BMPs TO PROTECT TREES AT THE LOT LEVEL: NEW CONSTRUCTION, REMODELING & REDEVELOPMENT

Audience

This section is directed toward:

- homeowners, businesses, landowners, and communities,
- builders, contractors, and subcontractors, and
- utility companies.

Overview

Protecting wooded areas and individual trees at the lot level has direct benefits to landowners, homeowners, businesses, neighborhoods, communities, and the landscape as a whole. Builders and contractors undertake construction in accordance with zoning ordinances and should observe existing conservation easements and covenants, including those related to trees.

Wooded areas and trees can be severely damaged during land development. Construction damage to trees includes mechanical injuries, soil compaction, and soil contamination (Figure 16, page 53). Mechanical injuries to trunks and branches are the most common types of above ground injuries. These injuries may cause trees to lose their aesthetic value and initiate insect and disease problems such as oak wilt. Tree roots can also suffer mechanical damage from excavating, grading (cut and fill), trenching, or equip-

ment traffic within the protected root zone. Although the tree's root injuries are difficult to see and predict, they can severely impact tree survival and growth, predisposing affected trees to disease and insect problems.

Soil compaction is most likely to occur when construction equipment is driven over an area. It can also be caused when construction materials or equipment (including workers' personal vehicles) are stored or parked near trees. Soil compaction is the main cause of tree loss following construction. It is a physical compression of soil particles caused by ground pressure and vibration from equipment and by the weight of material stored near trees. It affects root growth, water percolation, gas exchange, and nutrient uptake. Severe soil compaction occurs on the topsoil within the first 2 to 4 inches, but may affect deeper soil. Trees affected by soil compaction will suffocate, become stressed and vulnerable to insects and disease, and be likely to die within two to five years. The same fate can occur when soil fill is added within the protected root zone or drainage patterns are altered and saturated soil conditions result within the protected root zone.

Recommended practices

Proactive planning and use of appropriate approaches and tools can ensure greater protection and conservation of wooded areas and trees during construction. The following steps are necessary to achieve protection goals. They include goal definition, tree inventory and assessment,

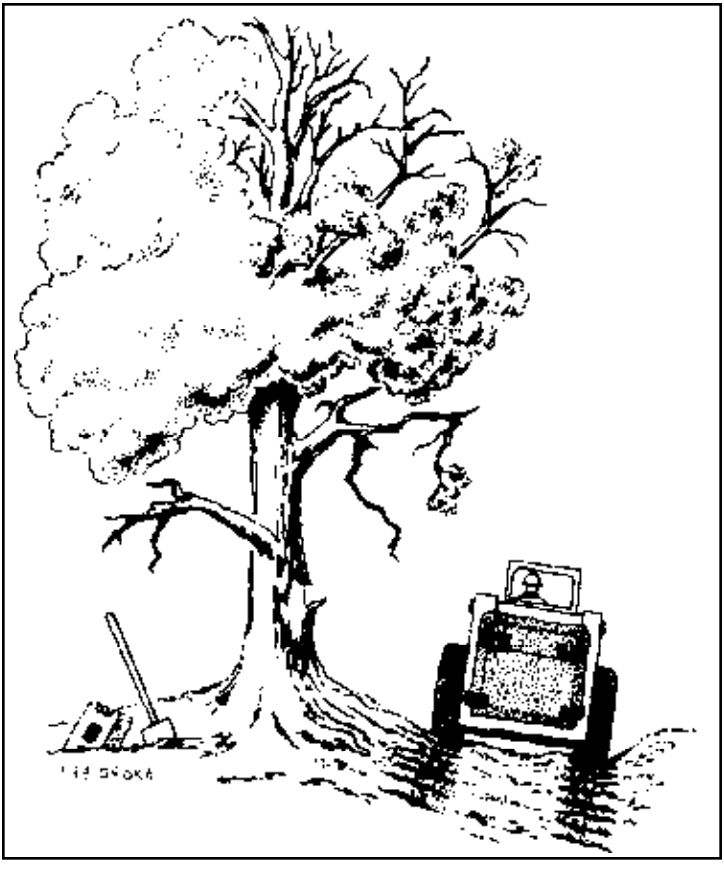


Figure 16. Using equipment near protected trees can cause severe mechanical injury to trees and compact soil in the protected root zone.

selection of building site and construction zone, creation of a protection plan, selection of a protection method, and monitoring and evaluation.

