1.4 The project proponent is required to present a detailed report to the approving authority. This report must encompass the project's specifics, such as its site, design, and size, alongside its anticipated significant effects, feasible alternatives, and strategies to avoid, minimize, mitigate, or compensate for likely significant environmental impacts.

2.1.5 Mandatory regulations govern the public disclosure of the project, ensuring there is awareness that it has been subjected to an EIA process. These regulations include provisions for public participation in the decision-making procedure. Post-decision, the public is informed and retains the right to legally challenge the outcome.

2.1.6 **Strategic environmental assessment (SEA)** employs a variety of analytical and participatory techniques to incorporate environmental considerations into a wide range of policies, plans, and programmes, taking into account their social and economic ramifications. SEAs serve as a practical tool for achieving the UN General Assembly's 2000 Millennium Development Goal 7 on Environmental Sustainability. They encompass methods aimed at embedding environmental considerations into policymaking, assessing their interconnections with economic and social elements. Applied at the initial stages of decision-making, SEAs help in shaping and evaluating the potential effectiveness and sustainability of policies, plans, and programmes. This role sets SEAs apart from conventional environmental assessment tools like Environmental Impact Assessment (EIA), which are successful in addressing environmental aspects of specific projects but less suited for broader strategies. While not replacing EIA and other

1 Directive 2011/92/EU as amended by 2014/52/EU. The first Environmental Impact Assessment Directive (85/337/EEC) was established in 1985. Since then, it has undergone four revisions to align with the European Union's international obligations and other legal advancements. In 2011, Directive 85/337/EEC, along with its subsequent amendments, was consolidated into a single, updated act (Directive 2011/92/EU), which is the prevailing legislation in effect as of 01/01/2025.

methodologies, SEAs complement these tools, offering a broader, more integrated approach to environmental assessment.

2.1.7 The **'Do No Significant Harm' (DNSH)**[2] principle is crucial within the EU Sustainable Finance framework, particularly in legislation like the Taxonomy Regulation, Sustainable Finance Disclosure Regulation, and Benchmark Regulation. This principle ensures that economic activities and investments considered sustainable do not harm environmental or social objectives.

2.1.8 In the context of construction and development activities, the DNSH principle mandates that development projects integrate environmental safeguards, ensuring that construction activities do not significantly harm existing natural resources. Project managers and technical supervisors must work together to adhere to these principles, implementing sustainable practices and engaging relevant experts to address any tree -related issues. This collaborative approach not only fulfils regulatory requirements but also promotes the preservation of trees and greenery, aligning development efforts with broader environmental sustainability goals.

2.1.9 The European Union's political landscape has significantly influenced the perception and valuation of amenity trees. Various EU directives and policies encourage member states to develop urban greening plans. These plans often highlight the economic, social, and environmental value of trees in urban settings, further emphasizing their importance in sustainable urban development.

2.1.10 The **European Green Deal**, introduced by the European Commission, aims to make Europe the first climate-neutral continent by 2050. It encompasses a set of policy initiatives targeting various sectors, including biodiversity, clean energy, and sustainable agriculture.

2.1.11 Within the Green Deal, trees, especially those outside forest environments, are recognized for their multifaceted contributions. They play a pivotal role in urban cooling, carbon sequestration, enhancing biodiversity, and improving air quality. This acknowledgement has elevated the importance of valuing these trees appropriately.

2.1.12 The **EU's Biodiversity Strategy for 2030** emphasizes the importance of green infrastructure, including non-forest trees, in creating resilient ecosystems. The strategy's goals indirectly promote the preservation and appropriate valuation of trees in urban and peri-urban areas.

2.1.13 The **Nature Restoration Law** was introduced to improve ecosystems for people and the planet. This unique European law is a key part of the EU Biodiversity Strategy. It focuses on fixing damaged ecosystems, especially areas that store carbon and help lessen the effects of natural disasters. Main goals:

- Restore ecosystems, habitats, and species throughout the EU's terrestrial and marine regions.
- Ensure the sustainable recovery of a biodiverse and resilient environment.
- Support the EU's climate change mitigation and adaptation goals.
- Fulfil international obligations.

2.1.14 **IUCN Biodiversity Net Gain (BNG)** refers to the guidelines and protocols developed by the International Union for Conservation of Nature (IUCN) to ensure that development projects result in a net positive impact on biodiversity. It involves taking steps to ensure that any negative impacts on biodiversity caused by development projects are outweighed by measures that enhance biodiversity. This can include activities such as habitat creation, restoration, and the implementation of biodiversity-friendly practices.

2.1.15 Key aspects of BNG include:

- Assessment and Baseline Measurement: Establishing a clear baseline of the existing biodiversity conditions before development starts.
- Mitigation Hierarchy: Applying a structured approach to avoid, minimize, restore, and, as a last resort, offset any adverse impacts on biodiversity.
- Quantifiable Gains: Implementing measurable and demonstrable biodiversity improvements that exceed the losses caused by development.

2 European Securities and Markets Authority (2023, November 22). 'Do No Significant Harm' definitions and criteria across the EU Sustainable Finance framework. ESMA30-379-2281. Available at: https://www.esma.europa.eu/sites/default/files/2023-11/ESMA30-379-2281_Note_DNSH_definitions_and_criteria_across_the_EU_Sustainable_Finance_framework.pdf

- Long-Term Sustainability: Ensuring that biodiversity gains are sustainable and maintained over the long term, often beyond the lifecycle of the development project.
- Stakeholder Engagement: Involving local communities, stakeholders, and experts in planning and implementing biodiversity enhancement measures.

2.1.16 The Sustainable Development Goals[3] are a set of interconnected objectives, ranging from eradicating poverty to climate action. They highlight the intertwined nature of environmental, social, and economic sustainability. In the context of tree value perception, the emphasis on environmental sustainability, particularly in goals like 'Life on land' (SDG 15), underscores the importance and value of trees in achieving these global objectives.

2.2 Qualification

2.2.1 Ensuring the well-being of trees and preserving suitable growing conditions for them amidst substantial alterations in their surroundings are complex, specialized endeavours that require the knowledge and experience of a professional who has received proper training in the field.

2.2.2 References to national qualifications may be recognized locally. These are listed in the national annexes to this standard.

2.2.3 From the perspective of arboriculture, the following are examples of qualifications at an international (EU) level which can help with tree-related questions:

- European Tree Technician (EAC);
- VETcert Veteran Tree Specialist (Consulting level); and
- ISA Board Certified Master Arborist.

2.2.4 Utilizing this standard necessitates a comprehensive understanding of trees and their maintenance. Inappropriate application of these guidelines and the associated calculation models may result in significant discrepancies in results, potentially leading to avoidable legal disputes.

2.2.5 It is advisable that within the scope of the standard, a dedicated expert with knowledge and experience in Tree Impact Assessment (TIA) and technical oversight is integrally involved throughout all stages of tree protection during development activities (Chapter 3).

2.2.6 For the effective execution of Environmental Impact Assessments (EIA) and Strategic Environmental Assessments (SEA), it is essential to establish a network of specialized experts.

3 **The Sustainable Development Goals** (SDGs), also known as the Global Goals, are a set of 17 interconnected objectives established by the United Nations General Assembly in 2015.

3. Stages of tree protection during development activities

3.1 Introduction

3.1.1 In the process of urban development, the harmonious integration of pre-existing natural elements, especially trees, into the built environment is becoming increasingly important for human well-being.

3.1.2 To be successful, a structured approach to tree preservation during development projects is essential. This section outlines the key phases in this approach, each with distinct objectives and methodologies, ensuring that tree protection is a key aspect of the planning and construction process.

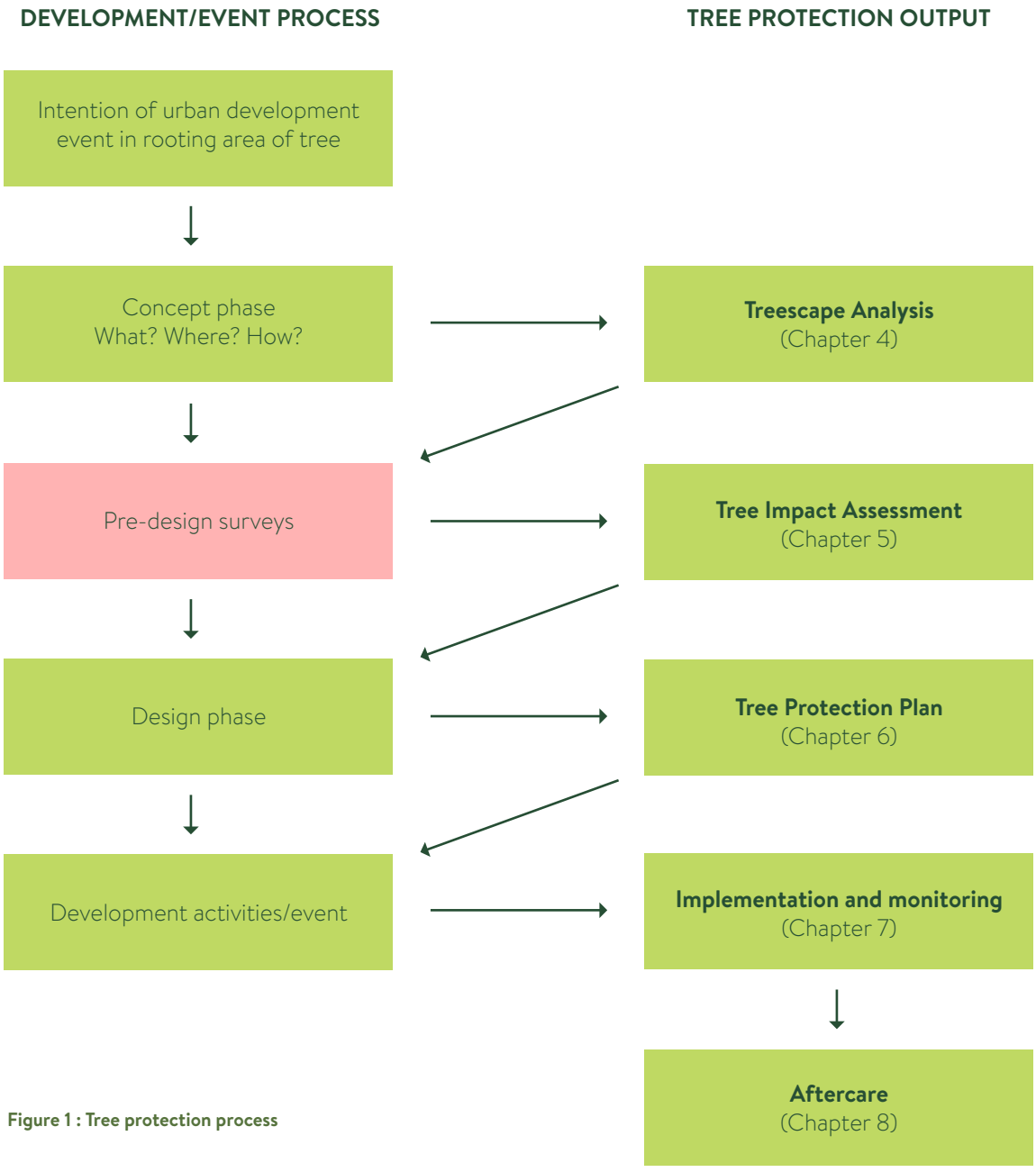


Figure 1 : Tree protection process

3.2 Concept phase

3.2.1 **Objective:** To recognize the presence of trees and their growing environment. To establish an initial understanding of the potential impact of project and a willingness to integrate tree preservation into the development process.

3.2.2 **Activities:**

- Analysis and understanding of the existing landscape, including its trees.
- Identification of restrictions and regulations connected with the site (monument, water protection, nature protection etc.)
- Assessment of the relevance and potential impact of the proposed project in relation to the tree population, including ecological and social implications.
- Development of a preliminary approach for tree preservation.
- Developers' consultation with arborists on the feasibility of the intended concept.

3.2.3 **Output:** Treescape Analysis describing overall characteristics of the trees for next steps in the process (pros and cons of potential variants of the project).

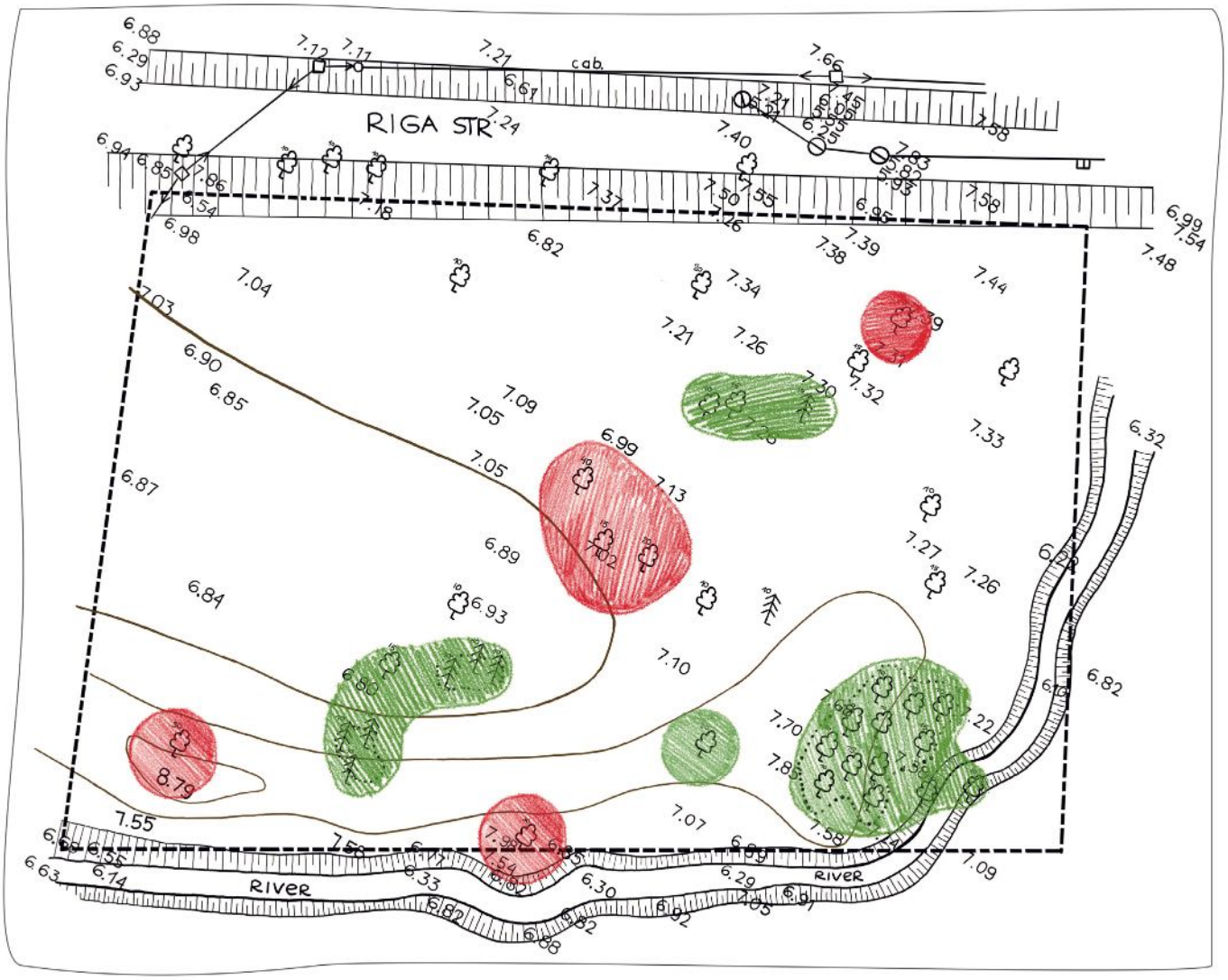


Figure 2 : Example of Treescape Analysis map

3.3 Pre-design surveys

3.3.1 **Objective:** To gather detailed information and data about the site and trees to inform planning and design.

3.3.2 **Activities:**

- Mapping tree locations in relation to the proposed development and all relevant activities associated with it.
- Conducting tree inventory and assessments including tree categorization.
- Providing detailed analysis (soil, biodiversity etc.) if relevant.
- Identifying specific tree protection requirements.

3.3.3 **Output:** Tree Impact Assessment (TIA) detailing tree and site data, and development recommendations and restrictions.

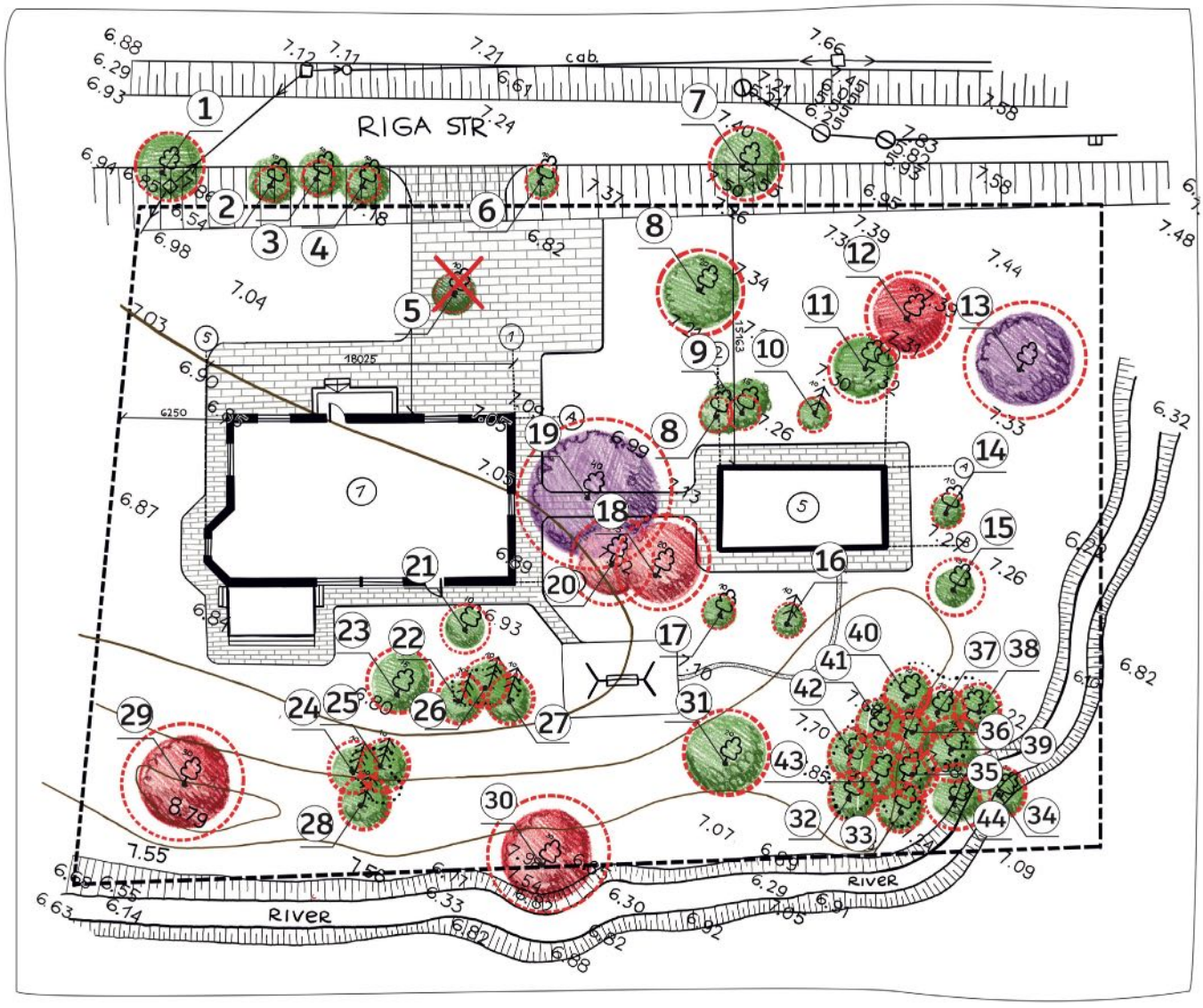


Figure 3 : Example of Tree Impact Assessment map

3.4 Design phase

3.4.1 **Objective:** To develop a comprehensive plan that integrates tree protection with design.

3.4.2 **Activities:**

- Defining detailed tree protection measures to avoid damage (e.g., root protection areas, temporary barriers, implementation techniques).
- Designing development layouts that minimize impact on trees.
- Defining corrective measures to mitigate unavoidable or unintended damage.
- Drawing up recommendations for a (compensatory) planting and transplanting plan.
- Consultation between relevant development specialists and arborists on applicability of the proposed measures.
- Integrating tree protection measures into construction documents (e.g. tender documents).

3.4.3 **Output:** Tree Protection Plan (TPP) which includes all necessary measures to preserve trees and their growing conditions. Includes the timings and detailed descriptions of all proposed measures. Includes description of implementation and aftercare plan.

