4 LAND & STREAM MANAGEMENT

Iowa's rivers are constantly shifting and changing and can be challenging places to design, construct, and maintain water trails. This section discusses aspects you will immediately encounter when developing a water trail: launches, parking areas, and trails. The intended users and expected use suggest how these amenities are designed and constructed. Water trails intended for extended families, for example, are designed differently from those intended for experienced paddlers on multi-day trips.

4 LIST OF FIGURES AND TABLES

INTRODUCTION

Water trail users' most intense experience of land happens near the water. And the land draining into lakes and streams has a tremendous impact on users' water trail experiences. Use and management of that land directly affects the condition of the water body. For example, eroded soil eventually finds its way to the water and acts as a pollutant. Stormwater runoff from parking and mown areas also enters water bodies through drainage culverts and contributes to stream channel and bank degradation. Wildlife habitat can also be impacted by disruption of near-water areas.

Water, soil, and vegetation resources require attention during water trail construction and on a long-term basis. Conservation practices should be used during water trail establishment to repair existing damage at launch sites, as well as to protect the land from later damage from high flows, stormwater runoff, and vegetation removal or change. Habitat improvements in riparian and stream-edge landscapes are also included in water trail design.

After construction, launches and other water trail sites should be inspected at least annually for erosion, invasive species, and other types of impact. Mitigation strategies should be employed as soon as possible after identification of a problem.

Vegetation is a key element in determining the value of a site for wildlife. Appropriately placed vegetation also helps manage stormwater, build soil quality, and add visual interest for people. The best types and species of vegetation to establish at a site or along a stream edge will depend on the conditions of the site and the wildlife species important to protect and promote in the region. The Iowa Wildlife Action Plan, available online on Iowa DNR's web page, describes state and regional goals and needs for habitat. Historic vegetation information about a site, while interesting, is not usually relevant to the altered landscape and stream channel conditions found in Iowa today.

Two categories of management are included in this manual: management practices for near-stream land and those for the streams and streambanks. These practices provide guidelines for habitat establishment that also protect the land from erosion and provide interesting visual corridors for water trail users. These practices are essential for sites disturbed by water trail construction, such as launches, and they are recommended for the entire stretch of the trail.

4A

NEAR-STREAM LAND MANAGEMENT

Land management associated with water trails focuses on areas where water trail users physically move between land and water, including launch sites, portage sites and trails, and other pull-off or camping sites. All riparian landscape areas visually accessible from the water are also critical to the experience of water trail users. Habitat improvements are integrated with recommendations for erosion control and vegetation management. Near-stream land management includes slope protection, gully repair, general vegetation management, and visual access management.

Conservation practices associated with near-stream land can include seeding or introducing live stakes, bare-root or container-grown plants, local boulders and rock, limited amounts of riprap, mulch, or compost. Native species should be used exclusively in water trail projects. Invasive species should be eradicated as much as possible. Specialty products, such as sod blocks and rolls formed with native prairie species, are also commercially available. Stone riprap should be used judiciously; large blankets of riprap on banks can create upstream or downstream erosion problems, visually distract from the natural landscape, and limit vegetative establishment. Broken concrete is not advised for slope or bank stabilization under any circumstance.

SLOPE PROTECTION

Earthwork, or changing the slope of land, is often necessary to construct launches, parking areas and trails. Areas where this is done are susceptible to erosion unless control measures are established during and soon after construction. Both temporary and permanent slope stabilization practices are important. Resulting slopes exceeding 33 percent (or 3:1) require special attention. Steeper slopes, based on local soil characteristics, may require stabilization with a combination of vegetation and rock.

Understanding the site. Successful slope protection requires attention to sun exposure and to soils present on the site. Sites with full sun require different plant species than do full-shade sites. The Iowa Soil Survey provides soil characteristics and behavior under specific conditions. Iowa Soil Survey documents, including maps, can be downloaded online at no cost. Note that soil surveys provide information primarily related to agricultural production, and soil conditions can vary from descriptions in the survey. This is particularly true in urban areas where soil has been modified and near streams where lowering the water table affects the species of plants that would be successful.

After the soil types are determined, amend or aerate the soils as needed to promote plant establishment. Amend soils lacking a topsoil layer, or "A" horizon, with compost mixed into the top 6 inches of existing soil. Soils with compost added absorb more runoff and hold it more effectively for plants to use than non-composted soils. Equipment and foot traffic during construction can compact soil, requiring deep-core aeration or scarification before planting. Scarification is also useful in incorporating compost into the top layer of soil.

In addition to improving soil before planting, landscape fabric or mulch is used anytime seeding or planting occurs on steep slopes. Biodegradable, erosion-control fabrics are made expressly for use with newly seeded slopes. Other landscape fabrics are available to place around tree, shrub, and perennial plantings to control weed invasion. Plastic and other waterproof materials are not used, as they prevent soil and plants from absorbing runoff. A 2–inch-thick mulch layer is an alternative to erosion-control fabric. Mulch materials include chipped or shredded wood, often available from utility companies or municipalities at no cost.