Define goals

The goals should include:

- protection of wooded areas and trees from construction damage,
- compliance with zoning regulations, conservation easements, and covenants, and
- maintenance and enhancement of community aesthetics and property values.

Inventory and assess trees

Tree inventory and resource assessment are specialized activities that should be performed by a natural resource professional (e.g., forester or arborist). The extent of the tree inventory and assessment depends on a number of factors including lot size, cover type, and stage of development activity (new development and remodeling). On lots of less than two acres, do a complete tree survey (that is, the tree count by species of all trees 2 inches in diameter and larger). Also, assess the health and growth condition. On lots of more than two acres, use either a complete or partial survey, depending on the cover type. The local tree preservation ordinance may specify the type of tree survey.

When doing a complete tree survey, measure the diameter of all trees and assess the health condition and growth characteristics of all measured trees. Trees less than 8 inches in diameter can be recorded by species, growth, and health condition. The diameter of trees larger than 8 inches is measured at 54 inches above the ground and slope side. The inventory should follow these steps:

◆ **Obtain or draw a boundary map of the lot**

Identify corners, streets, and all easements.

◆ **Record the location of all trees and wooded areas**

Record the location of all trees and wooded areas on the resource map (Figure 17, page 56). A professional surveyor may be used to more accurately locate trees close to the building site.

◆ **Do a tree survey and health assessment**

This assessment includes tree identification by species and age class and assesses health condition by growth characteristics, including trunk form (linear tree, crooked trunk, or bowing), crown form, and health condition (presence of conks, signs of stress, pests, disease, dead branches, and wilted leaves). Tree identification is needed to define the species distribution and composition on the property; to determine site suitability; to anticipate the cost of removing, replacing, and transplanting; to determine long-term

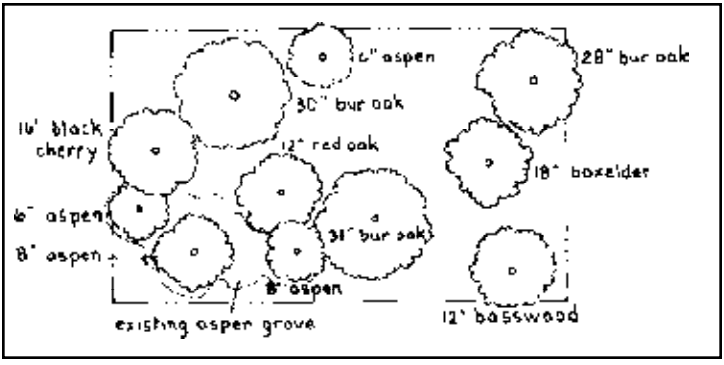


Figure 17. A resource map at individual lot level shows the location of the wooded area and individual trees, the species composition, and diameter of trees at breast height.

health and disease problems as well as silvicultural or arboricultural treatments; and if applicable, to comply with local tree preservation ordinances.

◆ **Record tree survey and health assessment information**

Write the information gathered on the resource map including the species and size. Other information such as health condition and growth characteristics can be recorded on the map or on a separate sheet.