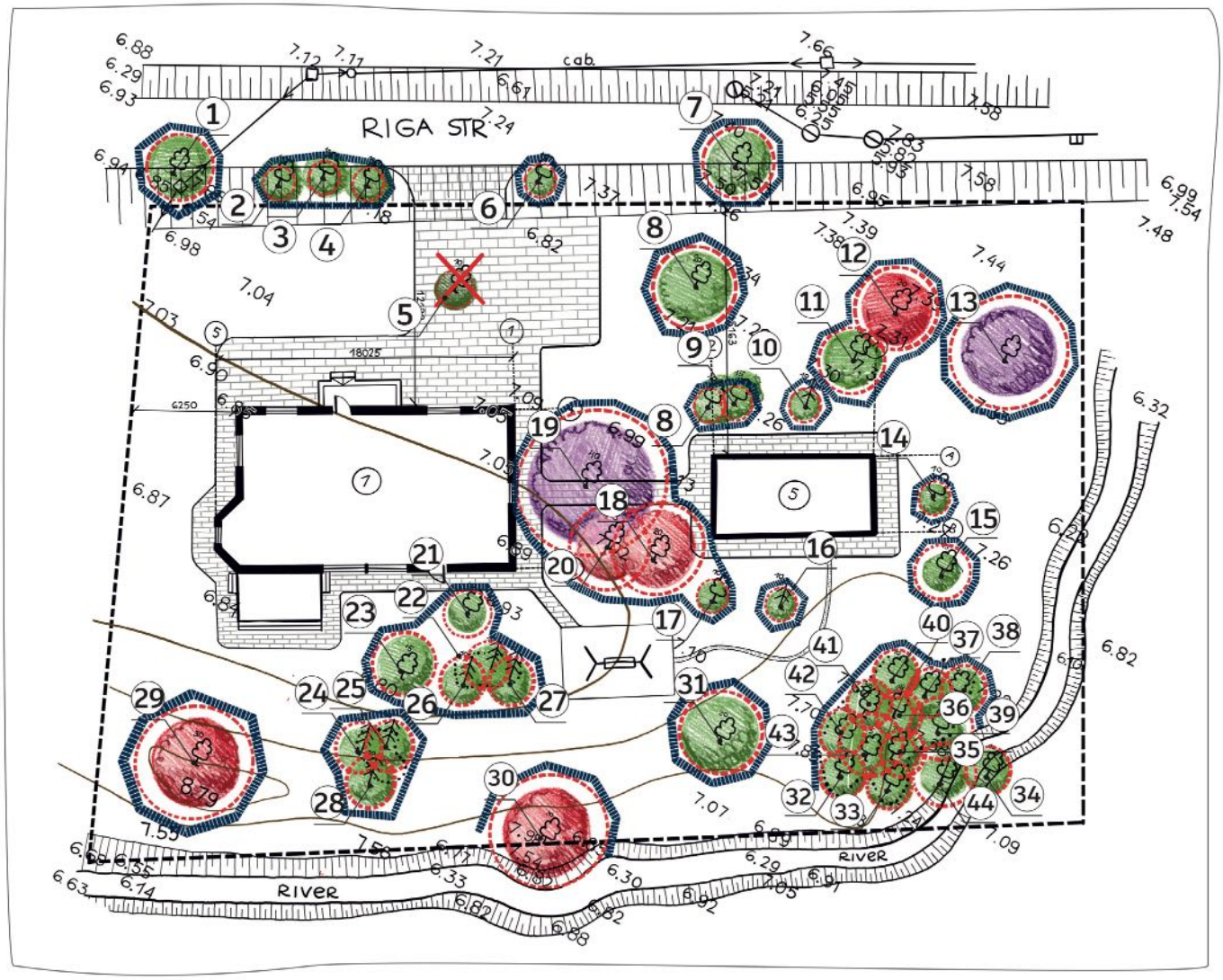


Figure 4 : Example of Tree Protection Plan map

3.5 Implementation and monitoring

3.5.1 **Objective:** To implement the construction project including all tree protection measures defined in the Tree Protection Plan. Monitoring of development activities and tree health, including adjustments to procedures, techniques, and tree protection if necessary.

3.5.2 **Activities:**

- Implementing protective measures for trees before development begins.
- Ensuring all personnel on site (including subcontractors) are aware of tree protection guidelines and follow them.
- Adjusting development techniques as needed to mitigate unforeseen impacts on trees.
- Regular monitoring of tree health and protection measures.
- Making adjustments to protection strategies as required.
- Regular monitoring of all activities which might impact protected trees and site conditions.
- Regular communication between construction managers, arborists, and environmental consultants.
- Documenting any incidents or deviations from the Tree Protection Plan.

3.5.3 **Output:** Regular notes in the construction diary with evidence that all proposed measures have been implemented.

3.6 Aftercare

3.6.1 **Objective:** To maintain and ensure the ongoing health and safety of trees after the development phase, addressing any long-term impacts the development might have had.

3.6.2 **Activities:**

- Assessing all trees on the development site (physiological condition and structural integrity).
- Developing and implementing ongoing tree care strategies, which may include regular pruning, watering, pest and disease management, and soil care to mitigate stress caused by development.
- Regular monitoring over several years to detect delayed effects.
- Integrating the impact of development into tree risk strategies (e.g. structural weaknesses worsened by development activities or increase/decrease in site occupancy).
- Integrating changes in tree micro-environment (e.g. sunlight exposure, hydrology, soil composition) in management plans.

3.6.3 **Output:** Keeping detailed records of all post-development management activities. This documentation is crucial for assessing the effectiveness of the strategies employed and for future reference.

3.6.4 Neighbouring Trees: In setting up the full process for tree protection, it is essential to include trees on adjacent plots that are not part of the construction site. These neighbouring trees need to be recognized and protected in the same manner as trees within the construction area. The following steps should be taken:

- Treescape Analysis: Include neighbouring trees in the initial Treescape Analysis to assess their health, structure, and the potential impact on them of the construction activities.
- Tree Impact Assessment (TIA): Evaluate the potential effects of construction on these neighbouring trees. This includes assessing risks related to root damage, changes in soil composition or level, and other environmental stressors.
- Tree Protection Plan (TPP): Develop and implement protection measures for neighbouring trees, incorporating them into the TPP. These should include barriers, root protection zones, and monitoring protocols to ensure their well-being throughout the construction process.

3.6.5 By incorporating neighbouring trees into the Treescape Analysis, TIA, and TPP, comprehensive tree protection and maintenance of the integrity of the surrounding landscape can be ensured.

3.6.6 The following chapters describe the deliverables of the scheme set out above.

4. Treescape Analysis

4.1 Introduction

4.1.1 The primary deliverable for the concept phase is the Treescape Analysis, an initial survey which provides a comprehensive evaluation of the existing tree landscape. This analysis is crucial for understanding the impact of proposed development on trees and greenery, enabling the planning team to make informed decisions and incorporate tree protection strategies from the outset.

4.1.2 The Treescape Analysis includes:

- The incursion of the designated area into regions with enhanced heritage and nature protection.
- The presence and location of utility protection zones.
- An overview of green infrastructure and the tree population, including relevant aspects like water and nutrient resources, wind protection, biodiversity connections, etc.
- Information about the presence and location of protected trees, natural monuments and veteran/ancient trees, protected species and heritage protection areas.
- Defining the extent of the influence of the construction process and new infrastructure on the growing conditions of trees.

4.2 Nature and heritage protection areas

4.2.1 The concept phase has substantial significance, especially in the context of nature protection areas such as Natura 2000 sites, bird protection areas, other designated environmental sanctuaries, and heritage protection sites.

4.2.2 Nature protection areas are vital for preserving biodiversity. They serve as habitats for a wide range of flora and fauna, some of which may be endangered or rare. Similarly, heritage protection areas are essential for preserving cultural, historical, and architectural treasures. Construction processes need to be aligned in a way that minimizes disruption to these ecosystems and heritage sites.

4.2.3 These areas often fall under strict legal and regulatory frameworks that mandate specific guidelines for any construction activity. It is crucial to understand and adhere to these regulations in order to avoid legal repercussions and to promote ethical practices. These frameworks include both environmental regulations and heritage preservation laws.

4.2.4 Integrating nature and heritage protection areas in construction planning is a step towards sustainable development. It reflects a commitment to developing in harmony with the environment, ensuring long-term ecological balance and preservation of historical sites.

4.2.5 The way construction projects address environmental and heritage concerns, especially in sensitive areas, significantly affects public perception and can influence a company's reputation for corporate responsibility.

4.2.6 Strategies for integration in construction processes may include:

- **Comprehensive Environmental Impact Assessments (EIA):** If applicable, conducting detailed assessments to understand the environmental impact of proposed construction projects on nearby protected areas.
- **Heritage impact assessments:** If applicable, conducting detailed assessments to understand the impact of proposed construction projects on nearby protected heritage areas. These assessments evaluate how construction activities might affect the historical, cultural, and architectural values of the site. The goal is to identify and mitigate potential negative impacts on heritage properties and ensure that construction is conducted in accordance with heritage conservation principles.

- **Collaborative planning with environmental and heritage bodies:** Engaging with environmental agencies and conservationists early in the planning process ensures a balanced approach that respects both development needs and conservation priorities.
- **Adaptive (tree-friendly) construction methods:** Employing construction methods that are less invasive and more adaptable to the surrounding natural environment, thus minimizing the impact on protected areas.
- **Buffer zones and corridors:** Establishing buffer zones and wildlife corridors to ensure that there is minimum disruption to the habitats and migration patterns of species living in these protected areas and creating protective boundaries around heritage sites and objects.
- **Monitoring and mitigation plans:** Implementing robust monitoring systems to continuously assess the impact of construction activities, and having mitigation plans in place to address any adverse effects swiftly.
- **Community engagement and awareness:** Involving local communities in the planning process and raising awareness about the importance of these protected areas can foster a sense of shared responsibility and cooperation.

4.3 Utility protection zones

4.3.1 The integration of utility lines, both underground and overhead, into the treescape analysis phase of construction processes is of paramount importance. This integration ensures a harmonious balance between development needs and the preservation of the natural environment, particularly the trees.

4.3.2 Trees are vulnerable to damage from both underground and overhead utility work. For instance, digging for underground utilities can harm tree roots, while overhead lines might require tree trimming. Identifying utility lines enables planners to devise strategies that minimize harm to trees, thereby preserving their ecological and aesthetic values.

4.3.3 For temporary events, utility services are often needed, but their installation must not affect tree crowns or roots. In places where events are held regularly, it is better to build a network of pipes to carry the utility services for the different events.

4.3.4 Trees in close proximity to utility services, especially power lines, pose safety risks. Tree branches can cause power outages, fires, or even electrocution risks if not managed properly. Accurately mapping utility lines ensures safe distances are maintained between trees and utilities during construction and subsequent maintenance.

4.3.5 Many regions have specific regulations regarding the proximity of trees to power lines and other utility services. Ignorance of these regulations can lead to legal complications, fines, or enforced modifications post-construction. Understanding the placement of utility services helps in adhering to these regulations from the outset.

4.3.6 Proper planning regarding the placement of utility services relative to trees can reduce the need for frequent maintenance. It also prolongs the lifespan of both the utilities and the trees, resulting in cost savings and sustainable development.

4.3.7 Implementation strategies:

- **Pre-construction surveys:** Conducting thorough surveys that map both trees and utility lines before construction begins. This helps in creating plans that accommodate both effectively.
- **Collaboration with arborists and utility companies:** Engaging with arboricultural experts and utility providers early in the planning process ensures that both trees and utility needs are addressed.
- **Innovative construction techniques:** Utilizing construction techniques that minimize impact on tree roots and canopies, such as air-spading or tunnelling, rather than traditional trenching.
- **Regular monitoring and maintenance:** Establishing a schedule for regular monitoring and maintenance post-construction to ensure the safety and health of both the utility lines and the trees.

4.4 Overview of green infrastructure and tree population

4.4.1 **Components:** At its core, green infrastructure consists of a diverse array of elements, each contributing uniquely to environmental health and human well-being. These elements include urban forests, parks, green roofs and walls, street trees, water bodies like rivers and ponds, wetlands, and green corridors such as hedgerows and wildlife paths. Among these, trees stand as the pillars of green infrastructure, offering a multitude of benefits that are indispensable.

4.4.2 The planning and management of green infrastructure must therefore give due consideration to trees, recognizing their multifaceted role in environmental sustainability, social well-being, and economic viability.

4.4.3 **Tree population analysis:** Collecting basic data on tree populations is crucial for informed decision-making and effective management within the context of green infrastructure. This data provides the foundation for understanding the current state of the tree population and planning for its preservation and enhancement.

4.4.4 Adequate data on trees is essential for making informed decisions. The level of detail required may vary between projects, but having comprehensive and accurate information ensures that decisions are based on a thorough understanding of the tree population and its needs.

4.4.5 **Tree evidence (Basic survey inventory):** This data encompasses understanding of the types and distribution of trees within a given area, whether urban or rural. It involves identifying the various species of trees and mapping their locations to understand their spatial distribution patterns.

4.4.6 **Additional details:** Additional details regarding tree dimensions (including height, trunk size, and crown characteristics) are beneficial for describing each tree individually. The composition and structure of densely packed canopies or combinations of trees and shrubs could be illustrated through delineated boundaries (polygons) and the diversity of species.

4.5 Protected trees, natural monuments and veteran/ancient trees

4.5.1 **Protected or veteran/ancient trees:** The identification of trees with a special level of importance or protection within construction areas is critically important. During the concept phase, these trees must be accurately mapped and thoroughly documented to ensure their preservation throughout the project.

4.5.2 **Protected species:** It is essential to identify and protect any species that are classified as protected within the construction area. This includes both flora and fauna that may be impacted by the development activities, as well as their specific habitat features.

4.5.3 **Conservation (heritage) site protection:** Areas designated as conservation or heritage sites require special attention to ensure that construction activities do not negatively impact their historical, cultural, or environmental value. Specific measures must be taken to preserve the integrity of these sites or objects during and after the construction process.

4.6 Influence of the construction process and new infrastructure on growing conditions

4.6.1 The impact of construction activities on the growing conditions of trees is a critical consideration. In the process of treescape analysis, it is essential to assess and pre-define ways of mitigating the effects of construction on tree health and growth, particularly during the Tree Impact Assessment phase of construction projects (see 5.1.3 for details)

4.6.2 Considering the influence of construction activities on growing conditions is an integral part of responsible urban development. By proactively addressing these challenges during the treescape overview phase, developers and construction professionals can significantly reduce the negative impact on trees.

4.6.3 The analysis of the construction project or event affects not only the built structure but also all the activities necessary for it to be completed.

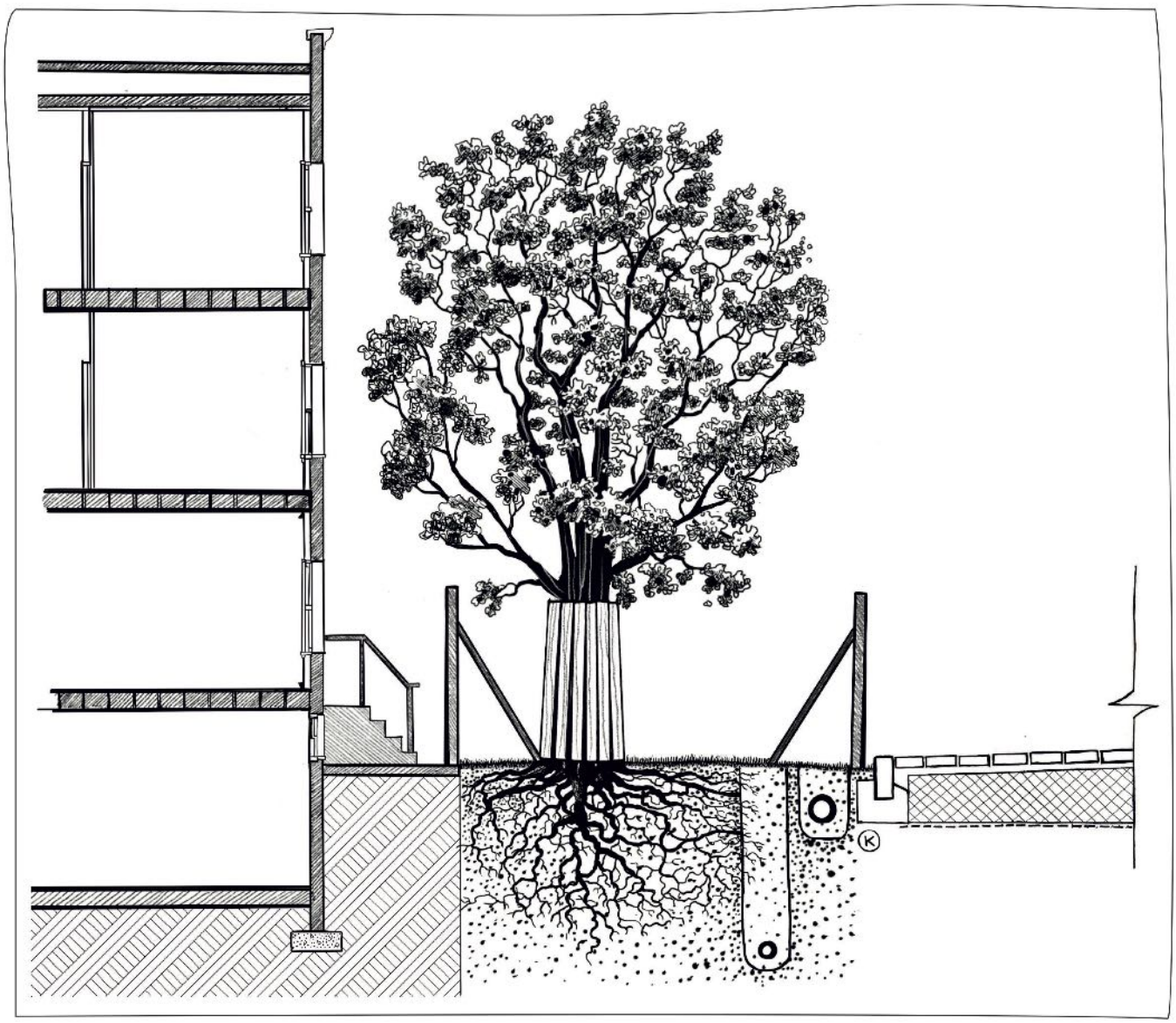


Figure 5 : Challenges facing trees in urban settings

5. Tree Impact Assessment (TIA)

5.1 Introduction

5.1.1 Tree Impact Assessment is a specialized evaluation conducted to understand the potential impacts of proposed construction activities on existing trees and their surrounding environments.

5.1.2 This assessment is a critical component of the planning and development process, aimed at ensuring the protection and preservation of trees in and around construction sites.

5.1.3 The key components of TIA are analysis of the following factors (see Appendix 3 for an explanation of the terms):

- Impact analysis,
- Root system disturbance,
- Canopy damage,
- Soil and water changes,
- Chemical exposure,
- Heat sources,
- Light/shade conditions,
- Dust pollution,
- Ground level changes,
- Mitigation strategies,
- Recommendations for tree removal and replacement,
- Legal and environmental compliance.

5.1.4 TIA is essential for identifying potential risks to trees and prescribing measures to prevent or minimize harm. Conducting a TIA helps developers comply with legal requirements and avoid penalties associated with unauthorized tree damage or removal.

5.1.5 TIA reflects a commitment to environmental stewardship, recognizing the value of trees in urban ecosystems for biodiversity, climate regulation, and community well-being.

5.1.6 TIA can be used to test the feasibility of a project and shape public perception, promoting a responsible approach to development plans.

5.2 Tree survey

5.2.1 A tree survey, as the initial step in Tree Impact Assessment, is a comprehensive examination of trees within and surrounding a proposed development site. It adheres to the parameters set out in EAS 04:2025 (EN) – European Tree Assessment Standard, ensuring a thorough and standardized approach to evaluating the trees in question.

5.2.2 The survey encompasses all trees within the proposed development area and its immediate vicinity. This ensures a complete understanding of the existing arboricultural landscape that might be affected by the development.

5.2.3 **Data recording:** For each tree, the survey involves recording a set of defined parameters. These parameters are outlined in EAS 04:2025 (EN) – European Tree Assessment Standard and typically include:

- Species identification
- Dendrometry
- Physiological condition
- Mechanical integrity
- Life expectancy
- Protected tree habitat
- Tree value calculation

5.2.4 **Contextual analysis:** The survey develops an understanding of the relationship of each tree to its surroundings, including its ecological connections, contribution to the landscape, and interaction with nearby structures or other environmental elements.

5.2.5 The data is compiled in a comprehensive report that serves as an initial document for the subsequent stages of the TIA.

5.3 Tree categorization

5.3.1 Based on the tree survey, trees designated for protection are divided into the following categories. These categories define the priorities of their preservation during construction:[4]

5.3.2 **Category A – Trees for definite preservation and protection:** Typically, trees in Category A include:

- Trees protected by special regulation, such as green monuments or notable Veteran/ancient trees and prospective.
- Trees with the prospect of a long-term future or major specimens of a stand or group.
- Trees with significant functional values, including compositional, landscaping, historical, and biological values, or trees forming a habitat of significant conservation interest.
- Trees in avenues.
- Veteran/ancient trees.
- Taxonomically interesting trees.

5.3.3 **Category B – Trees recommended for preservation:** Typically included in Category B are:

- Trees with medium-term longevity.
- Trees with poor health status (physiological condition or structural integrity).
- Trees with compromised stability, unless they are judged to be in Category A for other reasons.

5.3.4 **Category C – Trees that might be relocated or removed according to construction requirements:** Trees typically placed in Category C are:

- Young trees in the establishment phase and established individuals capable of relocation.
- Medium- to short-term longevity trees without significant value at the site.
- Trees with significantly poor physiological condition or structural integrity.

5.3.5 **Category D** – **Trees to be removed anyway** and which have no connection to the construction activity.