Plant choice. Plant choice is a critical aspect of establishing a successful, stable near-stream site. Native species in combinations of warm and cool season grass and forb species are recommended for areas where non-woody plants are the goal. Establishing native vegetation on a site includes identifying an appropriate plant community, rather than selecting one or two species to establish. In general terms, the greater the variety of species in a seed mix, the broader the adaptability for wildlife, overall resiliency, and long-term success.

Plant communities include groups of native species that evolved to suit specific microclimates and soils. The USDA Natural Resources Conservation Service (NRCS) technical resources web page provides restoration tools for non-woody plant communities. Species lists for 15 native Iowa plant communities are provided. Examples include the Central Midwest Sedge Meadow and the Central Mesic Tallgrass Prairie. The NRCS web page also provides a Plant Community Query, allowing selection of the most suitable plant communities based on soil conditions at a specific site.

Methods for installing plant material at a site include seeding, using dormant cuttings, bare-root planting, and container-grown planting. Selecting plant species for a project site requires regional climate knowledge. Contact local conservation staff to determine appropriateness, as not all species listed are considered native in all areas of the state.

Establishing plants with seed. Seeding is probably most appropriate when an area is large and not steep. Table 4A-1 and 4A-2 list native species commonly established in Iowa. Commercially prepared seed mixes are available from both regional distributors and Iowa-based producers. County conservation boards and county roadside vegetation managers often harvest locally grown seed and make it available for use in the county. Local-ecotype seed species are also available for most species. The additional cost or effort to obtain local-ecotype seed is reasonable if you want to establish regional or state-occurring genetic varieties of native plants. Look for diverse seed mixes adapted specifically to full sun or full shade if your site is one or the other. If not, standard seed mixes usually contain some species adapted to each.

Work 1 to 2 inches of compost into the top layer of soil before seeding. Erosion-control fabrics intended for use over seeded areas greatly increase germination rates and reduce erosion. When these fabrics are used on river banks, though, floods can cause sheer stresses that damage or transport fabrics that aren't secured in redundant manners.

Canada wildrye can be used as a quick-establishing cover grass that survives submergence and dies back over the course of several years. Judiciously seeding it among other seeds, plugs, or live stakes can stabilize soils near the water's edge.

Existing plants can also be transplanted from nearby areas into the desired site. Ensure plants are native to the region and not known to be invasive.

Table 4A-1.
Native Herbaceous Flowering Plants Suitable for Near-Stream Areas[1]. Plants selected for flood-prone areas must be adaptable to wet conditions.

Flowering Plants

Common Name	Botanical Name	Height (ft)	Conditions	Light Requirements
Compass plant	Silphium laciniatum	4'-6'	dry/mesic	full sun – semi-shade
Ironweed	Vernonia fasciculata	4'-6'	mesic/wet	full sun
White wild indigo	Baptisia lactea	3'-6'	mesic	full sun
Meadow rue	Thalictrum dasycarpum	3'-6'	mesic/wet	part shade
Prairie blazing star	Liatris pycnostachya	3'-5'	mesic/wet	full sun
Grayhead coneflower	Ratibida pinnata	3'-5'	dry/mesic	full sun
Stiff goldenrod	Solidago rigida	3'-5'	dry/mesic	full sun
Blue vervain	Verbena hastata	3'-5'	mesic/wet	full sun
Swamp milkweed	Asclepias incarnata	3'-4'	mesic/wet	full sun – semi-shade
Illinois bundleflower	Desmanthus illinoensis	3'-4'		full sun; shade intolerant
Purple coneflower	Echinacea purpurea	3'-4'	mesic	full sun – part shade
Wild bergamot	Monarda fistulosa	3'-4'	dry/mesic/wet	full sun – light shade
Culver's root	Veronicastrum virginicum	3'-4'	mesic	full sun
New England aster	Aster novae-angliae	2'-5'	mesic/wet	full sun – semi-shade
Ox-eye sunflower	Heliopsis helianthoides	2'-5'	dry/mesic	full sun – part shade
Pale purple coneflower	Echinacea pallida	2'-4'	dry/mesic	full sun
Showy goldenrod	Solidago speciosa	2'-4'	dry/mesic	full sun
Spiderwort	Tradescantia ohiensis	2'-4'	dry/mesic/wet	full sun – moderate shade
Prairie sage	Artemisia ludoviciana	2'-3'	dry/mesic	full sun – semi-shade
Butterfly milkweed	Asclepias tuberosa	2'-3'	dry/mesic	full sun – semi-shade
Canada milkvetch	Astragalus canadensis	2'-3'	dry/mesic/wet	full sun
Rattlesnake master	Eryngium yuccifolium	2'-3'	dry/mesic/wet	full sun
Roundheaded bushclover	Lespedeza capitata	2'-3'	dry/mesic	full sun
Foxglove beardtongue	Penstemon digitalis	2'-3'	mesic	full sun – part shade
Hoary vervain	Verbena stricta	2'-3'	dry/mesic	full sun
Smooth blue aster	Aster laevis	1'-5'	dry/mesic	full sun

[1]List compiled using Iowa DNR (2005).