■ Select trees or groups of trees to protect

Use the following criteria to select trees or groups of trees to protect:

- select trees or groups of trees as needed to comply with any local tree preservation ordinances,
- select trees and wooded areas found within conservation easements or covenants,
- select trees that are suitable to the site conditions (e.g., native species and trees with desirable growth characteristics),
- select trees that provide direct benefits (e.g., wildlife habitat, shade, windbreak, screening, privacy, etc.),
- select trees that are connected to other trees (e.g., groups or lines of trees) on adjoining property to achieve connectivity, and
- pay particular attention to younger trees that may have greater tolerance for site disturbance during construction.

◆ Mark trees or groups of trees to protect

Identify protected wooded areas or trees with colored ribbon (yellow or orange). If there are fewer trees to remove than to save, it may be more cost effective to mark trees to be removed. Use a standard color.

◆ Record information on the resource map

Record the location of the tree and the species name or a code on the resource map. Trees or areas to protect may be indicated with a letter P (protect) or S (save) and trees to remove may be shown with a letter

R (remove) or C (cut). Colored markers (e.g., yellow, orange, or blue) can also be used or a combination of letters and colored markers.

■ Select building site and construction zone

The homeowner, developer, builder, contractors, engineers, utility companies, and natural resource specialists should work together to select a building site and construction zone. Involving a realtor, landscape architect, and architect at the early stage of development is also important.

After reviewing all ordinances pertaining to the subdivision, including setback, conservation easements, utility and other easements, and existing covenants, select the building site, construction zone, and other areas.

◆ Select building and additions site and assess open space

The building site includes spaces for the main structure and additions and other outbuildings, driveways, garage and parking areas, and utilities (septic systems, drain fields, sewer, gas, water, well, and communication and electrical lines). The percentage of open space needs to be determined when selecting sites for building and additions sites. It should be part of the overall planning process.

◆ Select construction zone

The construction zone includes all access routes for construction equipment (trucks, tractors, utility vehicles), parking areas during construction, a material storage site, an area for cleaning and performing maintenance on equipment, and, if needed, a space for a temporary office.

◆ Identify other areas

Other areas to identify may include setbacks, utility and other easements, and areas dedicated to conservation easements, covenants, and other uses. Check with local units of government (city, township, county), homeowner associations, and nonprofit organizations (such as the Minnesota Land Trust) for other pertinent information about land-use practices on the subdivision (see Appendix 1, page 91).

For single family residential development in wooded lots, select the corner of the lot as the building site to minimize loss of trees and maximize tree protection area (Figure 18, page 60). Areas having trees of lower conservation value or poor health can be selected as building sites and construction zones.

■ Create a tree protection plan

A tree protection plan for wooded areas or individual trees at the lot level consists primarily of protecting the protected root zone. The protected root zone should be off limits to any activity. More detailed guidance may be

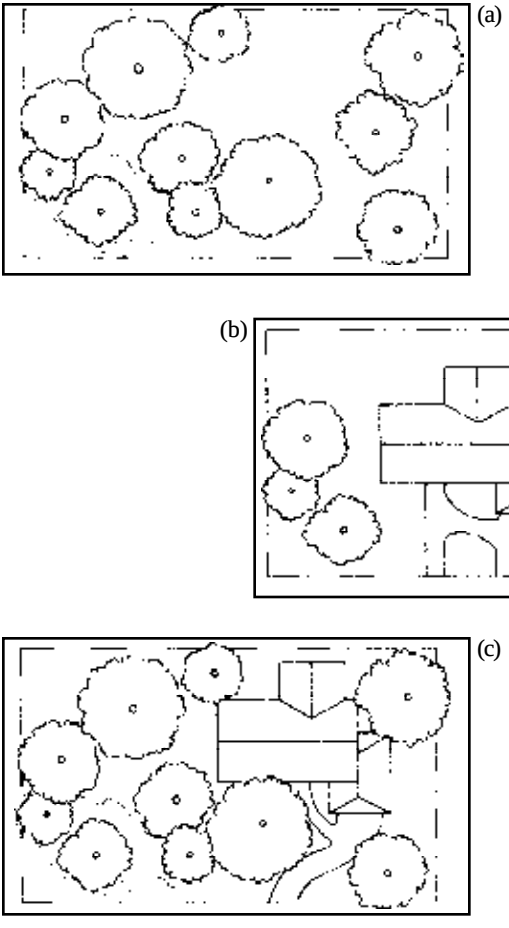


Figure 18. On a wooded lot (a), selecting the center of the lot as the building site (b) conserves less trees than selecting the corner of the lot as the building site (c), which saves more trees.