5.3.6 Specific, pre-defined colour coding for each category of trees can simplify map orientation and improve clarity.

5.4 Tree value definition/calculation

5.4.1 In the context of urban planning and development, accurately defining and calculating the value of trees is paramount. This process is not merely a financial assessment but a comprehensive evaluation of the ecological, social, and aesthetic contributions of trees.

5.4.2 The process of tree value calculation should proceed with respect to the framework defined by EAS 05:2025 (EN) – European Tree Valuation Standard.

5.4.3 Establishing the value of trees is a critical step in the process of issuing tree felling permits and determining the appropriate level of compensation and/or protection. This compensation is typically provided in the form of planting new trees, carrying out compensatory works, or making financial payments.

5.4.4 Quantifying tree services provides a tangible measure of their environmental importance, which is crucial for informed decision-making in urban development.

4 Based on BSI (2012). BS 5837: Trees in Relation to Design, Demolition and Construction – Recommendations. British Standards Institution, London.

5.5 Consideration of tree planting and transplanting

5.5.1 In the process of TIA, the consideration of new tree planting and tree transplanting is of utmost importance.

5.5.2 **Planting trees** in urban areas is, or can be, a basic compensatory strategy for the losses as a result of the project. Calculations of lost ecosystem services can help determine the need for new plantings.

5.5.3 **Transplanting trees**, rather than cutting them down during development activities, serves as a sustainable approach. It allows for the preservation of mature trees, which are vital for their immediate ecological benefits and historical significance. The process, however, requires careful planning, expertise, and consideration of the tree's health, age, and species.

5.5.4 Transplanting can sometimes be misused as a way out of conflicts with construction. It should be only reserved for specifically defended cases. The first choice is always to retain trees and protect them properly.

5.5.5 Integrating tree planting and transplanting within urban planning is critical for sustainable development. It involves collaboration between urban planners, arborists, and environmentalists to identify optimal locations for planting and transplanting, ensuring that these activities complement other urban functions.

6. Tree Protection Plan (TPP)

6.1 Introduction

6.1.1 The Tree Protection Plan is a strategy designed to safeguard trees during construction or development projects. It includes measures to protect tree structures both below and above ground, ensuring their preservation and resilience. This plan is often required in order to obtain planning permission.

6.1.2 The TPP must prioritize protecting tree roots and soil structure, establishing methods to minimize impact and facilitate restoration when necessary. These include consulting arborists or soil specialists when planning excavation near tree root zones and implementing strategies to maintain soil health.

6.1.3 The TPP should outline specific protective actions, such as erecting barriers and designating exclusion zones, to prevent damage from construction activities. It should also assess soil and groundwater quality, proposing measures to preserve these elements and to mitigate any negative impacts from construction.

6.1.4 Additionally, the TPP should consider the broader ecosystem, focusing on preserving the habitats of species that interact with and depend on the trees. This involves minimizing disruption to understorey plants, fungi, and fauna, and timing construction activities to avoid critical periods for these species.

6.2 Initial State Assessment

6.2.1 The Initial State (zero) Assessment focuses on comprehensively evaluating the current state of the environment, particularly soil conditions and water levels. This assessment forms the baseline from which any changes or impacts due to construction activities can be measured. Depending on the extent and form of the development project, it can consist of the following areas of interest (see Appendix 4):

- Tree condition.
- Soil condition.
- Water level.
- Vegetation, soil network, tree associated organisms.

6.2.2 The Initial State Assessment provides a detailed and comprehensive understanding of the existing environmental conditions. It serves as a benchmark for monitoring changes and guiding decision-making throughout the construction process, ensuring that tree protection and environmental sustainability are at the forefront of development planning.

6.2.3 In situations where the timespan between the Tree Impact Assessment (TIA) and the Tree Protection Plan (TPP) is less than one year, and no significant changes or impacts on the trees are anticipated, the Initial State Assessment can be substituted with the TIA. This approach aims to streamline the process while maintaining the accuracy and reliability of tree assessments.

6.3 Protection zones

6.3.1 Protection zones are the areas which are critical for maintaining the health and stability of trees during and after development activities. These zones are primarily defined by the extent of a tree's root system and are calculated to ensure minimum damage during construction or other activities.

6.3.2 **Tree Protection Zone (TPZ):** If the zone is based on a formula, it is the area extending from the trunk to a distance defined either by the crown spread or the dimension of the trunk multiplied by a coefficient, where impacts can cause mechanical or physiological damage to the tree and the soil environment (rhizosphere). Activities within this zone are allowed only under specialist supervision and must be carried out with care to avoid irreparable damage.

6.3.3 The TPZ extends both below and above ground.

6.3.4 Typical ranges of calculated TPZs are:

- A circle with a radius of 8 to 15 times the trunk diameter (measured at 1 m or 1.5 m above ground level).
- The crown projection area + 1 to 5 m.
- An important consideration is the depth of the TPZ, which may be specified in a national appendix and can vary between 1 m and 1.8 m. In many scenarios, the TPZ can be deeper than this and needs to be specified individually.

6.3.5 For particular scenarios, such as trees on slopes, leaning trees, or trees with hindrances in their rooting areas, the TPZ may be defined using specific considerations. These include the condition of any obstruction, the effect of the designated zone on the tree's physiological condition and stability, and specific taxonomic characteristics. Ideally, the perimeter of the individual protection zone should be positioned as far from the tree's base as is feasible.

6.3.6 Within the TPZ, the arboricultural consultant can differentiate between activities that are allowed, allowed with protective measures or not allowed, on the basis of the presence of (structural) roots and/or the distance to the tree. Typically, activities within the zone immediately surrounding the tree base have the potential to cause the greatest impact, as this is where the structural roots of the tree are located.

6.3.7 **Street/road trees:** In densely built areas where erecting proper protection zones is challenging, a detailed survey of the current development of roots and branches is necessary, potentially using techniques such as air spade excavations.

6.3.8 It should be emphasized that the scope of the roots of a freely growing tree often exceeds the crown diameter by many times, with the highest density of roots occurring at the border of the crown diameter. Some root systems can extend between 2 and 10 times the crown projection, depending on the species, resources, and climate zone.

6.3.9 Additionally, some trees can have adaptations to specific conditions either within or outside the TPZ.

6.3.10 The approved provisions are a compromise aimed at enabling the implementation of the works while providing trees with a minimum space needed for survival.

6.3.11 The TPZ should be designed to safeguard not just trees but also shrubs, vines, and perennial plants.

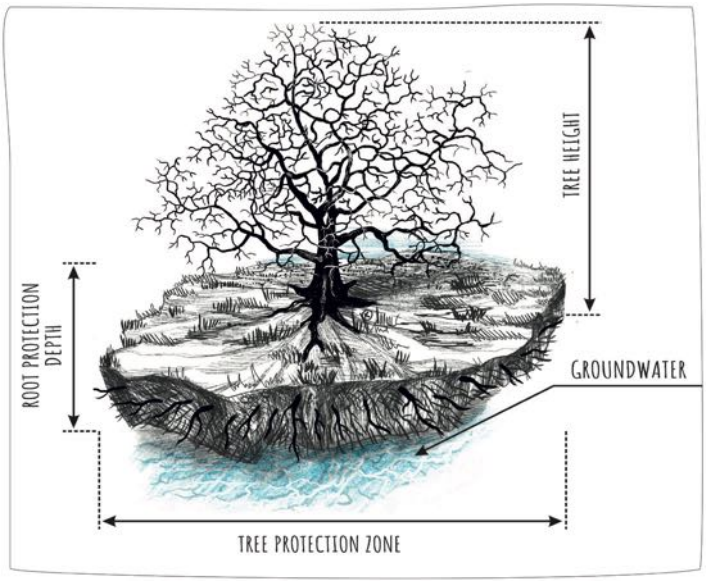


Figure 6 : Tree Protection Zone

6.3.12 **Fencing a TPZ:** Whenever feasible, the entire TPZ should be fenced with a non-moveable, impermeable barrier, standing at a minimum of 2 m in height. This barrier can be extended to encompass adjacent trees, thereby forming a unified protected area.

6.3.13 If circumstances prevent the permanent or full installation of such a fence, a temporary or partial barrier may be erected, after agreement and under the supervision of the arboricultural consultant.

6.3.14 In situations where installing a protective fence is entirely unfeasible, it is crucial to establish the maximum possible root, trunk, and crown protection measures and a high level of communication and supervision to ensure that appropriate protection measures are effectively implemented.

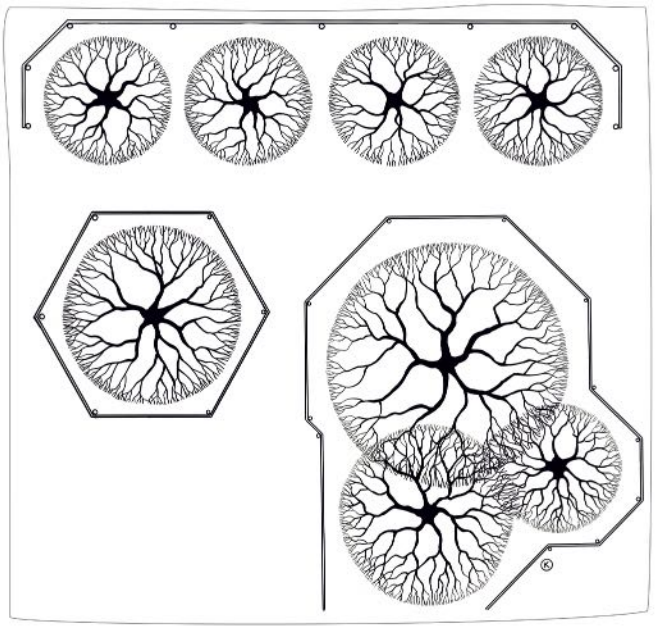


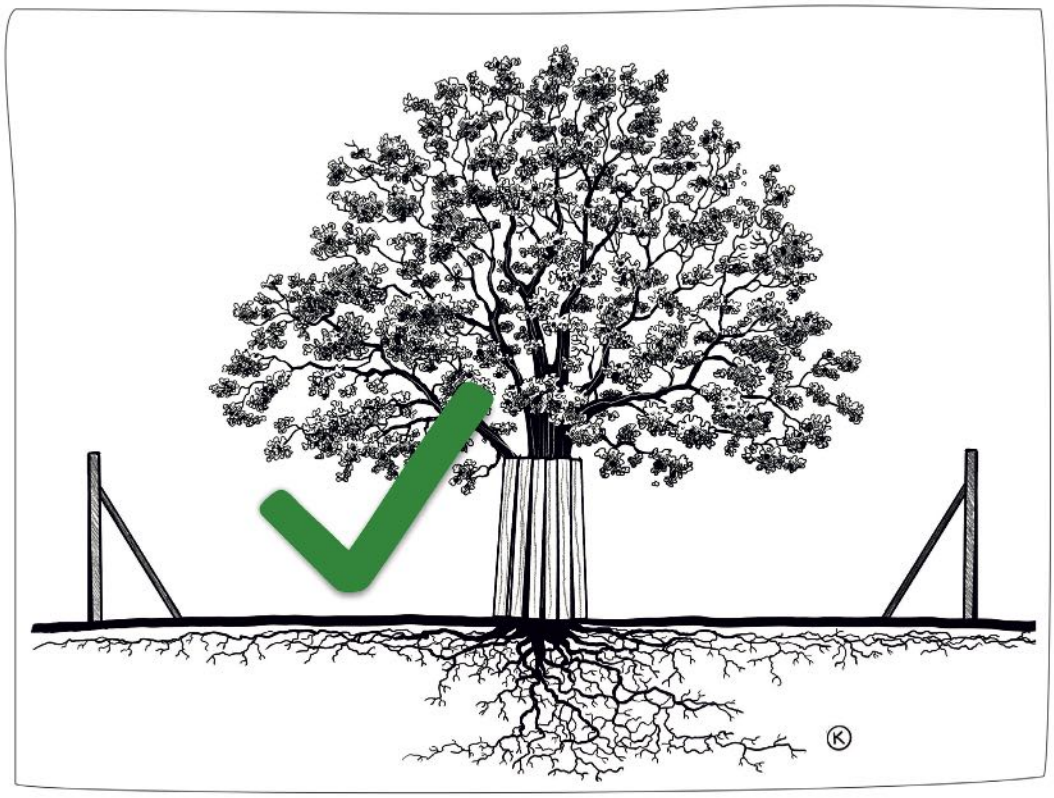
Figure 7 : Examples of fencing of the TPZ.

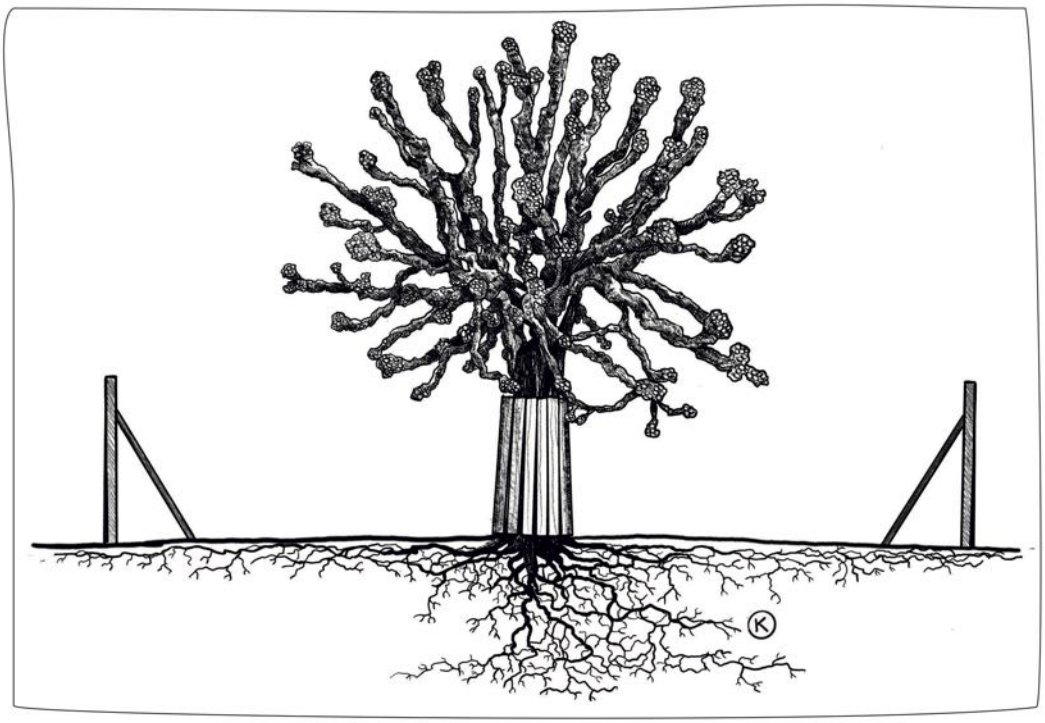
6.4 Other protection measures

6.4.1 There are several influences associated with construction activities that can affect the physiological or structural integrity of trees or other plants, even if they are outside the Tree Protection Zone. These influences include:

- Open fires.
- Heat emitters.
- Changes to the underground water table.
- Dust emitters.
- Storage of chemicals and construction materials.

6.4.2 The proposed minimum distances for these sources to prevent adverse effects are detailed in Appendix 4.





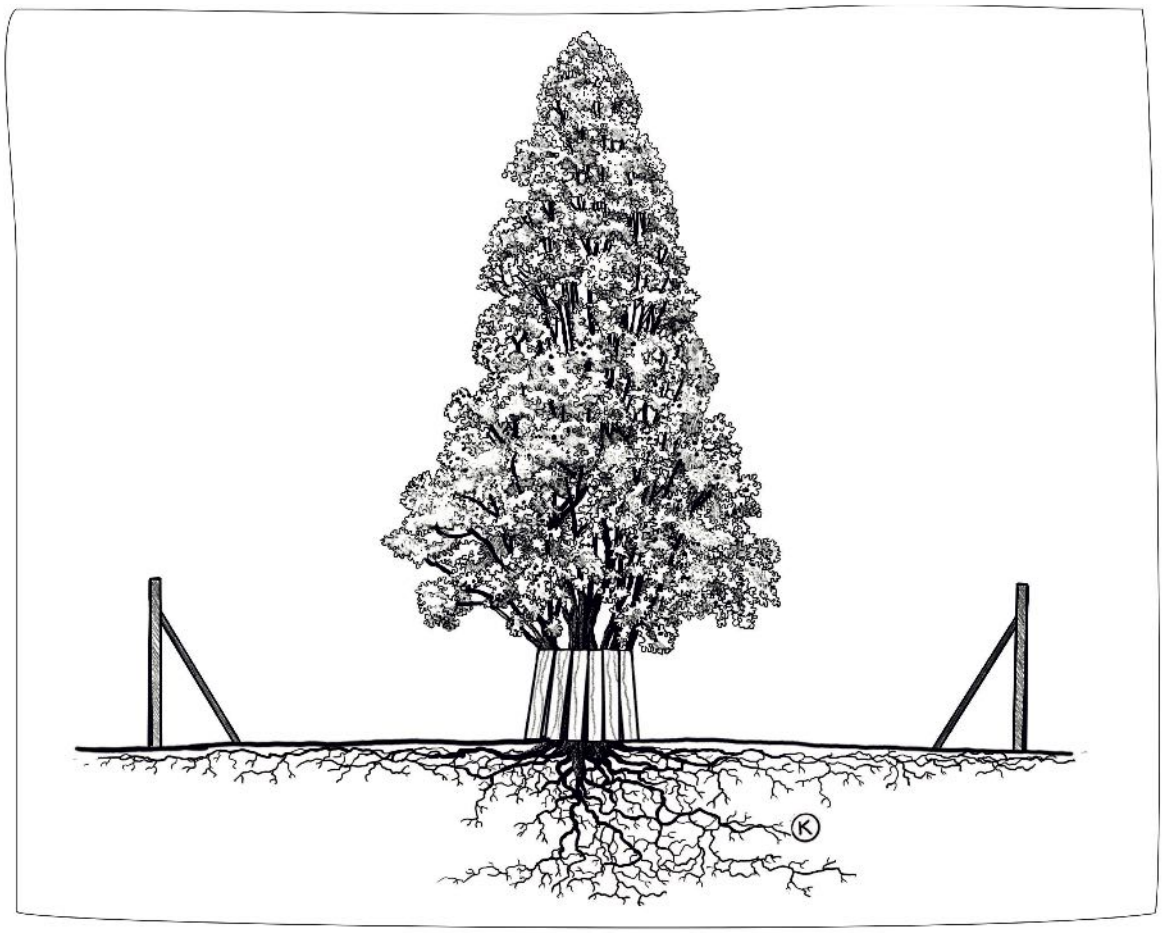


Figure 8-10 : Examples of tree protection zone

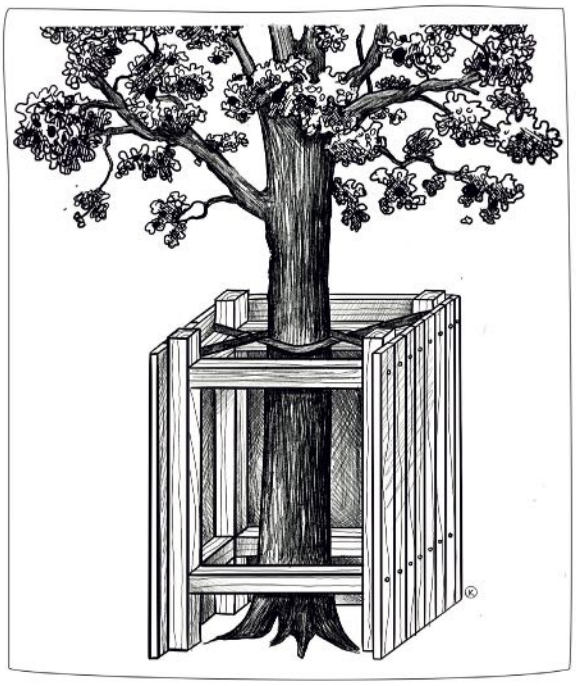
6.4.3 In cases where trees are not in a designated protection zone, specific measures are crucial. Any installed protection elements must not restrict the radial growth of tree trunks and root flares. Trunk protection should be installed beyond the root flares of the tree.

6.4.4 A protective structure must be sturdy and have a maximum height just below the lowest structural branch of the tree, with a minimum height of 2 m. The protective structure must be placed 10 cm away from the trunk. This protective structure serves to protect the tree against impact damage, for example by machines.

6.4.5 Trunk protection must not be in contact with the surface of the trunk, root flares, or branches. A suitable, flexible, and resilient padding should be placed between the trunk and the protective structure to cushion any potential impacts.

6.4.6 The extent of the structure should be as wide as possible to cover at least the mechanical root system and ideally a significant portion of the physiological root system.

6.4.7 The trunk protection must not be damaged, relocated, or removed during construction or event activities.



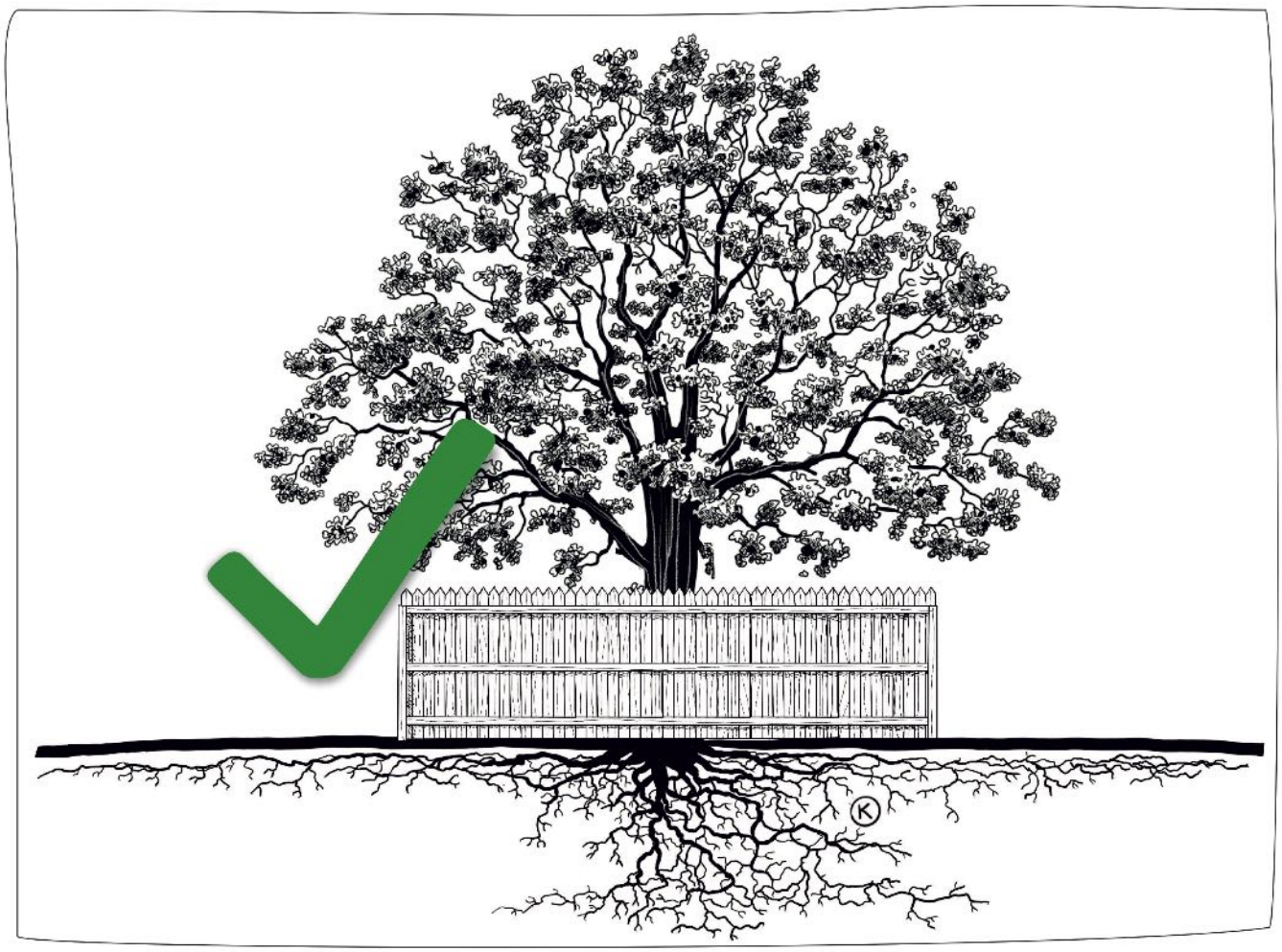


Figure 11-12 : Examples of tree- and stem protection barriers

6.4.8 In cases where trees are to be exposed to increased sunlight, consideration should be given to protecting the trunks from sunscald. This is especially important for young trees and species with thin bark. Protection should be carried out according to EAS 03:2022 (EN) – European Tree Planting Standard, or in line with other defined measures with a similar effect.

6.4.9 The importance of tree preservation should be communicated to all operators and technical teams involved in the construction process to avoid damage to the aerial parts of the tree.

6.4.10 If applicable, additional considerations must be addressed and individually defined in the Tree Protection Plan in relation to:

- Ground protection when temporary movement of pedestrians or machinery is necessary.
- Protection of exposed tree roots outside the TPZ.
- Use of root barriers for exposed root protection.

For details and descriptions of the measures commonly required in these situations, see Appendix 4.

6.4.11 **Water extraction and watering:** If source extraction is required, all direct and indirect consequences of the water extraction and its associated effects must be assessed and mapped out by a specialized hydrological agency. Effective watering ensures that trees, especially those within or near the construction area, receive adequate moisture, mitigating the stress caused by nearby activities and potential changes in the soil structure.

6.4.12 This is especially important during dry periods or when natural water sources are disrupted.

6.4.13 Conversely, proper drainage is essential to prevent waterlogging, which can lead to root dieback and diseases. It involves the careful design and maintenance of drainage systems to ensure that excess water from construction activities or heavy rain is efficiently redirected away from the root zones of trees.

6.4.14 This balanced approach to water management – providing sufficient hydration while avoiding excessive moisture – plays a pivotal role in safeguarding the health and longevity of trees during changes due to development.

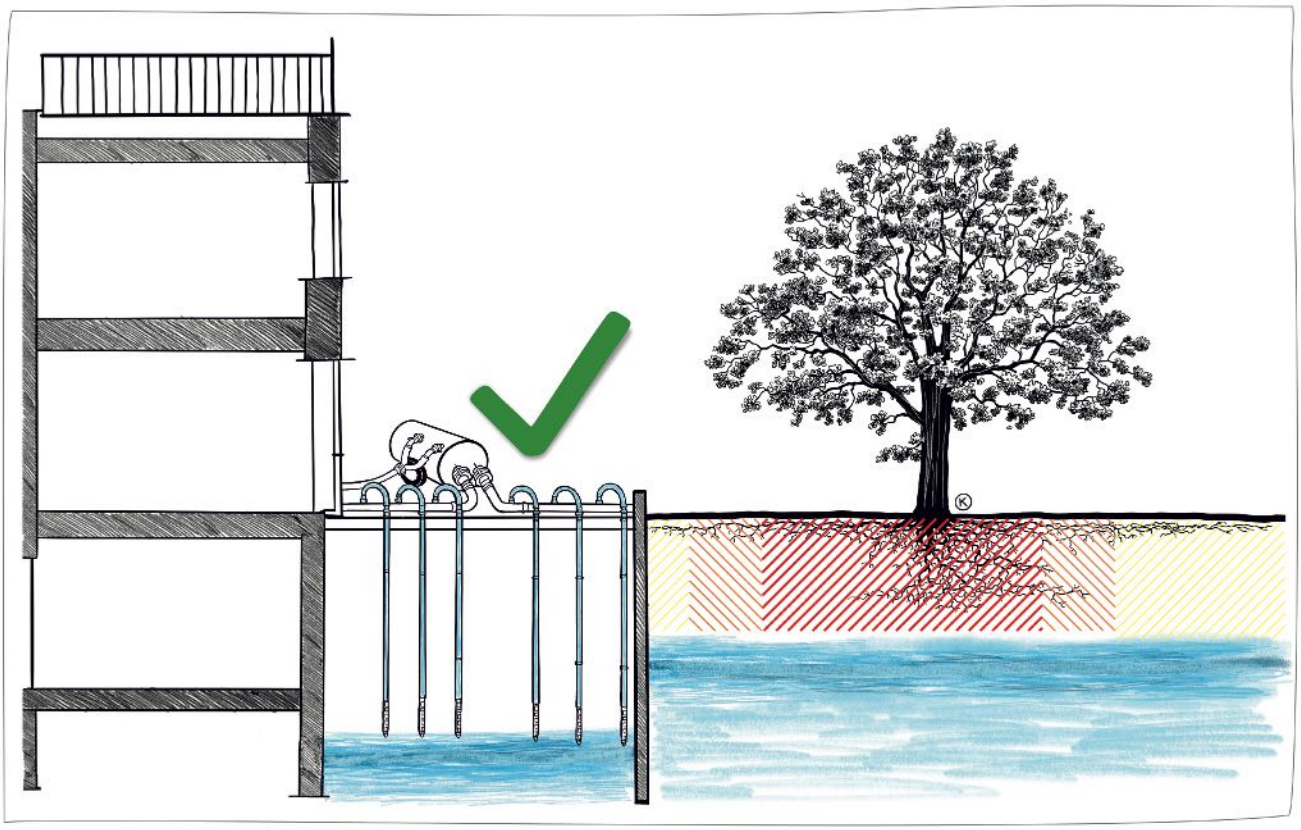


Figure 13 : Example of water management measures

load distribution mats, or track plates, for construction machinery is recommended when working on non-paved surfaces where vegetation soil has been preserved. These specialized mats are designed to distribute the weight of heavy machinery more evenly across the surface, minimizing soil compaction.

6.4.16 Compacting soil can significantly reduce its aeration and permeability, adversely affecting root growth and the overall health of nearby vegetation. By reducing the pressure exerted on the soil, load distribution mats help maintain the soil's structure and integrity, ensuring that essential nutrients, air, and water can reach plant roots effectively. This practice is particularly important in sensitive ecological areas or near existing vegetation.

6.5 Tree-friendly technologies

6.5.1 **Trenchless technologies:** may offer innovative solutions for protecting trees during development activities. These techniques allow for the installation and maintenance of underground utilities without the need for extensive digging and trenching, which can significantly disturb the root systems of trees. By minimizing soil disruption, trenchless methods help preserve the integrity of roots, thereby enhancing the overall health and stability of trees. See Appendix 5 for an overview of methods.

6.5.2 These methods are versatile and can be tailored to different soil conditions and project requirements. For example, horizontal directional drilling is ideal for installing pipes over long distances and through various soil types without open trenching, ensuring tree roots remain undisturbed. Similarly, micro-tunnelling, which uses a guided drilling head, is perfect for high-precision installations in challenging geological conditions.

6.5.3 Employing trenchless technologies can significantly enhance tree preservation during development projects. The strategic use of trenchless methods can also facilitate implementing individual protection zones, focusing on safeguarding the critical root areas of individual trees.

6.5.4 Integrating trenchless technologies into construction planning requires close collaboration with arborists and soil specialists. These experts can provide valuable insights into optimal opening point placement and potential tree health impacts. By taking advantage of this expertise, developers can ensure trenchless operations maximize tree protection.

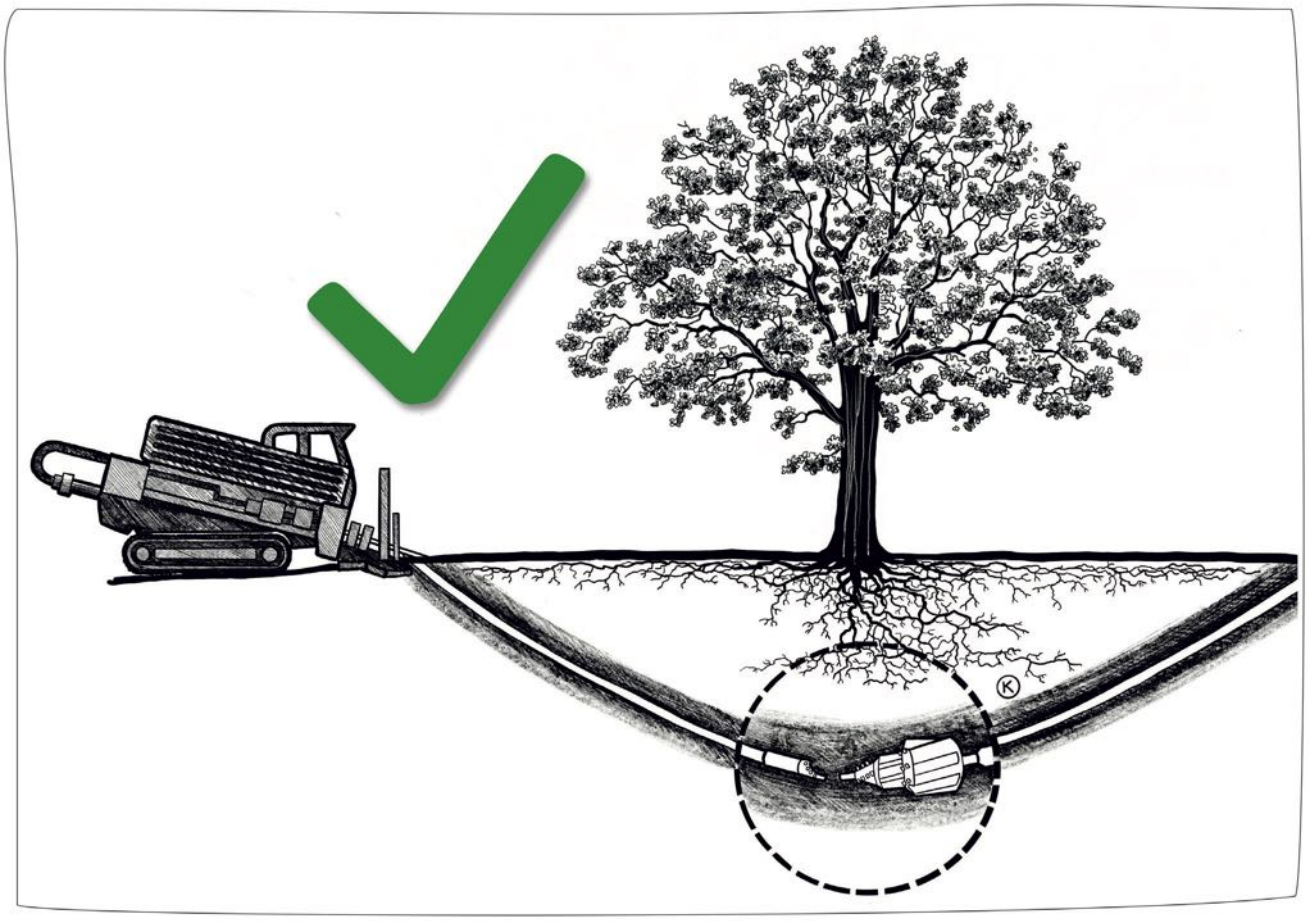


Figure 15 : Example of trenchless technologies

6.5.5 **Using an air spade for root exposure prior to excavation:** Before commencing open excavations near trees, it is advisable to use an air spade to expose the position of roots first. The air spade, which uses compressed air to remove soil without physically damaging roots, allows for a careful and detailed examination of the root structure. This non-invasive technique helps identify the exact locations of roots, ensuring they are not inadvertently damaged during subsequent digging. By discovering the position of roots beforehand, construction teams can plan their excavation strategies more effectively, minimizing harm to the tree and preserving its health.

6.5.6 **Utilizing micro-piles instead of 'trench and slab foundations' for construction:** In areas where tree protection is a priority, utilizing micro-piles for constructing foundations can be a beneficial alternative to traditional full bases. Micro-piles are small-diameter, deep foundations that can support structures while causing minimal disruption to the surrounding soil and root systems. When the load is focused on these slender piles, the root zones of nearby trees remain largely undisturbed, which promotes their continued growth and health. This method is particularly effective in preserving mature trees that have extensive root networks, allowing development to proceed without compromising tree integrity.

6.5.7 **Implementing elevated pavements:** Elevated pavements and cellular confinement systems are another innovative solution for protecting tree roots during construction. By raising the pavement above the ground, these methods preserve natural soil level and root systems. This approach prevents compaction and allows air and water to reach the roots, essential for the tree's health. This technique is especially useful in urban areas where space is limited and both pedestrian infrastructure and tree protection are necessary.

6.5.8 **Hard surfaces, grilles:** These can be used when constructing areas such as sidewalks or plazas near trees. Details can be found in EAS 03:2022 (EN) – European Tree Planting Standard.

6.5.9 For temporary events, the protection requirements for trees must be listed and specified, and a plan to restore the site to its original condition after the event must be described and agreed.

6.6 Planting as part of construction

6.6.1 A planting plan can be a component of the Tree Protection Plan, especially in scenarios where tree removal is unavoidable.

6.6.2 This plan serves as a compensatory measure to mitigate the environmental impact of removing trees. The planting plan should detail the proposed positions of the new trees, carefully selected to optimize use of space and environmental benefit while minimizing future conflicts with structures or other vegetation.

6.6.3 Additionally, defining the size of the planting material is crucial.

6.6.4 The entire planting process, from site preparation to aftercare, should align with the guidelines specified in EAS 03:2022 (EN) – European Tree Planting Standard.

6.6.5 The tree planting plan must be synchronized with the construction plan and communicated to all stakeholders.

6.7 Tree transplanting plan

6.7.1 The default approach is to protect trees and adapt the design accordingly. Only in cases where this is not an option should transplanting be considered.

6.7.2 The decision to transplant should be based on several key factors that ensure the health and survival of the tree both during and after transplanting.

6.7.3 **Physiological capacity:** Trees selected for transplantation should demonstrate strong vitality and an inherent capacity to withstand the stress of relocation. This evaluation involves considering the genetic adaptability of the species to such processes.

6.7.4 **Tree value:** The tree must possess significant characteristics that justify its conservation. These could be its dendrological importance or its aesthetic, ecological or historical attributes.

6.7.5 **Conservation of tree value:** The primary goal of transplantation should be to maintain the tree's health, structure, and overall integrity. Trees that cannot retain these qualities post -transplanting are not suitable candidates.

6.7.6 **Transplantation method:** The method employed plays a crucial role in the tree's future health. Older trees, with deeper and/or more extensive roots in their environment, are more susceptible to transplant shock. Therefore, the choice of technique and the resources allocated are critical to ensure a successful transplantation.

6.7.7 **Maintenance post-transplanting:** Correct and sustained maintenance is essential. This includes setting up an automatic irrigation system tailored to the tree's needs, taking into account soil characteristics and seasonal variations. Large trees may require several years of active maintenance before they become self-sustaining. Some may even need lifelong care.

6.7.8 **Economic suitability:** The economic value of a tree and the ecosystem benefits it provides should be weighed against the cost of transplantation. Projects that greatly exceed these values might not be justifiable.

6.7.9 **Final location:** Transplanting is only viable if the new location maintains or enhances the tree's value. Transplanting to a less prominent or inappropriate environment is not advised.

6.8 Possibilities for improving future growing conditions

6.8.1 Increasing the rooting area gives trees access to more soil, improving water and nutrient absorption, and leading to a stronger root system and improved vigour.

6.8.2 This is especially beneficial for trees in constrained spaces with limited soil volume.

6.8.3 More soil volume helps buffer against environmental stressors like drought and pollution, enhancing tree resilience.

6.8.4 Expanding soil volume supports tree vitality and urban ecosystem health, improving urban living conditions.

6.8.5 Strategies include:

- Installation of root bridges.
- Use of structural substrates.
- Installation of anti-compaction systems.

6.8.6 **Mechanical soil de-compaction** involves loosening compacted surface soils through de-compaction aeration methods and loosening the top layer.

6.8.7 This process is often carried out under tree canopies, but only to a depth which avoids damaging the root collar, larger roots, and existing ground cover.

6.8.8 **Aeration**, which reduces soil compaction and enhances water infiltration, is usually carried out with machinery in grassy areas but should avoid the TPZ of adult trees and areas with visible large roots.

6.8.9 **Soil biodiversity remediation** is crucial for nutrient cycling, soil structure, and plant health.

7. Implementation

7.1 Introduction

7.1.1 During the development implementation process, it is possible that trees may incur damage. It is crucial to minimize this damage to acceptable levels by applying protection and control measures to avoid all preventable and structural damage.

7.1.2 Workers and non-arborists should be instructed and trained in how to protect trees and avoid causing damage.

7.1.3 If applicable, it is advisable to place information boards on the construction site's fencing. These boards should include contact information for the Tree Protection Plan (TPP) Supervisor and general information about the tree protection procedures. A template for these boards is provided in Appendix 8.

7.1.4 **Effective communication** is crucial throughout the construction process. Formal communication should be documented in the construction diary (see Section 7.7 and Appendix 7), ensuring that all actions and decisions are recorded systematically.

7.1.5 Equally important is informal communication, which fosters collaboration and quick resolution of issues. This includes regular on-site meetings, verbal updates, and spontaneous discussions among team members. Both formal and informal communication help maintain transparency, address concerns promptly, and ensure that everyone involved is aware of the tree protection measures in place.

7.1.6 In the complex and dynamic environment of construction projects, the coordination of various roles and responsibilities is critical for ensuring the successful implementation of a TPP.

7.1.7 The following sections serve as a comprehensive guide for managing and implementing TPPs in construction projects, emphasizing the importance of coordination, communication, and adherence to established standards and procedures.

7.2 Responsibilities (Roles)

7.2.1 During the development process, several parties need to fulfil their specific roles to ensure success. The following is a list of stakeholder roles and relevant responsibilities; for further details, refer to Appendix 6.

7.2.2 Head of Construction:

- Project planning and coordination.
- Policy and regulation compliance.
- Resource allocation.
- Team communication and training.
- Supervision and enforcement.
- Liaising with TPP Supervisor.
- Monitoring and reporting.
- Crisis management and mitigation.
- Documentation and record-keeping.

7.2.3 TPP Supervisor (Arboricultural consultant):

- Technical expertise and advice.
- On-site supervision.
- Liaison and communication.
- Training and awareness.
- Monitoring and documentation.
- Problem-solving and adaptation.
- Regulatory compliance and reporting.
- Emergency response.

7.2.4 Contractors:

- Compliance with the TPP.
- Effective communication.
- Training and supervision.
- Proper use of machinery and equipment.
- Monitoring of Tree Protection Zones (TPZs).
- Response to incidents.
- Environmental awareness.
- Documentation and reporting.
- Coordination with other parties.