obtained from the Minnesota Extension Service publication *Protecting Trees from Construction Damage: a Homeowner's Guide* (Miller et. al., 1993). A tree protection plan follows three orderly steps:

◆ Determine and delineate the protected root zone

The protected root zone is the area near trees that should be avoided during construction. It is defined as the area directly below the branches of mature trees or the dripline (Figure 19, page 62). Since roots extend beyond this zone, the protected root zone can be extended beyond the dripline whenever possible to minimize construction damage to roots.

A number of methods have been developed to determine the protected root zone.

✳ Trunk diameter method

Measure the tree diameter in inches at breast height (54 inches above ground). Convert the measurement to feet or to a foot and half for every inch to obtain the radius of the protected root zone (Coder, 1995).

✳ Site occupancy method

Predict the tree diameter at breast height in inches for that tree at 10 years old. Multiply the number by 2.25 and convert the result into feet to obtain the radius of the protected root zone (Coder, 1995).

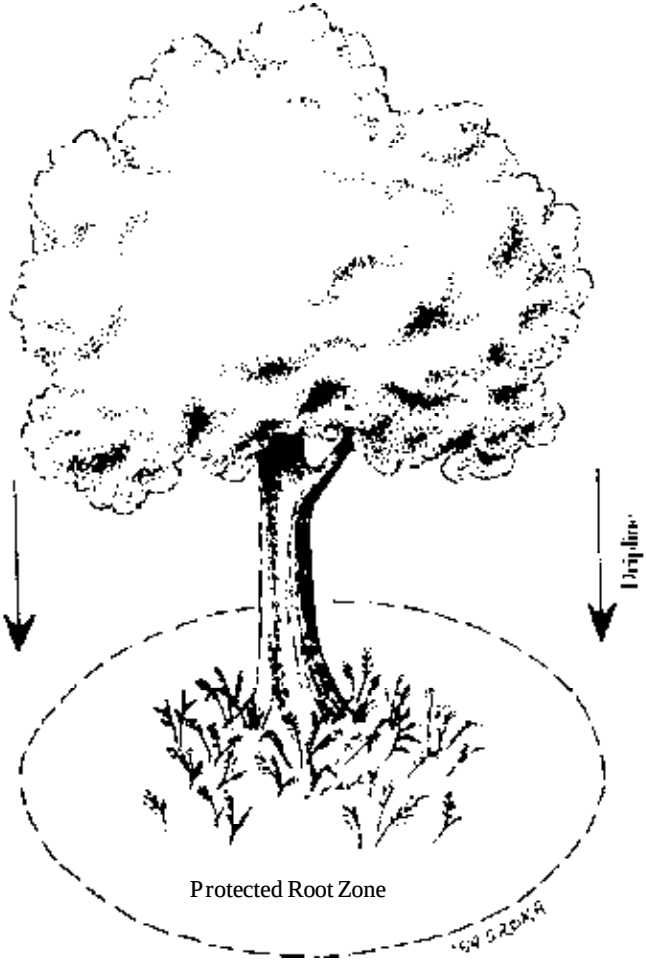


Figure 19. The protected root zone of a mature tree may be determined by projecting the dripline.

✴ **Minimum area method**

Protect an area of approximately 6 feet in radius around the trunk as the protected root zone.