7.2.5 Tree Workers:

- Understanding and implementing the TPP.
- Specialized tree care.
- Monitoring tree health.
- Effective communication.
- Use of equipment and machinery.
- Emergency response.
- Adherence to safety protocols.
- Training and skills development.

7.2.6 Construction Workers:

- Understanding the importance of the TPP.
- Adherence to protective measures.
- Careful operation of machinery and tools.
- Regular communication and reporting.
- Compliance with site-specific guidelines.
- Emergency procedures.
- Maintenance of tree protection measures.
- Environmental awareness.

7.3 Process of TPP supervision

7.3.1 The supervision of the TPP is a process that spans the entire duration of a construction project, ensuring the safety and health of trees from start to finish.

7.3.2 Throughout the project, regular checks are integral to this process. These checks involve routine inspections to assess the condition of the trees and the effectiveness of protective measures. The frequency and nature of these inspections are determined based on the project's scale, duration, and potential impacts on the trees.

7.3.3 An essential component of TPP supervision is the documentation of all activities related to tree protection. This includes keeping detailed records of initial tree condition, any change or damage that occurs during construction, and the measures taken to prevent or mitigate such impacts.

7.3.4 The TPP supervisor, typically a qualified arboricultural consultant, is responsible for maintaining these records. They must ensure that all protective measures are in place and adhered to, and that any deviation from the plan is properly justified and documented.

7.3.5 Moreover, the documentation serves as a vital tool for accountability and compliance. It provides a clear trail of actions taken, enabling effective communication between construction heads, contractors, and tree workers.

7.4 Changes and amendments

7.4.1 In the dynamic environment of a construction project, changes and amendments to the TPP may become necessary. However, it is imperative that such modifications are only considered in justified cases.

7.4.2 This means that alterations to the TPP should occur only when unforeseen circumstances arise that significantly impact the initial plan, such as unexpected environmental conditions, discovery of an endangered species, or safety concerns. Any proposed change must undergo a thorough evaluation to assess its necessity and the potential impact on the tree protection objectives.

7.4.3 Effective communication and monitoring are key when implementing changes to the TPP. Once a change is deemed necessary and justified, it should be clearly communicated to all stakeholders, including the construction team, tree workers, environmental specialists, and local authorities if required. This communication should detail the nature of the change, the reasons behind it, and the expected outcomes.

7.4.4 Monitoring these changes involves regular checks and assessments to ensure the amended measures are effectively protecting the trees. This might include increased frequency of inspections or additional reporting requirements. The TPP supervisor plays a critical role in this, acting as the central point for both disseminating information about the changes and gathering feedback on their implementation.

7.4.5 Documenting any changes and amendments to the TPP is crucial for maintaining transparency and accountability throughout the construction process. This documentation should include a detailed description of the change, the justification for it, and any approvals or consultations undertaken.

7.4.6 Additionally, it should record the implementation process and its impact on the tree protection goals. This documentation serves as a vital record for auditing purposes and helps in future planning and continuous improvement of tree protection strategies.

7.4.7 Documentation should be accessible to all relevant parties and updated in real-time to reflect the current state of the TPP. This ensures that everyone involved in the construction project is aware of the latest tree protection measures and can adapt their work accordingly.

7.5 Emergency Tree Protection Plan

7.5.1 In the event of an urgent situation, it is essential to have a clear and effective protocol to limit damage to trees. It is crucial to ensure immediate communication with the responsible tree officer who should be informed as soon as an emergency arises so that they can provide guidance on protective measures and oversee the operation.

7.5.2 Urgent situations that trigger this procedure may include, for example, imminent water pipe repairs, failures of trees or tree parts, or road accidents.

7.5.3 Prompt and clear communication can help in assessing the situation accurately and deploying the necessary resources to minimize any potential harm to the trees.

7.5.4 It is advisable to provide training for other municipal services involved in emergency operations. These services should be educated on the importance of tree protection and the specific protocols in place for working around trees.

7.5.5 If possible and applicable, it is important to use physical barriers and signage to clearly demarcate the adjusted buffer zones and inform all personnel on site about the temporary changes. This signage should include warnings about the presence of protected trees and instructions to avoid causing any damage. Visual aids can be highly effective in maintaining awareness and compliance among the workers.

7.5.6 After the emergency work is completed, the affected trees should be assessed thoroughly. This assessment should include evaluating the extent of any damage, implementing necessary treatments, and planning for ongoing care and monitoring to support tree recovery.

7.6 Setting up a Tree Protection Zone and other measures

7.6.1 The first step in safeguarding trees during construction is the establishment of a Tree Protection Zone (TPZ). Where possible, this zone should be delineated with robust, visible fencing to create a physical barrier around the tree or group of trees.

7.6.2 In particular, the TPZ must protect the rooting area of trees, which, as described in 6.3.8, can often extend significantly beyond the tree canopy.

7.6.3 Implementing and installing protection zones is more challenging for street trees, where construction activities present an opportunity to enhance growing conditions. In compacted street soils, construction activities provide a rare chance for tree roots to expand beyond the original planting pit.

7.6.4 The trunk of the tree is particularly vulnerable to mechanical damage during construction activities. To prevent such damage, protective materials like padded wrappings or specialized tree guards should be installed.

7.6.5 Altering the area around the trunk base can lead to structural insecurity in trees, necessitating temporary supports such as poles or cables during construction or renovation work.

7.6.6 Changes in soil compaction around the roots and trunk can significantly impact the tree's stability, affecting it differently under tension and compression forces. To address these stability issues, specifically designed and temporary/permanent anchoring systems can be implemented.

7.6.7 Such anchoring systems should carefully be tailored to the tree's specific needs, taking into account the varying impacts of soil compaction and the tree's response to tension and compression.

7.6.8 The tree crown needs protection from potential damage due to construction equipment, debris, or changes in the environment. Measures may include pruning to remove potentially hazardous or unhealthy limbs, installing physical barriers or supports to guard against mechanical damage, and ensuring that construction activities do not significantly alter the availability of natural light or moisture. Any pruning should be carried out by a qualified arborist to ensure it promotes the tree's health and does not lead to undue stress or vulnerability.

7.6.9 The integrity of the TPZ and its associated measures is paramount. Under no circumstances should the protective barriers, whether fencing, trunk guards, or crown protection, be removed, breached, or damaged. This rule must be strictly enforced to prevent inadvertent harm to the tree. All personnel on the site should be adequately briefed on the importance of these measures and the consequences of violating them. Regular inspections should be conducted to ensure that the protective measures remain intact and effective throughout the construction process.

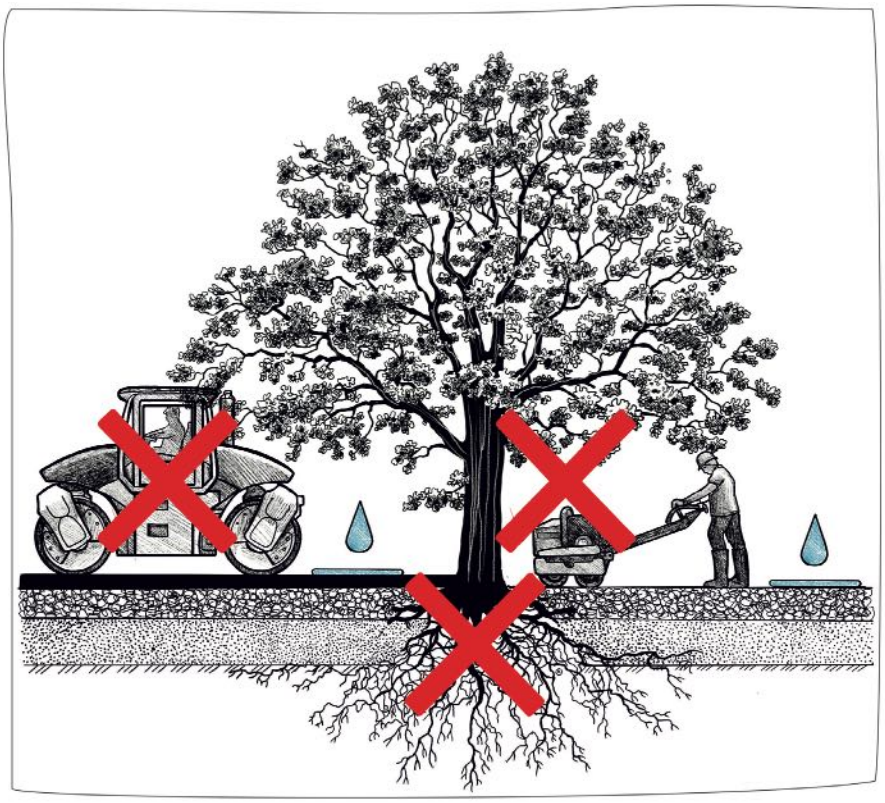


Figure 16 : Prohibited activities to prevent soil compression.

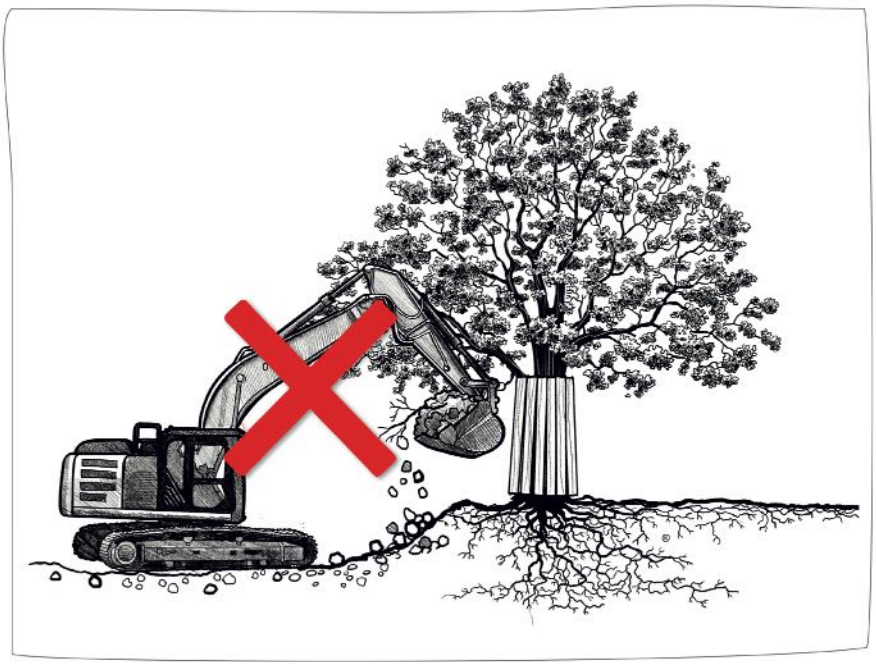


Figure 17 : Prohibited activities to prevent root damage.

7.7 Arboricultural works as a part of implementation

7.7.1 Pruning should be carried out to remove dead, diseased, or hazardous branches where access is required, according to the design or during construction.

7.7.2 Crown lifting, which involves the removal of lower branches, should only be performed when necessary, such as to provide clearance for construction equipment or enhance visibility. This process should be minimal to prevent undue stress on the tree and should always be done in accordance with professional arboricultural practices. The techniques for these interventions are defined in EAS 01:2022 (EN) – European Tree Pruning Standard.

7.7.3 In some cases, cabling may be necessary to provide additional support to branches that are structurally weak or at risk of failure. These interventions should be performed by qualified arborists to ensure they adhere to professional standards and do not harm the tree. The techniques for these interventions are defined in EAS 02:2022 (EN) – European Tree Cabling/Bracing Standard.

7.7.4 The use of tree-friendly technologies can be instrumental in preserving tree health during construction. These tools are used for safely excavating soil around tree roots without causing damage, allowing for inspections, root pruning, or improvements to the rooting environment. Cooperation with arboricultural experts is vital when using these techniques to ensure they are applied correctly and effectively.

7.7.5 Root pruning may be necessary in some cases to prevent damage to the tree during construction. This should be done with care, as excessive root pruning can harm the tree's stability and health. Root pruning should always be overseen by an experienced arborist to ensure it is done correctly and sustainably.

7.7.6 Enhancing the rooting area of trees can significantly contribute to their long-term health and stability. This may involve amending the soil, improving drainage, or reducing soil compaction. Such improvements should be tailored to the specific needs of each tree and should be guided by an understanding of the tree's species and its particular requirements.

7.7.7 Incorporating arboricultural works in construction projects is crucial for the protection and preservation of trees. These activities, ranging from pruning and cabling to root area improvement, must be conducted with professional expertise and care. By doing so, construction projects can mitigate their impact on the existing trees, ensuring a harmonious balance between development and the natural environment.

7.8 Communication (construction diary)

7.8.1 A construction diary (see Appendix 7) is a comprehensive record-keeping tool used to document various aspects of the construction process, including those relating to the impact on trees.

7.8.2 **Monitoring activities:** This involves regular checks and logging of all construction activities that could potentially affect trees, ensuring that these actions are managed in a way that minimizes harm to the tree environment.

7.8.3 **Change documentation:** The diary serves as a detailed record of any changes in construction methods or site layout, or unexpected developments that might impact trees. This helps in tracking the cumulative effects of the project on trees and provides a historical record for reference and accountability.

7.8.4 **Error logging and mitigation measures:** Mistakes or oversights that occur during construction and that impact on trees are recorded in the diary, along with the steps taken to mitigate these effects. This process is crucial for learning from incidents and improving tree protection strategies in the future.

7.8.5 **Communication and training tool:** The construction diary can also function as a communication medium, disseminating vital information about tree protection measures, guidelines, and emergency protocols to workers. It may also include details of training sessions or instructions provided to workers regarding tree protection.

7.8.6 **Regulatory compliance and reference:** The diary helps ensure compliance with the TPP and serves as a reference for TPP supervisors and other stakeholders to review and assess the ongoing impact of construction activities on tree health.

7.9 Waste and excess material management

7.9.1 Effective waste and excess material management is crucial in construction projects, particularly for safeguarding tree health and the environment. The first step in this process involves the diligent removal of all debris and chemical remains from the construction site. These include construction materials, scraps, and any chemical substances that may have been used during the construction process.

7.9.2 Special attention must be given to ensuring that these materials do not contaminate the soil, water sources, or the wider environment surrounding the trees.

7.9.3 Regular clean-up schedules should be implemented to maintain a clean and safe site. Additionally, responsible disposal methods must be adhered to, ensuring that all debris and chemicals are disposed of in an environmentally friendly manner, following local regulations and environmental guidelines.

7.9.4 Waste and excess material management involves the establishment of designated areas for temporary storage of materials, strategically located outside tree protection zones. This measure is essential to prevent any accidental damage to the trees and their root systems.

7.9.5 These temporary storage zones should be clearly marked and located at a safe distance from the protected trees to avoid any inadvertent harm caused by material spillage, runoff, or physical contact.

7.9.6 The choice of location for these storage areas should take into account factors including ground slope, proximity to water bodies, and prevailing wind direction to minimize environmental impact.

7.9.7 Regular monitoring and maintenance of these storage areas are vital to prevent overflow, leakage, or other issues that could lead to contamination or damage to tree protection zones.

8. Completion of construction activities and aftercare

8.1 Introduction

8.1.1 The completion of construction activities marks a significant milestone in any development project.

8.1.2 The hand-over is a systematic procedure required to efficiently wrap up construction activities, ensuring that the site is left in a safe, sustainable, and environmentally friendly condition.

8.2 Documenting and reporting

8.2.1 Documenting and reporting at the conclusion of construction activities are critical steps to ensure that all changes made to the site, especially concerning trees and vegetation, are intentional, beneficial, and in alignment with the established Tree Protection Plan (TPP).

8.2.2 **Verification of intended changes:** Confirm that all changes made to the site, particularly those affecting trees and vegetation, are deliberate and align with the planned objectives. This step is crucial to ensuring that the project's environmental goals are met.

8.2.3 **Compliance with the TPP:** The TPP serves as a guiding document throughout the construction process. The final assessment must verify that all actions taken on site are compliant with the stipulations of the TPP. This includes checking for any unintended harm to trees, assessing the effectiveness of protective measures, and ensuring that any deviations from the plan were managed appropriately.

8.2.4 **Identification of unplanned changes:** During construction, unforeseen changes to the original plan for the project can occur. The final assessment aims to identify any such changes, understand their impact, and determine if they are acceptable or require remediation. This step is vital for maintaining the ecological balance and integrity of the site.

8.2.5 **Documentation for future reference:** Detailed documentation of the final state of the site is essential for future reference. This documentation should include photographic evidence, written reports, and any other relevant data that captures the condition of the site at the completion of the construction phase. This record is invaluable for future maintenance, potential audits, and as a benchmark for similar projects.

8.2.6 **Reporting:** The final step involves compiling a comprehensive report that summarizes the findings of the final site/tree assessment. This report should clearly articulate whether the site's current state aligns with the initial objectives and the TPP. It should also include recommendations for any further actions or monitoring required to maintain the health and safety of the site, particularly the trees and vegetation.

8.3 Definition of an aftercare plan

8.3.1 The aftercare phase is a critical component, particularly in ensuring the long-term health and safety of the trees and surrounding natural environment affected by the construction activities.

8.3.2 **Establishing the aftercare objectives:** The primary objective of the aftercare plan is to monitor and manage the site to ensure the continued health and vitality of the trees and landscape. This involves regular inspections, maintenance activities, and interventions as required. The objectives should be clearly defined, realistic, and tailored to the specific needs of the site and the species present.

8.3.3 **Monitoring schedule and activities:** A critical aspect of the aftercare plan is establishing a comprehensive monitoring schedule. This schedule should detail the frequency of site visits, specific areas to be inspected, and the indicators to be evaluated, such as tree health, soil condition, and the integrity of protective measures implemented during construction. The schedule should be flexible enough to accommodate seasonal changes and unexpected events.

8.3.4 **Maintenance and intervention strategies:** Maintenance activities are essential for addressing any issues identified during monitoring. These may include watering, pruning, pest control, and repairing or reinforcing tree supports or protective barriers. The plan should outline clear procedures for each maintenance activity, including the methods to be used, frequency, and responsible parties.

8.3.5 **Long-term tree assessments:** Long-term tree assessments are vital for detecting any delayed effects of the construction activities. These assessments should be conducted by qualified arborists and include a thorough examination of all parameters defined by EAS 04:2025 (EN) – European Tree Assessment Standard.

8.3.6 **Adaptation and responsive actions:** The aftercare plan must be adaptable, allowing for responses to unforeseen challenges such as disease outbreaks, extreme weather events, or other environmental stressors. It should outline the process for identifying, reporting, and responding to such events to mitigate their impact effectively.

9. Protection of trees before, during and after public events

9.1 Introduction

9.1.1 Parks and other open spaces are often used as venues for activities such as:

- Fairs,
- Concerts,
- Community and municipal festivals and celebrations.

These events may significantly increase the number of people and /or property that could be affected by tree failure, especially if they are located in a dense city with a low proportion of green spaces.

9.2 Event layout

9.2.1 The event organizer must provide detailed information, including:

- Type of activity: A description of the planned event or activity.
- Attendance: The expected number of people and the duration of their presence (days/nights).
- Occupation zones: Specific areas within the park that will be used or occupied.
- Transport zones and vehicles: Details of transport routes within the park and the types and numbers of vehicles that will be used.
- Duration: The total duration of the activity, from setup to dismantling.
- Services to be installed: Information on any services to be installed, such as water, electricity, or other utilities.

9.2.2 As a fundamental principle, events should be tailored to suit the site (e.g., a park) rather than altering the site to fit the events. Major modifications should be avoided.

9.3 Initial impact assessment

9.3.1 A thorough visual inspection must be conducted before any event to identify any risks to attendees posed by trees. This includes checking for dead or overhanging branches and other potential hazards.

9.3.2 Biodiversity assessment: A comprehensive list of local biodiversity that may be affected by the event must be compiled. Particular attention should be given to nesting birds and protected fauna. Measures should be taken to minimize disturbance to these species. In the case of significant conflicts with protected species/green infrastructure, refusal of permission to run the event should be considered.

9.3.3 Identification of vulnerable zones: A detailed map identifying vulnerable zones within the park should be created. These zones require special protection during events to prevent damage to sensitive areas.

9.3.4 Protection and usage plan: Areas with constant or frequent activity need a dedicated protection and usage plan. This plan should include guidelines for managing events to minimize wear and tear on the park's infrastructure and natural resources.

9.3.5 Capacity control: The capacity of the event area must be controlled to prevent overcrowding and ensure the safety and comfort of attendees. This may include setting a maximum number of participants and monitoring entry points.

9.4 Tree protection measures

9.4.1 Service installation: Events frequently require the installation of services such as electricity and, at times, water. Trees should not be used as support poles for these services.

9.4.2 Use of movable poles: In areas where events are held regularly, it is recommended that movable poles in pre-prepared holes or permanent infrastructure is installed. This allows for easy setup and removal without causing harm to the park's trees or landscape.

9.4.3 Installation of protection tubes: To avoid using trees as support structures, protection tubes can be installed along pathways designated for cars and pedestrians. These tubes can house the necessary cables and pipes, protecting both the trees and the park's overall aesthetic.

9.4.4 Protection when trees are used as supports: If trees must be used to support services, all materials involved should be non-damaging to the trees. Additionally, event organizers should be required to pay a deposit before the event. This deposit ensures that all installations are removed afterwards and that no damage has been done to the trees.