✴ **Dripline method**

This is the most commonly used method. The radius of the protected root zone by the dripline method can be determined by two ways. The first consists of measuring the distance of the branch that extends horizontally farthest from the trunk and multiply by 1.5 to obtain the protected root zone radius. The second consists of projecting the tree dripline downward to the ground and delineating the area beneath the tree branches or crown as the protected root zone.

Selecting the appropriate method requires knowledge of the tree species and site condition. A forester, arborist, or other natural resource professional should make the selection. The dripline method is often preferred to protect mature trees (individuals, groups of trees, or wooded areas). However, when using the dripline method for individual trees, some adjustment should be made for trees with narrow crowns. The minimum area method can be used to protect young trees (seedlings and saplings). The dripline or minimum area methods offer only an optimum space for tree survival and growth because roots extend far beyond the dripline or the minimum area. Therefore, the larger the protected root zone, the better it is for the tree's growth and survival.

■ Select and implement tree protection method

Tree protection consists primarily of preventing physical damage to trees from driving or parking equipment, storing materials near trees, headquartering working crews near trees, and disturbing the site within the protected root zone.

◆ Protected root zone does not conflict with building site and construction zone

If enough clearance exists between the protected root zone and the building site or construction zone, simply build a fence to prevent any activity and access within the protected root zone and hang "off limits" signs on the fence to alert crews and other people visiting the site (Figure 20).

A fence prevents activities such as driving or parking equipment and storing materials such as soil from occurring within the protected root zone (Figure 21, a and b, page 66).

◆ Protected root zone overlaps with building site

If the protected root zone overlaps with the building site, decide whether to remove trees, transplant trees, change the building site or the building design, or use building materials that may cause less site impact on trees. For instance, a pervious pavement may be used to build a driveway. A pavement type requiring a thinner cross section such as concrete may be used

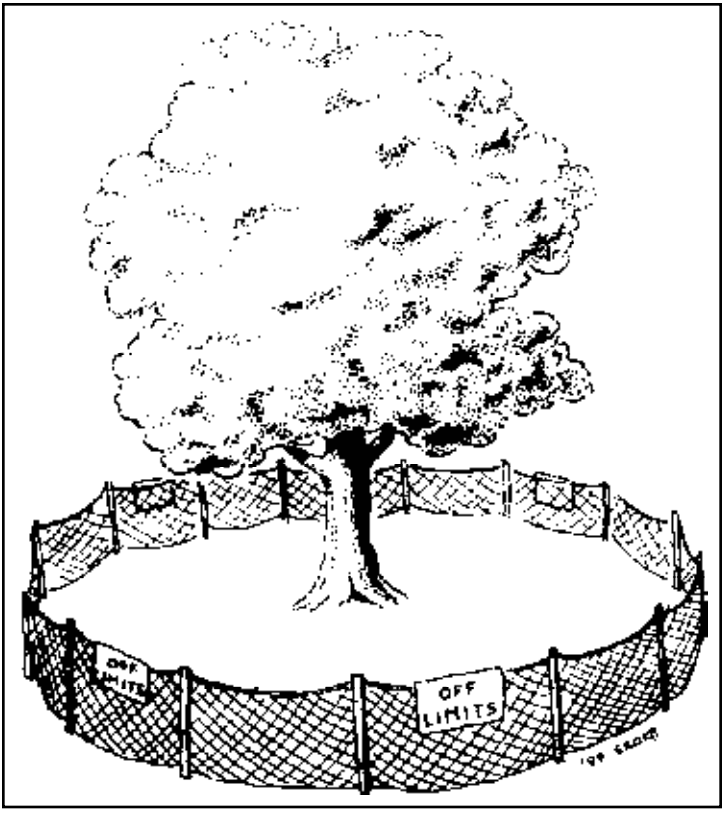


Figure 20. A highly visible fence and "off limits" signs should be placed around the protected root zone of each conserved tree to prevent any site disturbance and mechanical injury.

Figure 21. Parking equipment (a) or storing soil (b) within the protected root zone causes soil compaction and affects tree growth and survival.

instead of asphalt. Geotextile materials can be used at the bottom before pouring the concrete to reduce subbase compaction.

◆ Protected root zone overlaps with construction zone

If the protected root zone overlaps with the construction zone, a number of options can be used:

✳ Build a travel route to minimize impact on soil and root systems

A layer of wood chips may be spread or a crossing bridge installed for temporary use (Figure 22, page 68). When using wood chips for a temporary travel route, the thickness and structure of the wood-chip layer will depend on the type, size, and weight of equipment to be used. The use of mixed, particle-size wood chips spread at least 12 inches thick may be adequate. After the project is completed, the wood chips or crossing bridge must be removed and the site restored by adding ventilation holes, fertilizating, and watering.

✳ Reduce the size of the construction zone and limit the traffic

The space allocated for the construction zone can be reduced and a limited crew allowed on the site at a given time. Ground traffic for moving building materials or debris can be reduced by using a crane and pumping system instead.

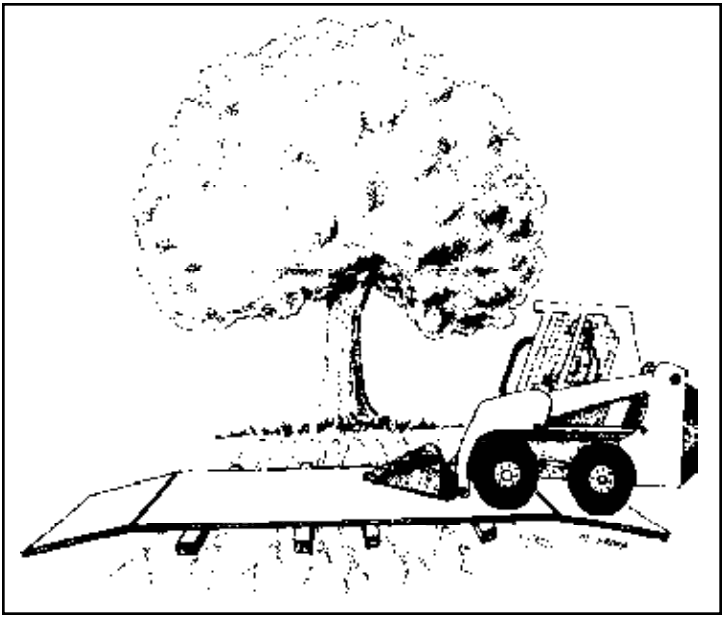


Figure 22. A temporary crossing bridge can be used near the protected root zone to minimize soil compaction and mechanical injury to the tree.

◆ **Protected root zone overlaps with utility easements**

If the protected root zone overlaps with utility easements, trees can be removed or the building design can be modified to comply with the easements. In a new development site, using a joint underground trench for utilities (gas, electricity, and cable) minimizes utility easements and site disturbance, and saves trees. Whenever cost effective and appropriate, tunneling

can be used instead of an open trench. When possible, manual or water-pressure trenching can also be used to minimize impacts on tree root systems (see utility infrastructure, page 77).

◆ Protected root zone overlaps with grading area, cut, or fill

Cutting or filling grades near the protected root zone for road construction or the building site can affect tree growth and vigor (Figure 23, page 70). Use custom grading instead of mass grading to minimize disturbances and tree damage during excavation.

✳ Reduce damage from cutting grades

Removing soil or cutting grades near the protected root zone may remove the organic soil, affect soil hydrology, deprive the tree of water and nutrients, and weaken tree resistance to wind (particularly when roots are severed). When cutting a grade near the protected root zone, prune severed woody roots immediately, water the soil around trees, and protect severed roots (with a temporary structure such as black plastic and a permanent structure thereafter) to minimize exposure to air and sun. Avoid stepper cuts exceeding 4 feet and use a step-down cut approach instead. After grading is complete, build a retaining wall, as needed, to stabilize the grade and prevent soil erosion (Figure 24, page 72).