9.4.5 Respecting park layout: The layout and design of the park must be respected at all times. Services should not traverse natural zones and must utilize existing pathways wherever possible to prevent disruption to the park's environment and infrastructure.

9.4.6 Utilize existing paths: Direct foot traffic and vehicle movement to existing paths where soil compaction is already high, avoiding previously unused zones to protect them from additional stress.

9.4.7 Protection measures for use of heavy machinery: If heavy machinery, such as cranes or heavy goods vehicles, is needed on site, cover the paths with track plates and gravel to protect good soil areas from excessive compaction.

9.4.8 Parking zones: Designate parking zones outside tree areas to minimize root zone compaction.

9.4.9 Surface protection: Protect susceptible soils during activities by using wooden platforms or track plates. If these are not available, apply adequate mulching to help reduce compaction.

9.4.10 Post-event lawn care: After activities that may cause compaction, use lawn machinery like aerators to relieve soil compaction, ensuring they are used away from main roots.

9.4.11 Special tree protection zones: Establish protected zones around special trees, similar to construction protection practices. High-traffic areas, such as those around toilets and bars, should receive extra protection.

9.4.12 Soil integrity: Alterations to soil levels should be strictly prohibited.

9.4.13 Tree and root protection: Cutting trees, branches, or roots is forbidden without explicit permission from the arborist team.

9.4.14 Proper waste management is crucial during park events to prevent environmental damage. Ensure all waste generated is managed properly. Liquid waste in particular should be controlled to avoid contamination from cleaning activities.

9.5 General recommendations

9.5.1 Effective communication with all parties involved is essential to ensure compliance with tree and park protection measures.

9.5.2 Provide a detailed explanation of tree and park protection measures to event organizers and any companies involved in the event.

9.5.3 Sanctioning regime: The park's owners may establish a sanctioning regime to enforce compliance with park regulations. This could include fines or other penalties for activities that cause damage or violate park rules.

9.5.4 Emergency plan: An emergency plan must be prepared to address potential adverse weather conditions, such as storms, strong winds, floods or lightning strikes. The plan should include defined maximum acceptable wind speeds and procedures for event suspension or evacuation if conditions become hazardous.

9.5.5 Clearly mark areas designated for different activities and pathways to guide participants and prevent unintentional damage to sensitive areas.

Appendix 1 - Stakeholders

This table lists the main stakeholders for construction/event projects along with their roles and tasks. Further details of specific roles in the implementation phase are provided in Appendix 6:

Stakeholder	Roles, responsibilities
Regulatory Bodies (courts, central and local government):	- Directly or indirectly influencing the project and tree protection by general and project-specific decision and regulation. - Safeguarding trees, preserving site conditions, and protecting associated biodiversity, encompassing national and EU legislation as well as local decisions. NOTE: This legal framework is essential to ensure that these environmental elements are effectively protected and maintained.
Landowner/Manager (public or private) – Investor	- Acknowledging the value of their trees and actively seeking the trees' preservation as integral components of their assets as a core concept in allowing construction to take place. - Ensuring that the rights of neighbouring property owners are not violated during the construction process.
Designer	- Incorporating tree protection strategies into project designs. - Engaging with arboricultural experts for specialized advice, complying with regional environmental laws, clearly conveying tree preservation plans to build crews. - Overseeing the construction activities to modify protection approaches as needed.
Project Manager	- Transforming the design project into reality by assigning tasks to the contractor and coordinating the overall development of the project. - Ensuring that all activities adhere to environmental protection guidelines. - Implementing a Tree Protection Plan to avoid or minimize damage to trees and green spaces; overseeing the integration of sustainable practices. - Facilitating communication between stakeholders to address any environmental concerns.
Contractor	- Implementing Tree Protection Plans. - Ensuring coordination with arborists and designers for optimal tree safety. - Constantly monitoring and adapting to any changes in the construction environment including compliance with legal and environmental regulations. - Educating and managing the construction team in relation to the importance of tree preservation. - Identifying and managing any construction-related risks that could potentially harm the trees and having effective contingency plans ready.

Stakeholder	Roles, responsibilities
Technical (Construction) Supervisor or Manager	- Overseeing the construction process and ensuring quality control. - Monitoring all activities and promptly seeking the collaboration of the TPP (Tree Protection Plan) Supervisor for any tree-related issues. - Ensuring that tree protection measures are effectively implemented and any potential impacts on trees are promptly addressed.
Tree Consultant	Balancing the needs of construction projects with the preservation of trees, including: - Conducting detailed assessments of trees within and around construction sites – Tree Impact Assessment (TIA). - Based on their assessments and data provided by the project, tree consultants develop comprehensive Tree Protection Plans. - Identifying potential risks to trees during construction and all activities which can change the site characteristics and recommending strategies to mitigate these risks. - Collaborating closely with designers, construction teams and technical supervisors, tree consultants provide expert advice and guidance on how construction activities can be conducted with minimal impact on trees. - Monitoring the implementation of the Tree Protection Plan (TPP). - Educating and informing construction teams and stakeholders about the importance of trees and the best practices for their preservation.
TPP (Tree Protection Plan) Supervisor	- Overseeing the execution of the Tree Protection Plan (TPP), ensuring that all protective measures for trees are properly installed and maintained throughout the construction process. - Coordinating arborists, designers, and constructors to ensure that all activities comply with the specified tree protection strategies. - Adapting and modifying the TPP as necessary in response to changing conditions on the construction site or unforeseen impacts on the trees. - Serving as a key point of contact for addressing any tree-related issues or concerns raised by the construction team or other stakeholders, ensuring that tree protection remains a priority throughout the project.
Tree Worker/Arborist	Involved in the practical aspects of tree care and maintenance by: - Performing tree care tasks based on the Tree Protection Plan and instructions from a tree consultant (applying EAS 01:2022 (EN) – European Tree Pruning Standard and EAS 02:2022 (EN) – European Tree Cabling/Bracing Standard). - Tree planting, transplanting, and removal based on industry standards (applying EAS 03:2022 (EN) – European Tree Planting Standard). - Emergency tree care based on instructions from the technical supervisor and tree consultant. - Following and executing the guidelines set out in the Tree Protection Plan during the construction project. - Advocating for the preservation of trees in urban settings and educating others about the importance of trees for environmental health and community wellbeing.

See the national appendices to check the roles and tasks regulated by local law.

Appendix 2 -Treescape Analysis

CONSTRUCTION AREA ANALYSIS

Nature protection areas

International Level:

Natura 2000: A network of protected areas across the European Union aimed at conserving the most seriously threatened habitats and species.
Biosphere Reserves: Areas designated by UNESCO under the Man and the Biosphere (MAB) Programme to promote biodiversity conservation and sustainable development.

National Level:

National Parks: Large protected areas established by national governments to preserve the natural environment and wildlife, often allowing for public recreation and education.
Nature Reserves: Areas designated to protect specific natural features or species, often with stricter protection measures than national parks.
Wildlife Sanctuaries: Protected areas primarily aimed at the conservation of wildlife and their habitats.
Territorial System of Ecological Stability: A TSES is defined as an interconnected set of natural and modified, yet nature-friendly ecosystems that maintain natural balance.

Regional/Provincial Level:

Regional Nature Parks: Protected areas managed at a regional or provincial level, often focusing on both conservation and the sustainable use of natural resources.
Provincial Parks: Similar to national parks but managed at a provincial level, focusing on the preservation of regional natural landscapes and biodiversity.
Nature Conservation Areas: Regions designated by regional authorities for the protection of natural habitats and species.

Local/Municipal Level:

Local Nature Reserves: Smaller protected areas managed by local governments, often focusing on the conservation of local biodiversity and natural features.
Community Conservation Areas: Zones where local communities play a significant role in managing and protecting natural resources and biodiversity.
Green Belts: Areas around cities and towns designated to limit urban sprawl and preserve natural and semi-natural environments.

Specialized Protection Systems:

Small-Scale Protected Areas: These include small nature reserves, protected landscapes, and natural monuments that are designated to protect specific natural features or small habitats.
Marine Protected Areas: Zones designated to protect marine ecosystems, including coral reefs, mangroves, and seagrass beds, ensuring the conservation of marine biodiversity.
Bird Protection Areas: Specific areas designated to protect bird species, particularly migratory birds, often overlapping with other protected area designations like Natura 2000.
Ecological Corridors: Areas designed to connect fragmented habitats, allowing for the movement and migration of species to maintain genetic diversity and ecosystem health.
Buffer Zones: Areas surrounding core protected areas designed to provide additional protection and mitigate external pressures on the core zone.

Heritage protection areas/objects

International Level:

UNESCO World Heritage Sites: Areas of outstanding universal value designated by UNESCO for their cultural, historical, or natural significance.
Ramsar Sites: Wetlands of international importance designated under the Ramsar Convention.

National Level:

National Monuments: Areas or structures designated by a national government for their historical, cultural, or architectural significance.
National Parks: Protected areas established to conserve cultural heritage.
Historic Preservation Zones: Areas designated by national heritage agencies for their historical and cultural importance.

Regional/Provincial Level:

Regional Heritage Sites: Areas designated by regional or provincial governments for their cultural, historical, or environmental significance.
Cultural Landscapes: Regions recognized for their combined works of nature and man, designated at a regional or provincial level.

Local/Municipal Level:

Local Heritage Listings: Buildings, sites, or areas designated by local governments for their cultural, historical, or architectural value.
Conservation Areas: Zones within a municipality identified for their unique historical or architectural character, often subject to specific planning regulations.

Specialized Protection Systems:

Archaeological Sites: Areas protected due to their archaeological significance, often governed by specific regulations and managed by heritage authorities.
Historic Districts: Urban or rural areas with a concentration of historically or architecturally significant buildings and structures.
Cultural Routes: Paths or routes recognized for their historical and cultural significance, often protected and promoted for tourism and education.
Sacred Sites and Cultural Landscapes: Areas of cultural or spiritual significance to indigenous peoples or local communities, often protected through customary laws or national legislation.

Utility and Infrastructure Protection Zones

Water Protection Zones:

Water Supply Networks: Areas surrounding water pipes and treatment facilities to protect the quality and reliability of water supply.
Sanitary Protection Zones: Zones around water reservoirs and wells to prevent contamination.

Sewage and Wastewater Systems:

Sewage Pipeline Protection Zones: Designated areas around sewage pipes to prevent damage and leakage.
Wastewater Treatment Plant Zones: Protective areas to ensure the safe operation of treatment facilities.

Gas Pipeline Zones:

High-Pressure Gas Pipeline Protection Zones: Areas established to prevent excavation and construction activities that could damage pipelines.
Gas Storage Facilities: Protective zones around gas storage sites to prevent unauthorized access and potential hazards.

Electrical Grid Zones:

Transmission Line Protection Zones: Areas around high-voltage power lines to prevent interference and ensure safety.
Substation Zones: Protective areas around electrical substations to secure critical infrastructure.

Telecommunications Zones:

Fiber Optic Cable Zones: Designated areas to protect underground and aerial telecommunications lines.
Telecommunications Tower Zones: Protective zones around cellular and broadcasting towers.

Heat Transmission Network Zones:

Heat Pipeline Protection Zones: Areas designated around heat transmission pipelines to prevent damage and ensure the efficient delivery of heating services.
Heat Exchange Station Zones: Protective areas around heat exchange stations to secure the infrastructure and ensure safe operation.

Military and Police Communication Network Zones:

Designated areas to safeguard critical military communication infrastructure from damage and interference.
Police Communication Network Protection Zones: Protective zones around police communication facilities to ensure the security and reliability of law enforcement communications.

Road Protection Zones:

Highways and Major Roads: Designated areas on either side of the road to prevent unauthorized activities and ensure safe traffic flow.
Local Roads: Smaller protection zones around local roads to ensure safety and protect road infrastructure from encroachment.
Bridges and Tunnels: Specific zones to protect the structural integrity and ensure safe operation of bridges and tunnels.

Railway Protection Zones:

Main Railway Lines: Areas surrounding main railway lines to prevent interference and ensure the safety of rail operations.
Railway Stations and Yards: Protective zones around stations and rail yards to secure infrastructure and manage access.
Railway Crossings: Special protection zones at railway crossings to enhance safety for both rail and road users.

Watercourse Protection Zones:

Rivers and Streams: Designated areas along the banks of rivers and streams to prevent pollution, manage flood risks, and protect aquatic ecosystems.
Canals and Navigable Waterways: Zones around canals and navigable waterways to ensure safe navigation and protect infrastructure.
Floodplains: Protection zones in flood-prone areas to manage land use and reduce the risk of flooding.

Special Locations:

Airports:

- **Runway Protection Zones:** Areas around runways to ensure safe take-off and landing operations and to minimize risks from obstructions.
- **Airport Perimeter Zones:** Protective zones around the entire airport facility to secure infrastructure and manage access.
- **Communication Network Zones:** Protective areas around communication networks to ensure the reliability and security of emergency communication systems.

Green infrastructure and tree population analysis

Initial Site Assessment:

Site Visit: Conduct a thorough walk-through of the site to observe and document existing trees and vegetation.
Mapping: Create detailed maps indicating the location, species, and size of all trees and significant vegetation on the site.
Photographic Documentation: Take photographs of the existing treescape for records and reference.

Tree Evidence:

Identification: Identify tree species present on the site, noting any protected or endangered species.
Neighbouring trees: Identify trees on adjacent plots neighbouring the construction site which might be influenced by the construction activity, taking into consideration its character and extent.
Tree Dimensions: Record the basic dimensions of trees.
Protected and High Value Trees: Note the presence and position of trees with increased value (i.e. veteran/ancient trees) or with formal protection.

Ecological and Environmental Analysis:

Biodiversity Assessment: Assess the ecological value of the treescape, including the diversity of species and their roles in the local ecosystem.
Species Protection: Locate the presence of protected species of plants or trees.
Invasive Species: Map the presence of invasive species of trees or other plants on the site.
Habitat Evaluation: Identify any wildlife habitats supported by trees and other vegetation, including nesting sites and food sources.
Soil and Water Impact: Evaluate how trees affect the soil stability, water retention, and local hydrology.

Regulatory and Legal Considerations:

Zoning and Ordinances: Review local zoning laws and ordinances related to tree protection and land use.
Permits and Approvals: Identify any permits or approvals required for tree removal or construction activities affecting vegetation.
Compliance: Ensure all planned activities comply with relevant environmental protection laws and regulations.

Influence of construction on growing conditions

Based on the character and extent of the construction activity plan, estimate possible future changes in growing conditions.

Influence of Construction on Growing Conditions:

Soil Compaction: Assess the potential impact of construction activities on soil compaction, which can affect root growth and water infiltration.
Root Zone Disturbance: Identify areas where construction might disturb tree root zones, leading to potential stress or damage to trees.
Water Availability: Evaluate changes in water availability due to construction activities, such as alterations to drainage patterns or water table levels.
Light Conditions: Determine how construction might alter light conditions for existing vegetation, taking into consideration the placement of new structures or temporary works.
Air Quality: Assess the impact of construction-related pollution, such as dust and emissions, on the health of trees and vegetation.
Microclimate Changes: Analyse potential changes in microclimate conditions around the site due to construction, including temperature, humidity, and wind patterns.

Appendix 3 - Tree Impact Assessment

Site Name

Site Characteristics

Relevant Individual Tree Population

Tree No.	Tag No.	Species	DBH	Height	Crown Spread	Crown Height	Development Stage	Physiological Condition	Structural Integrity	Description	Tree Category (A–D)	Value Calculation	Proposed Transplant (Y/N)

Relevant groups of trees/shrubs

	Group No.	Species	Percentage Representation	Height						Description	Tree Preservation Zone (m)	Value Calculation	

- **Impact analysis:** The TIA examines how different aspects of the proposed construction – including changes to the soil, water drainage, light availability, and physical space – could affect the trees. This analysis considers both direct impacts (like damage to roots or branches) and indirect impacts (such as altered site hydrology).
- **Root system disturbance:** Construction activities, especially excavation, new soil layers and soil compaction, can severely damage the root systems of trees, leading to stress and decline in tree health.
- **Canopy damage:** Physical damage to branches and leaves from machinery or materials can reduce a tree's ability to photosynthesize and thrive.
- **Soil and water changes:** Alterations to the soil composition, pH, and water drainage patterns due to construction can adversely affect tree growth.
- **Chemical exposure:** Trees can be exposed to harmful chemicals and pollutants during construction, and this can impact their health and growth.
- **Heat sources:** Exposure to heat sources over both long and short periods can cause irreversible damage to the physiologically active components of trees and vegetation.
- **Light/shade:** The introduction of new structures can alter the availability of light, impacting on a tree's adaptation to its existing growing conditions. It is important to take into account both the potential for new shading and increased exposure to light and to implement mitigation measures if needed.
- **Dust pollution:** Construction activities can significantly increase dust pollution in the surrounding environment, affecting the physiological condition and growth of trees.
- **Ground level:** Construction projects often lead to changes in ground level, which can have a profound impact on the soil's air content and porosity, and water availability. These changes can affect the root systems of trees, potentially impeding their growth and health.
- **Mitigation strategies:** The assessment proposes strategies to prevent, mitigate, or correct negative impacts on trees. These can include altering construction designs, employing protective barriers, scheduling work to minimize disruption, or specifying particular construction techniques that are less harmful to trees. Also, if damage occurs, the solution may often involve generating a new soil volume to help the trees recover.
- **Recommendations for tree removal and replacement:** In cases where tree removal is unavoidable, the TIA provides recommendations for compensatory planting or other mitigation measures to offset the loss of trees.
- **Legal and environmental compliance:** The TIA ensures that the proposed construction complies with local, regional, and national regulations regarding tree protection and aligns with environmental conservation objectives.

Reporting

The following report structure is a proposed template that can be modified and adjusted to meet the specific needs of each project.

1. Professional report **titles** should clearly state its purpose, relevant site/address details, the author's name and the date. For reports over approximately 5 pages, they should include a list of contents. All reports should include page numbers, preferably in the form of 'page x of x', and paragraphs and appendices should also be numbered. It is advisable to clearly divide sections of observations from opinions and interpretations. Longer reports may benefit from an executive summary. All reports should include explanations of any terms or references used.

2. The report can **start** by outlining the importance of specific types of green infrastructure in both urban and rural environments. It synthesizes insights from the initial chapters of this standard, emphasizing the critical function of trees within this infrastructure, and is based on their significance.

3. The report includes **detailed outcomes from the tree surveys**, categorizing trees based on their health, age, biodiversity significance, and the categorization system set out in chapter 5. This part of the report provides a clear understanding of the tree population within the development area. The data should be provided in digital form and open exchange format.

4. The report addresses the **positioning or special zones**, including their implications on the treescape. This part of the report shows the interplay between urban utilities and natural elements, emphasizing the need for a balanced approach.

5. The core of the report encapsulates the **TIA**, detailing the potential impacts of the proposed development on the trees. It draws on the methodology and findings of the TIA, including tree protection measures and mitigation strategies.

6. The report incorporates a section on **defining the value of trees**, offering a detailed evaluation of their worth. This part highlights the economic, environmental, and social importance of trees, the level to which they may be affected, the costs associated with preservation, and the appropriateness of such preservation efforts.

7. Tree **planting and transplanting considerations**: This section of the report discusses strategies for tree planting and transplanting within the development area. It reflects on the importance of these activities as sustainable practices in urban development, aligning with the chapter dedicated to these topics.

8. The report culminates with a **comprehensive summary** of findings and provides actionable recommendations. This segment is crucial for decision-making, offering a roadmap for balancing development needs with tree conservation.

9. The report includes **appendices** with detailed tree surveys, tables, maps showing the location of significant trees, utility lines, and protected areas, as well as any other relevant supporting documentation.

Appendix 4 - Tree Protection Plan

INITIAL STATE ASSESSMENT

The Initial State Assessment is a critical step in any development project involving tree protection. The Initial State Assessment aims to establish a detailed baseline of the current environmental conditions, focusing on the health and status of existing trees and surrounding vegetation. This assessment typically (based on the type and extent of the construction activity) includes:

Soil conditions

- Soil composition and structure: Analysing the type of soil (clay, loam, sand, silt, peat) and its structure, including the presence of layers or horizons. This assessment should consider soil compaction levels and porosity, which affect root growth and water drainage.
- Soil chemistry: Testing for soil pH, salinity, nutrient content (nitrogen, phosphorus, potassium), and the presence of any contaminants. This analysis provides insight into the fertility of the soil and potential toxicity issues that might affect tree health.
- Soil biology: Examining the biological activity within the soil, including the presence of beneficial microorganisms, mycorrhizal fungi, and earthworms. These biological indicators help assessment of the soil's health and its capacity to support tree growth.
- Soil moisture content: Determining the current moisture levels in the soil, as this directly impacts the tree's water uptake ability. Monitoring for any signs of drought stress or waterlogging is essential.

Water level

- Groundwater levels: Measuring the depth and fluctuation of groundwater. This involves installing monitoring wells at various locations around the site to provide continuous data on groundwater levels.
- Surface water assessment: Evaluating the presence and condition of any streams, ponds, or wetlands within or adjacent to the site. This includes assessing the quality of the water and the interaction between surface and groundwater systems.
- Drainage patterns: Mapping the natural drainage patterns of the site and surrounding area. Understanding how water moves across and through the site is crucial for predicting potential impacts on trees during and after construction.
- Water quality: Testing water sources for pH, turbidity, contaminants, and nutrient levels. This data is vital for understanding the potential impacts on tree health and the broader ecosystem.