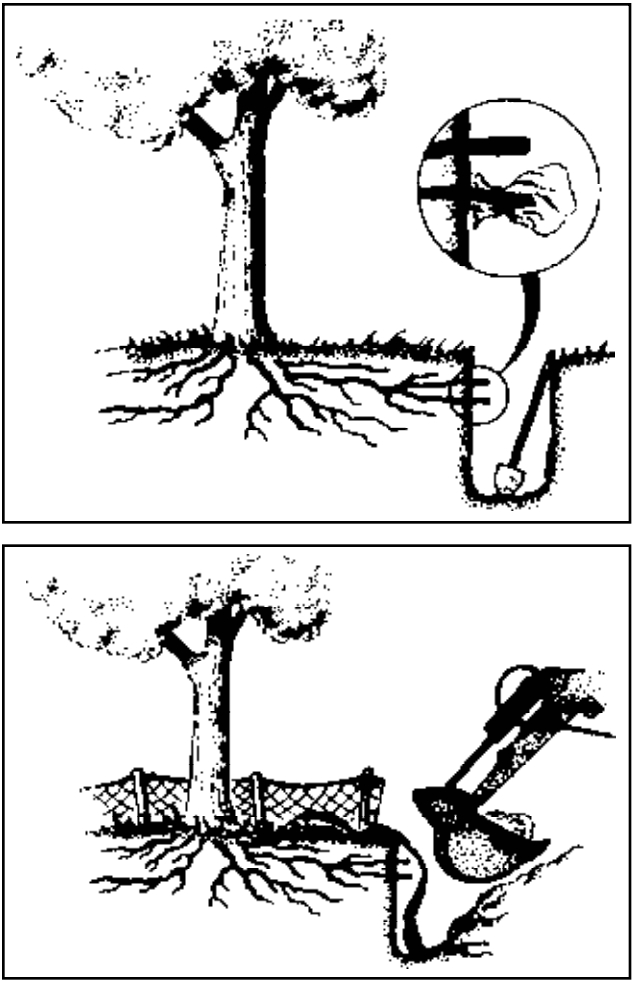


Figure 23. When roots are cut or severed during trenching or excavation, immediately protect roots with a bag (a) or tarp (b) to prevent drying.

✳ **Reduce damage from filling grades**

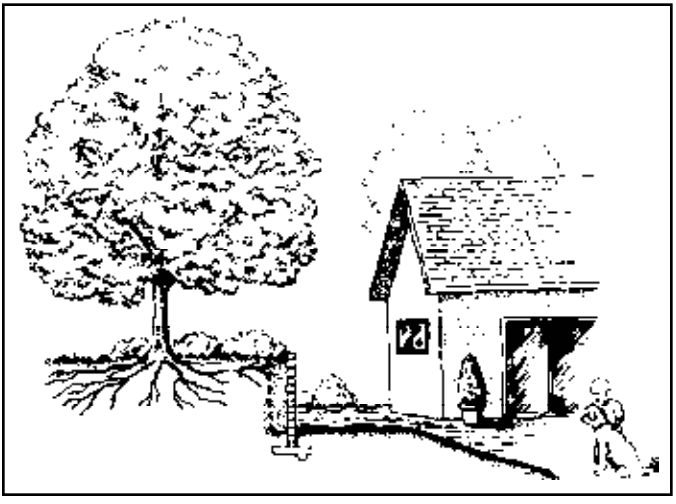
Adding soil or filling grades to level the site near the protected root zone has immediate and long-term effects on tree growth and survival. It may cause soil compaction and create anaerobic conditions. Trees may suffocate as a result. Before filling grades near the protected root zone, build retaining walls to prevent soil or filling materials from eroding over into the protected root zone (Figure 24, page 72). Retaining walls are structures built to stabilize the grade and prevent soil erosion and runoff. They can be built with a variety of materials including wood, rock, and concrete.