Vegetation, soil network, tree associates

- Vegetation survey: Conducting a thorough examination of the plant species within and surrounding the site. This includes identifying the types of vegetation, their health, density, and diversity. Understanding the existing plant community is crucial for assessing potential impacts on the ecosystem during and after construction.
- Tree association mapping: Identifying and documenting the relationships between different tree species and their associated flora and fauna. This includes understanding the ecological connections, such as mutual dependencies and the role of trees in providing habitat and resources for other species.
- Root zone investigation: Examining the extent and health of tree root systems within the site. This involves assessing the potential impact of construction on root health, including the risks of root damage, soil compaction, and changes in soil aeration and moisture levels.
- Mycorrhizal networks: Assessing the presence and health of mycorrhizal networks that connect trees and other vegetation. Mycorrhizae are crucial for nutrient and water uptake in plants and play a significant role in

the overall health and resilience of the vegetation network.
- Habitat connectivity: Evaluating the connectivity of vegetation habitats within and surrounding the site. This includes understanding how construction might disrupt these connections, affecting the movement and survival of various plant and animal species that depend on these habitats.

DEFINITION OF PROTECTION ZONES

The establishment of general Tree Protection Zones is described in detail in the text of the standard. The following text serves as an additional set of considerations for defining special conditions for protecting trees.

Protection against **fire**, particularly in the context of flammable substances and the risk of fire, is an essential consideration. Open flames should only be permitted at a minimum **distance of 20 m** from the edge of any tree canopy projection.

Protection against **excessive heat emitters**. Heat-generating equipment, such as generators and engine-powered units, should be positioned **at least 5 m** from the edge of the tree canopy. Special attention is required when construction machinery operates near tree canopies for extended periods. In such situations, it is crucial to ensure that exhaust gases are directed away from trees to prevent any potential heat damage.

Chemicals, including paints, solvents, and other potentially hazardous substances, must be stored securely and at a safe distance from trees. This precaution is necessary to prevent any accidental spills or leaks that could contaminate the soil and adversely affect tree roots. It is recommended that a designated storage area is established, clearly marked and isolated, preferably at a minimum distance as per safety guidelines from the nearest tree canopy. Additionally, containers should be well sealed and stored in a way that minimizes the risk of tipping or damage.

When working with construction chemicals, fuel, and similar toxic materials, it is essential to maintain a safe distance. These substances should not be used or stored within **at least 10 m** of the edge of the tree canopy projection. This rule also applies to the handling of contaminated water, including water used for washing construction machinery and vehicles.

Special attention must be given to preventing **pollution** near trees. This includes a range of pollutants, such as dust, chemicals, and construction debris. Pollution control strategies should ensure that no harmful substances or materials are released or stored within a **minimum distance of 10 m** of the tree canopy's edge. Specifically, dust suppression methods should be employed to minimize airborne particulates that could damage tree leaves and bark. The use of water sprays or dust barriers can be effective in this regard. Similarly, construction debris and waste materials must be managed meticulously to prevent contamination of the soil and nearby water sources.

Crown protection (movement plans cranes, platforms or other traffic).

To manage conflicts between the operational area of construction equipment and the crowns of trees, it is essential to work under professional supervision and establish clear work zones. Resolution of such conflicts may involve either the bonding of branches or localized pruning of crowns, as required, and this should be done with the consent and guidance of the professional supervisory team.

All such interventions must comply with the provisions of EAS 01:2024 – European Tree Pruning Standard. The proposed protective measures must be functional throughout the duration of construction -related activities.

Soil protection

Whenever possible, vehicular traffic should be directed away from tree rooting areas and preferably restricted to paved/asphalted surfaces and areas where soil compaction is not a concern.

Adequate measures must be taken to protect the soil from compaction in the Tree Protection Zone, along with additional protective actions.

Protection of the soil surface against compaction should be implemented according to the expected load. The installation and removal of soil surface protection should be carried out in a manner that avoids compacting the soil surface and the measures should only remain on-site for the necessary duration.

To reduce soil compaction, sandwich construction elements can be employed as a mitigation measure.

Temporary or permanent deposition of excavated material, construction materials, or equipment on an unprotected, unconsolidated soil surface is strictly prohibited.

Additionally, when access is allowed to the protected root zone, simultaneous protection of the tree trunk and canopy should be installed.

Table 1 : Recommended types of soil surface protection based on various types of load.

Load type	Protection type (minimum recommended thickness of the protection layer)	
Pedestrian traffic/small machinery	Chips/Gravel	200 mm
Up to 3.5 t	Chips/Gravel Geotextile	200 mm >200 g/m²
Over 3.5 t	Chips/Gravel Geotextile Distribution boards*	200 mm >200 g/m²

* May employ modular systems, plywood, wooden boards, concrete panels, etc.

Root protection

Excavation must be carried out using gentle techniques, such as with an air spade, high-pressure water or manual digging, with a careful approach to exposed roots.

- Roots **up to 3 cm** in diameter at the edge of the excavation toward the tree can be cleanly cut.
- Roots **over 5 cm** in diameter should be preserved without damage and protected against drying and frost effects. Only in exceptional cases may a professional supervisor decide to cut them, and there should be subsequent analysis of the tree's stability.

The walls of the open excavation must be protected against drying and frost in the direction of the tree. This includes minimizing the duration the excavation is open. Protection can be achieved by, for example:

- Regularly moistening the wall with a wet hessian cloth.
- Covering the excavation wall with suitable material.
- Installing a passage and immediately backfilling.

Soil barrier (root barrier): To support the adaptation of the root system, it is possible to install a root barrier. The root barrier should be installed one growing season before construction begins. The root barrier must extend through the entire depth of the rooted area, up to the depth of the construction excavation, typically to a depth of 70 cm. The outer side of the root barrier (away from the tree) is closed with non-woven fabric and secured against soil slippage. A substrate capable of retaining water well and allowing air permeability is added to the roots. The constructed root barrier must be regularly watered. It is essential to keep the barrier moist throughout the entire construction period.

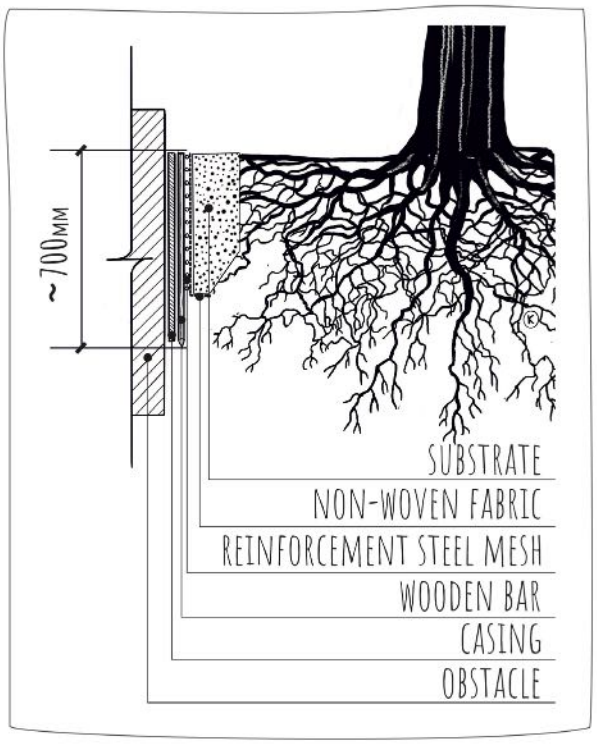


Figure 18 : Example of a root barrier

Soil level changes: If it is not feasible to maintain the original ground level, certain principles must be followed when adding fill in the Tree Protection Zone.
The fill should not be spread closer to the trunk than its diameter at ground level, with a minimum distance of 0.5 m. The fill process should avoid using impermeable materials, such as those with a high clay content.

- For permanent terrain elevation, a fill of up to 5 cm can be applied across the entire surface. Increasing the ground level with permeable materials up to 20 cm high, and sealing the soil surface with permeable covers, is permissible only up to 50% of the TPZ area.
- For larger fills, or when it is necessary to seal the surface with an impermeable cover, only 30% of the TPZ area may be covered. Before fill is added, all organic material, including vegetation cover, must be carefully removed from the soil surface. This should be done sensitively (by hand) to avoid significant damage to the tree roots.

Aeration systems can be put in place to enhance air distribution in the deeper layers of soil.
When fill is spread and permeable covers are being installed, care must be taken to prevent significant compaction of the terrain and damage to the roots.

Removal of trees or the addition of new structures in an area can significantly influence the physiological condition and stability of the remaining trees. When trees are removed, those newly exposed may suddenly face new environmental challenges, primarily due to increased exposure to wind and direct sunlight. New conditions can lead to increased structural stress and a higher risk of windthrow, especially if the trees have not developed strong wind-resistant structures due to their previously sheltered position.
Additionally, the sudden exposure to direct sunlight can cause stress to trees that are adapted to lower light conditions, potentially leading to sun scald or a disruption in their photosynthetic processes.
The change in microclimate due to tree removal or the construction of new structures can also impact the soil moisture level and the temperature around the remaining trees, further affecting their health and growth.
Thus, before there is any alteration in the landscape, whether it is tree removal or the addition of structures, the impact on the existing vegetation, particularly the retained trees, must be carefully considered.

Appendix 5 - Overview of trenchless technologies

NEW INSTALLATION

Without front-end operators

Method	Description	Use	Advantages	Disadvantages
Piercing – earth moles or rammers (earth moling)	Using ramming energy (compressed air or hydraulics), the soil is displaced by the operation of the earth mole. Pipes or cable conduits are laid either simultaneously or by pulling them through afterwards in sufficiently self-supporting soil.	Pulling cables and pipes with smaller cross-sections over short distances (up to approx. 25 m), e.g., under roads.	Low costs, flexibility, easy handling, quick execution.	Low accuracy, limited to short sections (up to approx. 25 m) and small cross-sections up to approx. 200 mm.
Horizontal ramming with a sealed front (blind reaming)	Welded pipes (sleeves or product pipes) are driven into the ground using ramming energy or pressing. The soil is displaced by a modified sealed front.	Crossing embankments, terrain irregularities, and obstacles for various product pipes.	High execution speed.	Limited to diameters up to 300–500 mm depending on conditions, large area required, the presence of impacts can affect the surroundings. Large area required. The presence of impacts can affect the surroundings.
Horizontal ramming or pushing with an open pipe volume	Pipes with an open front (sleeves or product pipes) are pushed into the ground using ramming or (less often and only for shorter lengths) pushing. Soil that enters the pipe is hydraulically expelled or washed out hydraulically or drilled out.	Crossing embankments, terrain irregularities, and obstacles for various product pipes.	High execution speed.	In cases of pushes longer than 6 m or where it is not possible to make a sufficiently long starting pit, shorter pipes must be pushed, which need to be welded more frequently.
Horizontal drilling	Applies drilling elements in a horizontal plane. It is usually combined with pipe pushing, with the drill head at the front creating space for further progress. The steel pipe is driven into the ground using a pushing device.	Installing pipes for underground gas, water, and, to a limited extent (short distances, large slopes), sewage.	Immediate stabilization of the borehole during drilling.	Limited diameters up to approx. 800 mm and mainly lengths of execution to approx. 50–80 m depending on conditions.
HDD equipment (horizontal directional drilling)	First conducts a guided pilot bore, either with removal or displacement. The removal is done hydromechanically with nozzles on the pilot head in non-cohesive soils, and with drilling tools in rock. Position of the drill head is determined by a transmitter, and changes in the drilling direction are made by rotating the steering plate in the head.	Suitable for longer distances – up to hundreds of metres – depending on the torque used. Suitable for pulling pipes or cables where exact gradients are not required.	Relatively easy handling and flexibility, high drilling speed.	Drilling corrections cause undulations in the drilled profile, usually making it difficult to maintain a smooth gradient.
Horizontal drilling with a pilot bore	First creates a pilot bore, and if correctly aligned, expands it to the required diameter through horizontal drilling.	Installing pipes with diameters up to approx. 100–1200 mm over distances up to 60–90 m.	Lower costs in the event of failure during the riskiest operations (blind drilling).	Higher labour intensity, lower execution speed.

Micro-tunnelling with slurry removal	Micro-tunnelling with slurry removal is the most versatile in terms of various geologies. The excavated soil is hydraulically transported using a transport medium to a separation facility, where it is separated.	Construction of gravity sewers and drainage collectors.	High accuracy and speed of execution (approx. 10 m per shift), ability to operate in variable and difficult geological conditions, minimal impact on the surrounding built environment.	Higher operational costs, larger surface area required in case of slurry separation.
Micro-tunnelling with auger removal	The soil is removed by an auger located in a special auxiliary pipe. Both the head and the auger are powered from the starting pit, though separate drives are also possible. In cohesive soils of solid consistency, soil removal can be facilitated by adding water to the face.	Sections up to approx. 80–90 m in uniform geological environments.	The usual length of the executed section is 50 m. In suitable rock, longer sections can be drilled.	More sensitive to geological changes, section lengths, and face stabilization is more difficult.

NEW INSTALLATION

With front-end operators

Method	Description	Use	Advantages	Disadvantages
Pipe jacking – **pipe jacking** with a shield	A shield is placed in front of the driven pipes, under which soil is excavated and transported out. In water-bearing environments, additional measures are desirable (dewatering, soil mass stabilization, compressed air, etc.).	Installing traversable sleeves (above 800 mm DN) over distances of 50–60 m.	Low operational costs, ability to remove obstacles from the face.	Risks associated with the presence of operators in the small profile at the face, high labour intensity, and the inability to directly install the product pipe.
Shield tunnelling – semi-mechanized or non-mechanized shield	Soil is excavated from an open face either manually or with partial mechanization. If the face is stable, no stabilization is required. The machine consists of a shell and, where applicable, disintegration tools. Soil is removed, for example, by belts or wagons.	Excavation of main collectors and conduits over longer distances.	Better quality, improved safety and work culture, faster progress compared to traditional tunnelling or manual jacking, lower costs compared to micro-tunnelling.	Certain limitations imposed by geology, problems with panel-lining leaks.
Manual excavation	Manual excavation, the so-called classical method, with the presence of people at the face. Disintegration is done manually, with jackhammers, and with mechanical loaders, material is transported to lifting pits by wagons or conveyors. Various types of casing and forefield protection may be used.	Construction of collectors and sewer or water supply conduits in larger and usually non-circular profiles.	The technology can be well supplemented by and combined with other supporting methods, making it generally quite flexible and resistant to sudden geological changes.	High labour intensity, low progress rates, large cost increases when conditions deteriorate.

RECONSTRUCTION

Renovation

Method	Description	Use	Advantages	Disadvantages
Relining with continuous pipe	A smaller diameter pipe is pulled into the repaired line, taking over the function of the old one.	Renovating concrete or cast-iron water pipes, typically with polyethylene pipes. Sometimes the diameter of the pulled pipe can be reduced before pulling to improve adherence.	Can be used for various pipe sizes, relatively quick and simple operation. The new pipe is not only tight but also statically fully load bearing.	The pipe is not connected to the original material; sometimes filling the interspace is necessary, and the final pipe profile is reduced.
Relining with cured-in-place pipes (CIPP)	Relining is performed with resin-based materials combined with textile fabrics, cured with hot water or steam.	Very commonly used for water and sewer lines, also applicable to connections.	Good adherence, applicable in a wide range of profiles (up to DN 100–2000 mm), the final profile is not significantly reduced.	The resulting product is tight but may not be statically load-bearing in the long-term under certain conditions.
Spiral-wound lining	Material, usually polyethylene-based, is spirally wound onto the renovated profile of the original line.	Similar to the previous methods.	Combines advantages and disadvantages of both previous methods. Better adherence than pull-in relining and higher static function than curing.	Greater labour intensity.
Sprayed lining material	Can be applied manually or by remote-controlled robots with rotating spray heads without underground operators. Cement mortars or other special construction materials, sometimes with dispersed fibres for better reinforcement, are used as the sprayed material.	Used mainly where diagnostics have shown an increase in degradation, to eliminate existing and potential future line failures.	Stops steel corrosion or concrete degradation, semi-structural materials partially ensure the static integrity of damaged pipes.	Compared to relining, only partial static reinforcement of materials is achieved.

RECONSTRUCTION

Restoration

Method	Description	Use	Advantages	Disadvantages
Pipe bursting	The old pipe is burst by a special tool, and a new pipe is pulled in behind it.	Replacing old pipes with new ones, maintaining the same diameter.	Virtually a new, fully functional pipe is created.	Complicated operation, especially concerning the access pit, which often needs to be newly created or expanded.
Burst lining	A cable is pulled through the old pipe, to which an expanding head with a bursting tool and a trailing column of pipes is attached. The expanding head enters the existing pipe, breaking and displacing its fragments into the surrounding soil. The new pipe is pulled into the expanded hole.	Works without using impacts. Suitable for plastic, metal, concrete, or fibreglass pipes. Used for restoring lines starting from DN 100 mm. Used where it is necessary to maintain road traffic and avoid damaging plants.	Wide range of materials and profiles. High execution speed. Suitable for distances up to approx. 150 m.	Intensive preparation and operation.
Cracking	A steel cable is pulled through the old pipe. A hydraulic winch in the target shaft and an expanding head with a cutting knife in the starting shaft are connected to the cable. The expanding head is pulled through the old pipe, breaking it with an air hammer, and a welded PE pipe is pulled in behind it.	Works with impacts generated by an air hammer. Suitable for replacing old cast-iron water pipes with new PE pipes of a larger diameter than the original. Used where it is necessary to maintain road traffic and avoid damaging plants and fences.	The pipe is pulled in over distances up to approx. 150 m from mounting pits or revision shafts.	Intensive preparation and operation.

RECONSTRUCTION

Repairs

Method	Description	Use	Advantages	Disadvantages
Contact injection	Local sealing of cracks and leaks. Can be performed manually or using remote-controlled robots.		Cost-effective method suitable where the line is otherwise in good condition.	Sealing injection often needs to be performed in multiple stages.
Sealing with sprayed material	Applied manually using spatulas.		Inexpensive and simple method.	May not be sufficient under demanding conditions.
Local repairs (inserts)	Similar to sealing sleeves but used locally.	Strengthening deformed or statically compromised sections.	Repair possible directly at the damaged location without the need to rehabilitate the entire section.	Repairs do not have the static load-bearing capacity of compact linings.
Flooding	Sealing material is forced through the walls of the pipe in the leaking section, strengthening and sealing it and filling voids behind the walls.		Not only strengthens the pipe but also fills any voids in the surrounding soil.	Intensive preparation and operation.

Based on:
International Society for Trenchless Technology. Trenchless Methods – Chart and Descriptions. Retrieved from https://istt.com
CzSTT, (2012), *Užívání bezvýkopových technologií při snižování emisí CO_2 během realizací staveb inženýrských sítí*, *Česká společnost bezvýkopových technologií*, s. 32
Kramer, S. R., McDonald, W. J., & Thomson, J. C. (2012). *An Introduction to Trenchless Technology* (Illustrated ed.). Springer Science & Business Media. ISBN 146153058X, 9781461530589.

Appendix 6 - Implementation Phase – Responsibilities

Head of Construction: This position entails a broad spectrum of responsibilities, particularly in overseeing the implementation of the Tree Protection Plan (TPP). The following outlines the key responsibilities of the Head of Construction in relation to tree protection:

- **Project planning and coordination:** Ensures that tree protection is a fundamental part of project planning from the outset. Coordinates with other key roles, such as the TPP Supervisor, to integrate tree protection measures into the overall construction plan.
- **Policy and regulation compliance:** Is familiar with all relevant local, regional, and national environmental regulations and policies regarding tree protection. Ensures that the construction project complies with these regulations throughout its duration.
- **Resource allocation:** Allocates appropriate resources (budget, personnel, equipment) to effectively implement and maintain tree protection measures. Facilitates the availability of specialized equipment or materials needed for tree protection.
- **Team communication and training:** Communicates the importance of tree protection to all team members, including contractors and construction workers. Ensures that staff receive adequate training regarding the TPP and their specific roles in its implementation.
- **Supervision and enforcement:** Oversees the daily operations to ensure that tree protection measures are properly implemented and maintained. Enforces the TPP guidelines and takes corrective actions when violations occur.
- **Liaising with TPP Supervisor:** Regularly consults with the TPP Supervisor (Tree Technician) for updates and advice on tree protection issues. Collaborates on any necessary changes or adjustments to the TPP based on construction progress or unforeseen challenges.
- **Monitoring and reporting:** Monitors the effectiveness of tree protection measures throughout the construction process. Reports on tree protection status to stakeholders and addresses any concerns raised by environmental bodies or community members.
- **Crisis management and mitigation:** Is prepared to address and swiftly resolve any issues that may arise related to tree protection, such as accidental damage to trees. Implements mitigation measures in the event of unforeseen impacts on protected trees.
- **Documentation and record-keeping:** Maintains comprehensive records of all tree protection measures, modifications, and incidents throughout the construction process. Ensures that all documentation is readily available for review by regulatory authorities or stakeholders.

TPP Supervisor (Tree Technician): The TPP Supervisor, often referred to as the Tree Technician, plays a specialized role in the effective implementation and supervision of the Tree Protection Plan (TPP) within a construction project:

- **Technical expertise and advice:** Provides expert guidance on tree biology, arboricultural practices, and the potential impacts of construction activities on trees. Advises the construction team on best practices for tree protection, including proper techniques for pruning, cabling, and root protection.
- **On-site supervision:** Regularly inspects the construction site to ensure that tree protection measures are correctly implemented and maintained. Monitors the physiological condition and mechanical integrity of protected trees, identifying early on any signs of stress or damage.
- **Liaison and communication:** Acts as the primary liaison between the construction team and environmental regulators or arboricultural consultants. Communicates effectively with the Head of Construction, contractors, and workers about tree protection standards and requirements.
- **Training and awareness:** Conducts training sessions for construction staff on tree protection measures and the importance of adhering to the TPP. Fosters a culture of awareness and respect for the environment among the construction team.
- **Monitoring and documentation:** Keeps detailed records of all tree protection measures, adjustments made, and any incidents affecting trees. Documents the condition of trees before, during, and after construction to assess the impact of the project.
- **Problem-solving and adaptation:** Addresses any tree-related problems that arise during construction, providing practical solutions

to avoid or minimize damage. Adapts the TPP as necessary in response to construction changes or unforeseen tree health issues.
- **Regulatory compliance and reporting:** Ensures that all tree protection measures meet local, regional, and national environmental regulations. Prepares and submits regular reports on tree protection to relevant authorities or stakeholders.
- **Emergency response:** Responds to emergencies involving protected trees, such as accidental damage, and implements immediate protective measures. Coordinates with other professionals for specialized interventions if required.

Contractors: Their responsibilities are directly linked to the daily operations on site, ensuring that the activities they undertake do not negatively impact the surrounding trees. These duties are critical for maintaining environmental sustainability and adhering to regulatory requirements.
- **Compliance with the Tree Protection Plan:** They understand and strictly adhere to the guidelines and measures outlined in the TPP, ensuring that all activities, especially those near protected trees, comply with the plan's specifications.
- **Effective communication:** Maintain clear and consistent communication with the TPP Supervisor (Tree Technician) and the Head of Construction. Inform the project management team immediately of any potential conflicts or issues related to tree protection.
- **Training and supervision:** Conduct or participate in training sessions about tree protection for all team members. Supervise the workforce to ensure that they understand and comply with tree protection measures.
- **Proper use of machinery and equipment:** Operate machinery and equipment in a manner that minimizes the risk to protected trees. Avoid any activities that could damage tree roots, trunks, or canopies, especially within designated protection zones.
- **Monitoring of Tree Protection Zones:** Regularly monitor and maintain tree protection zones, including barriers, fencing, and signage. Ensure that these zones are respected and not encroached upon by construction activities.
- **Response to incidents:** Promptly respond to any incidents or emergencies that may affect protected trees. Work with the TPP Supervisor to mitigate any damage and adjust practices if needed.
- **Environmental awareness:** Promote an understanding of the environmental impact of construction work within the team. Encourage practices that minimize harm to the natural environment, particularly trees.
- **Documentation and reporting:** Keep accurate records of activities near tree protection zones. Report any deviations from the TPP to the project management and the TPP Supervisor.
- **Coordination with other parties:** Collaborate with other contractors and subcontractors to ensure a unified approach to tree protection. Share best practices and lessons learned for the benefit of the entire project team.

Tree Workers: Tree workers play a crucial role in the successful implementation of the TPP during construction projects. This involves a blend of practical skills, adherence to arboricultural best practices, and coordination with the wider construction team.
- **Understanding and implementing the TPP:** They gain a thorough understanding of the Tree Protection Plan, focusing on specific requirements for each tree or group of trees. Implement the protective measures outlined in the TPP, such as installing barriers, mulching, and applying trunk protection.
- **Specialized tree care:** Conduct tree pruning, cabling/bracing, and other arboricultural works as per the TPP, always adhering to established standards and guidelines. Undertake tasks like crown lifting or root pruning only when necessary and in a manner that minimizes harm to the trees.
- **Monitoring tree health:** Regularly inspect trees within the construction site for signs of stress or damage. Report any concerns to the TPP Supervisor (Tree Technician) promptly.
- **Effective communication:** Collaborate closely with the TPP Supervisor, informing them of any changes in tree conditions or potential risks. Coordinate with construction workers and contractors to ensure that tree protection measures are understood and followed.
- **Use of equipment and machinery:** Operate equipment safely and responsibly, particularly when working near protected trees. Ensure that machinery is used in a way that does not damage tree roots, trunks, or branches.
- **Emergency response:** Be prepared to respond to emergencies involving trees, such as unexpected falls or breaks. Work with the TPP Supervisor and construction team to address and mitigate any immediate risks to tree health or safety.

- **Adherence to safety protocols:** Follow all safety protocols and guidelines, particularly when performing potentially hazardous tasks like climbing or using power tools. Ensure personal and team safety in all tree-related activities.
- **Training and skills development:** Stay updated with the latest practices in arboriculture and tree care. Participate in training sessions and workshops to enhance skills relevant to tree protection and care.

Construction Workers: Their responsibilities are vital in safeguarding the well-being of trees in and around construction sites, requiring a combination of awareness, adherence to protocols, and effective coordination.

- **Understanding of the TPP:** They familiarize themselves with the Tree Protection Plan, understanding specific requirements for tree protection within the construction site. Recognize the importance of tree protection measures and the reasons behind them.
- Adherence to protective measures: Strictly follow the tree protection guidelines set out in the TPP, such as respecting barrier boundaries and avoiding activities that could harm trees. Ensure that no equipment, materials, or waste are stored within the tree protection zones.
- **Careful operation of machinery and tools:** Operate machinery and equipment in a manner that avoids damage to tree roots, branches, and trunks. Be vigilant about the location of trees when manoeuvring heavy machinery or equipment near them.
- **Regular communication and reporting:** Immediately report any accidental damage to trees or protective measures to the TPP Supervisor (Tree Technician) or Head of Construction. Stay in constant communication with tree workers and the TPP Supervisor regarding any actions that might impact trees.
- **Compliance with site-specific guidelines:** Adhere to specific instructions given for the construction site, particularly those related to tree protection. Participate in briefings or training sessions provided about tree protection and the environmental considerations of the project.
- **Emergency procedures:** Understand the protocols for emergencies involving damage to trees or risks related to tree health. Assist in immediate protective actions if a tree becomes a hazard due to construction activities.
- **Maintenance of tree protection measures:** Regularly check and maintain the integrity of physical tree protection measures like barriers and ground coverings. Ensure that temporary structures or tools do not compromise tree protection zones.
- **Environmental awareness:** Are mindful of the broader environmental impact of construction work and strive to minimize harm to the surrounding natural elements. Show respect for the ecological value of trees and contribute to a culture of environmental responsibility on the construction site.

Appendix 7 - Construction diary

Outline of the construction implementation process

Introduction and Preamble

- The TPP Supervisor was instructed by the Developer on the (DD/MM/YYYY) to monitor works in relation to construction activities requiring Arboricultural Protection in respect of redevelopment proposals for ...
- The commission followed a Treescape Analysis, a Tree Impact Assessment and the resultant Tree Protection Plan (TPP).
- The following document outlines the construction implementation process and includes a Construction Diary Template.

Description of the Scheme

The Site

- The Site under consideration is ...
- The Site is located ...
- The Site context ...
- The Site currently comprises ...

Brief Description of the Scheme

- The proposed development of the site consists of ...

Tree Protection Measures

- The tree protection measures to be implemented as part of this scheme are detailed in the following arboricultural reports:
- Treescape Analysis – (Document no. and date)
- Tree Impact Assessment – (Document no. and date)
- Tree Protection Plan (TPP) – (Document no. and date)

Key Personnel and Individual Responsibilities

Role	Name	Contact Details
Head of Construction	- Name - Company Name	- Tel: - Email: - Address:
TPP Supervisor (Tree Technician):	- Name - Company Name	- Tel: - Email: - Address:
Main Contractor	- Name - Company Name	- Tel: - Email: - Address:
Sub-contractor(s)	- Name - Company Name	- Tel: - Email: - Address:
Tree Worker(s)	- Name - Company Name	- Tel: - Email: - Address:
Construction Worker(s)	- Name - Company Name	- Tel: - Email: - Address:

Identification of Responsibilities

Head of Construction

- Project planning and coordination
- Policy and regulation compliance
- Resource allocation
- Team communication and training
- Supervision and enforcement
- Liaising with Tree Protection Plan (TPP) Supervisor
- Monitoring and reporting
- Crisis management and mitigation
- Documentation and record-keeping

TPP Supervisor (Tree Technician)

- Technical expertise and advice
- On-site supervision
- Liaison and communication
- Training and awareness
- Monitoring and documentation
- Problem-solving and adaptation
- Regulatory compliance and reporting
- Emergency response

Contractor(s) and subcontractor(s)

- Compliance with the TPP
- Effective communication
- Training and supervision
- Proper use of machinery and equipment
- Monitoring of Tree Protection Zones
- Environmental awareness
- Documentation and reporting
- Coordination with other parties

Tree Worker(s)

- Understanding and implementing TPP
- Implementing the protective measures outlined in the TPP
- Specialized tree care
- Monitoring tree health
- Effective communication
- Using equipment and machinery
- Emergency response
- Adherence to safety protocols
- Training and skills development

Construction Worker(s)

- Understanding the TPP
- Adherence to protective measures
- Careful operation of machinery and tools
- Regular communication and reporting
- Compliance with site-specific guidelines
- Emergency procedures
- Maintenance of tree protection measures
- Environmental awareness

Timing and Methods of Site Visting

Process of TPP supervision

The supervision of the Tree Protection Plan (TPP) is a process that spans the entire duration of a construction project, ensuring the safety and health of trees from start to finish.

The TPP Supervisor shall attend site as follows:

- Pre-commencement of demolition to ensure tree protective fencing and ground protection are in place in accordance with the Tree Protection Plan.
- Pre-commencement of construction to ensure tree protective fencing and ground protection are in place in accordance with the Tree Protection Plan.

To monitor the following operations:

- Tree works enablement.
- Critical activities within the **TPP (TPZs)** of retained trees.
- Regular intervals or as agreed with the Head of Construction, based on site activities and operations.
- Tree condition and the effectiveness of protection measures.

The TPP Supervisor will remain in close regular contact with the Head of Construction throughout the scheme.

Construction Diary (Communication)

A construction diary is a comprehensive record-keeping tool used to document various aspects of the construction process, including those relating to the impact on trees.

- **Monitoring activities:** It involves regular checks and logging of all construction activities that could potentially affect trees, ensuring that these actions are managed in a way that minimizes harm to the tree environment.
- **Change documentation:** The diary serves as a detailed record of any changes in construction methods or site layout, or unexpected developments that might impact trees. This helps in tracking the cumulative effects of the project on trees and provides a historical record for reference and accountability.
- **Error logging and mitigation measures:** Mistakes or oversights that occur during construction and have an impact on trees are recorded in the diary, along with the steps taken to mitigate these effects. This process is crucial for learning from incidents and improving tree protection strategy in the future.

- **Communication and training tool:** The construction diary can also function as a communication medium, disseminating vital information about tree protection measures, guidelines, and emergency protocols to workers. It may also include details of training sessions or instructions provided to workers regarding tree protection.

Regulatory compliance and reference: It helps ensure compliance with the TPP and serves as a reference for TPP supervisors and other stakeholders to review and assess the ongoing impact of construction activities on tree health.

Construction Diary Template

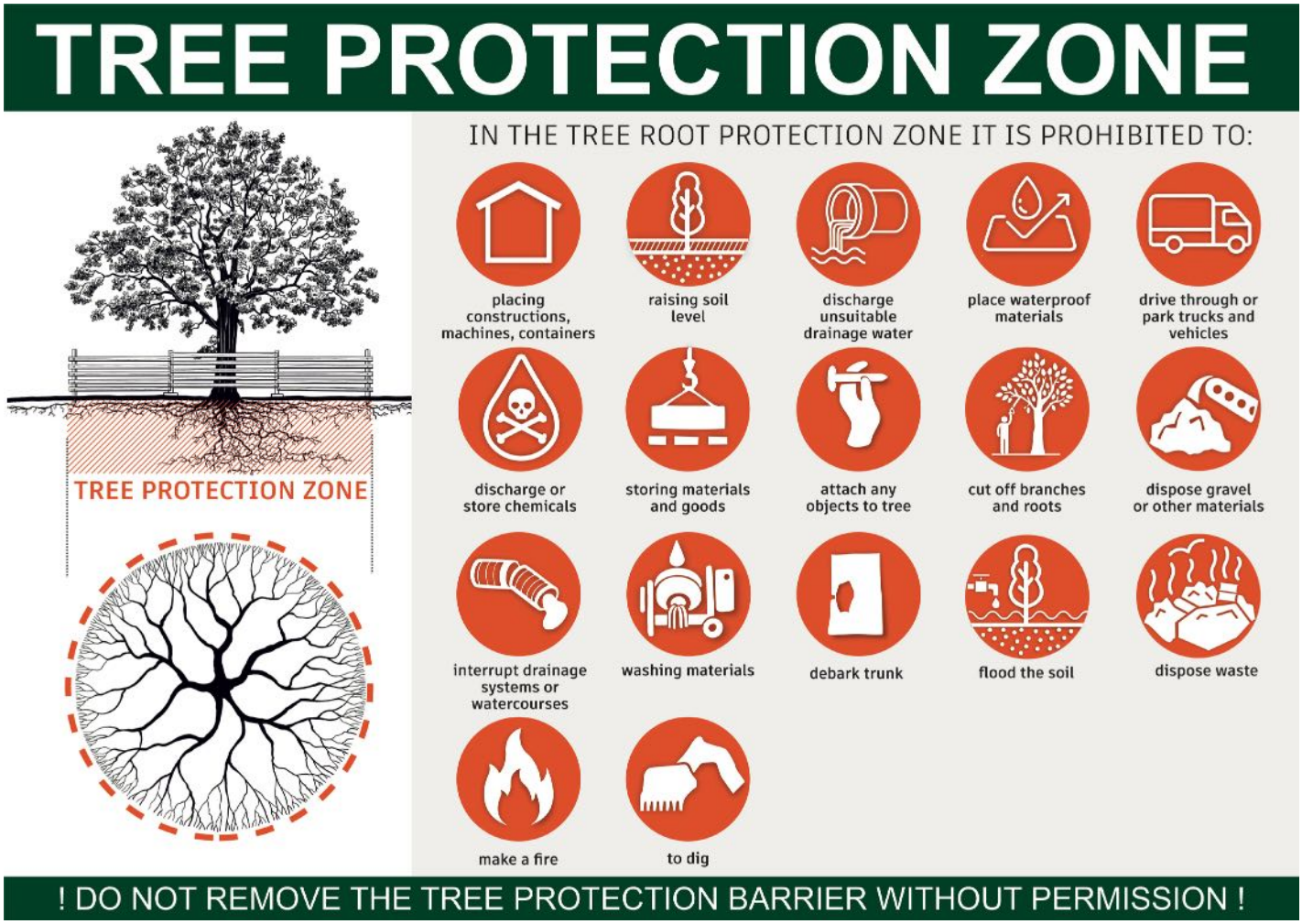
PROJECT: xxx	**HEAD OF CONSTRUCTION:** Mr/Ms xxx (Company Name)	**REPORT NO:** 001
DIARY COMPLETED BY: xxx	**DATE AND TIME:** DD.MM.YYYY 12:00	**SHEET:** 1 of 1

MATTERS ARISING FROM PREVIOUS CONSTRUCTION DIARY **WITH ITEM NO:**	*(1) Breached protective fence* *(2) Need to extend ground protection (Change documentation, amend TPP accordingly)* *(3)*

	LOCATION	**NOTES/ RECOMMENDATIONS/ CHANGE DOCUMENTATION**	**ACTION**
1	*e.g. T007, north of building*	*e.g. Damage to 7 m section of protective fence, materials spilled into Root Zone, further inspection requirements, damage to tree*	*e.g. Reinstate protective fencing, make good levels with topsoil in accordance with TPP*
2			
3			

Circulation List:
Head of Construction; Main Contractor; Sub-contractor; Tree Workers; Construction Workers

Appendix 8 - Examples of information



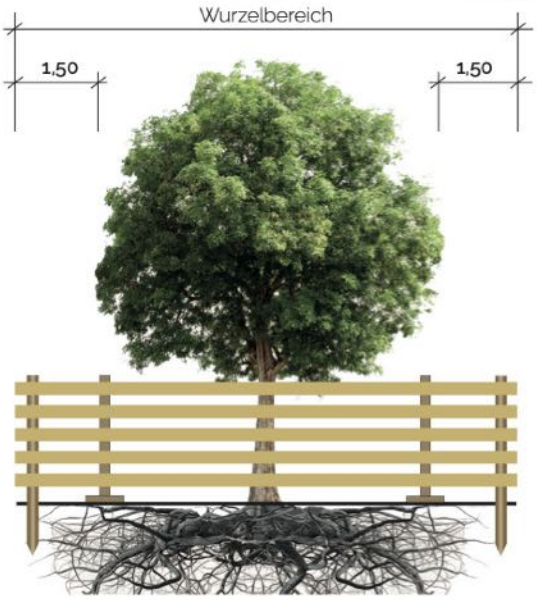
Baumschutz auf Baustellen

ARBEITSKREIS STADTBÄUME, DEUTSCHE GARTENAMTSLEITERKONFERENZ, Dezember 2022

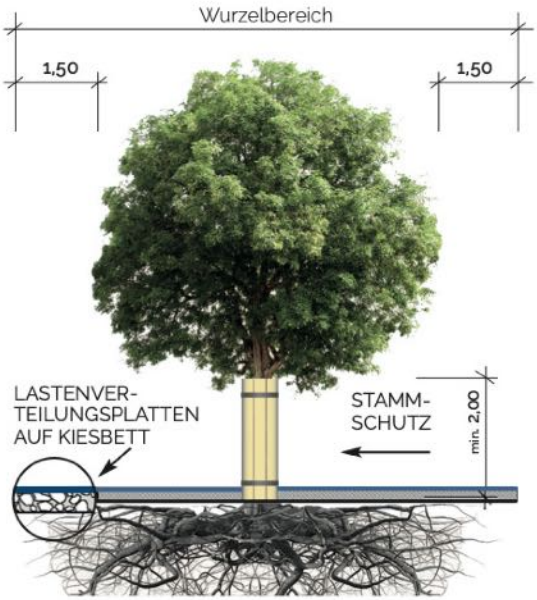
GALK e.V. Deutsche Gartenamtsleiterkonferenz

WICHTIG
DIN 18920 und RAS - LP4
ZTV-Baumpflege
BAUMSCHUTZSATZUNG

GALK STADTBÄUME



WURZELSCHUTZ DURCH ZAUN



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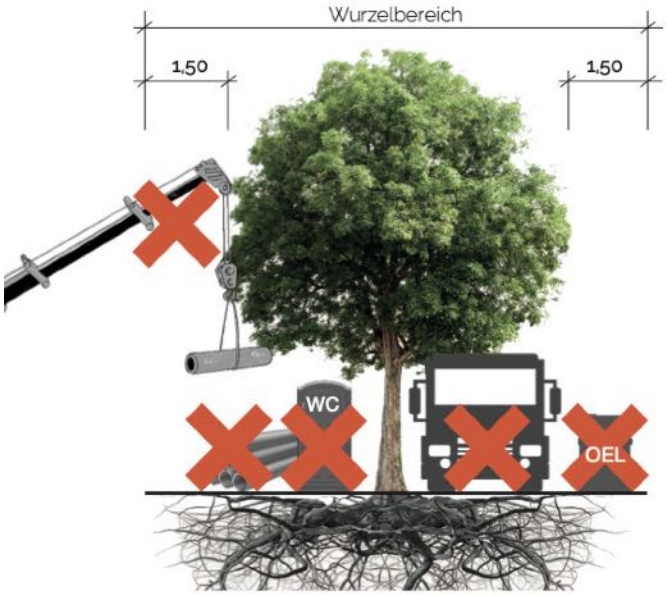
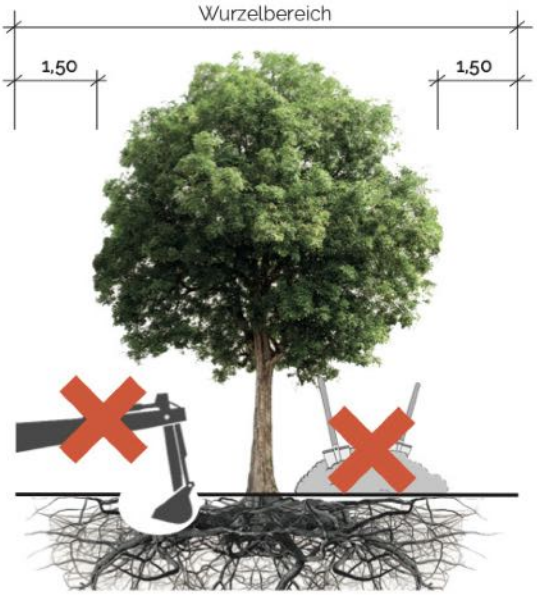


WURZELSCHUTZ DURCH GEFAHRVERMEIDUNG

NICHT BEFAHREN
KEIN ABLAGERN VON
- TREIBSTOFFEN
- BAUMATERIALIEN
- BAUSTELLENEINRICHTUNGEN
SCHWENKBEREICH BEACHTEN



WURZELSCHUTZ DURCH GEFAHRVERMEIDUNG

KEIN BODENABTRAG
KEINE AUFSCHÜTTUNG
NICHT VERDICHTEN
KEINE LEITUNGSVERLEGUNG
KRONE SCHÜTZEN

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