After grades have been cut or filled, treatments such as root and branch pruning, irrigation, and soil amendments may be necessary before installing the protected root zone fence and starting construction. These treatments can reduce impacts of construction, primarily those related to site disturbance (e.g., change in soil hydrology due to grading and microclimate). These treatments must be performed by skilled professionals. After construction is complete, site reclamation may be necessary.

■ Monitor and evaluate

Homeowners, businesses, landowners, developers, builders, and contractors should develop a monitoring and evaluation plan, indicate types of penalties, and sign a written tree protection plan before construction begins.

(a)



(b)

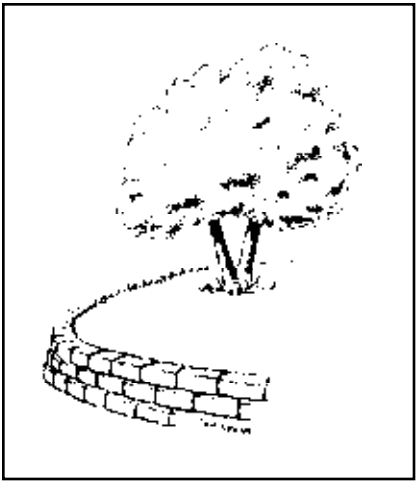


Figure 24. After cutting a grade near trees (a or b), build a retaining wall to prevent soil erosion.

The plan should specify tools and techniques that will be used to achieve protection goals. It may include frequent visits to the building site and penalties.

◆ **Visit the building site**

The homeowner or landowner should be allowed to visit the building site frequently during construction to check for any disturbance or violation of the tree protection plan.

◆ **Call for tree replacement plan**

The homeowner or landowner and the developer, builder, or contractor should agree on a tree survival and tree replacement program that should be extended between two to five years following construction.

◆ **Impose financial penalties**

Financial penalty should be agreed upon between the homeowner or landowner and the builder or contractor. Amount of financial penalty can be based on recommendations made in the *Minnesota Supplement to the Guide for Plant Appraisal with Regional Tree Appraisal Factors* (Minnesota Society of Arboriculture, 1996).

◆ **Make referrals**

The homeowner or landowner may agree to refer the builder or contractor to other homeowners for taking and protecting trees during construction.

Check list

- ☐ **Define goals**
- ☐ **Inventory and assess trees (lot scale)**
  - ☐ Obtain or draw a boundary map of the lot
  - ☐ Record the location of all trees and wooded areas
  - ☐ Do a tree survey and health assessment
  - ☐ Record tree survey and health assessment information
- ☐ **Select trees or groups of trees to protect**
  - ☐ Mark trees or groups of trees to protect
  - ☐ Record information on the resource map
- ☐ **Select building site and construction zone**
  - ☐ Select building and additions site and assess open space
  - ☐ Select construction zone
  - ☐ Identify other areas
- ☐ **Create a tree protection plan**
  - ☐ Determine and delineate the protected root zone
    - ☐ Trunk diameter method
    - ☐ Site occupancy method
    - ☐ Minimum area method
    - ☐ Dripline method
- ☐ **Select and implement tree protection method**
  - ☐ Protected root zone does not conflict with building site and construction zone

- ☐ Protected root zone overlaps with building site
- ☐ Protected root zone overlaps with construction zone
  - ☐ Build a travel route to minimize impact on soil and root systems
  - ☐ Reduce the size of the construction zone and limit the traffic
- ☐ Protected root zone overlaps with utility easements
- ☐ Protected root zone overlaps with grading area, cut, or fill
  - ☐ Reduce damage from cutting grades
  - ☐ Reduce damage from filling grades. Hang signs on the fence

☐ **Monitor and evaluate**

- ☐ Visit the building site
- ☐ Call for tree replacement plan
- ☐ Impose financial penalties
- ☐ Make referrals