Table 4A-1. continued

Table 4A-1 Continued.

Common Name	Botanical Name	Height (ft)	Conditions	Light Requirements
Stiff coreopsis	Coreopsis palmata	1’-3’	dry/mesic	part shade
Plains coreopsis	Coreopsis tinctoria	1’-3’	mesic	full sun; shade intolerant
White prairie clover	Dalea candida	1’-3’	dry/mesuc	full sun
Purple prairie clover	Dalea purpurea	1’-3’	dry/mesuc	full sun
Flowering spurge	Euphorbia corollata	1’-3’	dry/mesuc	full sun
Yellow gentian	Gentiana alba	1’-3’	mesic	part shade
Golden Alexander	Zizia aurea	1’-3’	mesic/wet	full sun
Black-eyed Susan	Rudbeckia hirta	1’-2’	dry/mesic	full sun – semi-shade
Leadplant	Amorpha canescens	24”-36”	dry/mesic	full sun – part shade
Partridge pea	Chamaecrista fasciculata	24”-36”	dry/mesic	full sun – semi-shade
Canada anemone	Anemone canadensis	12”-24”	mesic/wet	full sun – part shade
Aromatic aster	Aster oblongifolius	12”-24”	dry/mesic	full sun – part shade
Prairie phlox	hlox pilosa	12”-24”	dry/mesic/wet	full sun

Table 4A-2.
Native Grasses and Sedges Suitable for Near-Stream Areas[1]. Plants selected for flood-prone areas must be adaptable to wet conditions.

Grasses and Sedges

Common Name	Botanical Name	Height (ft)	Conditions	Light Requirements
Big bluestem	Andropogon gerardii	3’-9’	dry/mesic	shade intolerant
Indiangrass	Sorghastrum nutans	3’-5’	dry/mesic	full sun
Canada wildrye	Elymus canadensis	3’-4’	dry/mesic/wet	full sun – part shade
Little bluestem	Andropogon scoparius	2’-4’	dry/mesic	full sun – part sun
Prairie dropseed	Sporobolus heterolepis	2’-3’	dry/mesic	full sun
Sideoats grama	Bouteloua curtipendula	15”-30”	dry/mesic	full sun – part shade
Prairie cordgrass[2]	Spartina pectinata	3’-8’	wet	full sun
Baltic rush	Juncus balticus	1’-3’	wet	full sun
Three-square rush	Scirpus americanus	1’-3’	wet	full sun
Dark green bulrush	Scirpus atrovirens	3’-5’	wet	full sun
Wool grass	Scirpus cyperinus	3’-5’	wet	full sun
Bottlebrush sedge	Carex comosa	1’-2’	wet	full sun
Fringed sedge	Carex crinita	2’-5’	wet	full sun – full shade
Hop sedge	Carex lupulina	1’-4’	wet	full sun – part shade
Lurid sedge	Carex lurida	1’-3’	wet	full sun
River wildrye	Elymus riparius	3’-4’	wet	part shade
Virginia wildrye	Elymus virginicus	2’-4’	mesic/wet	part shade

[1] List compiled using information from Iowa DOT (2003), Lown (2001), and Ion Exchange.
[2] Plant establishment is successful using root material from existing plants worked into the soil rather than seed.

ESTABLISHING PLANTS WITH DORMANT CUTTINGS

Cuttings from dormant plants near a project site can be used to establish certain native woody species as an alternative to bare-root or container-grown plants. Cuttings established in this way are known as live stakes, a form of soil bioengineering. Harvesting stakes and fascine materials from a locally successful plant increases the probability that the stakes will grow well in the area. Species used for live stakes include those that establish roots from cuttings of branches or stems fairly rapidly. (See Table 4A-3). Collectively, these species are known as pioneering species because they are the first species to establish when adequate soil moisture is available. Rooting occurs when branches are in contact with soil and soil water and groundwater, and air voids are not present. While pioneering species are functional for near-stream areas, additional woody and herbaceous species should also be present.

Live stakes (Figure 4A-1, following page) are appropriate when construction is coordinated with the dormant cycle of woody plants and when pioneering species are acceptable for the project. Cuttings should be made the day before planting and anytime after leaf drop and before bud break. Cut side branches of trees or shrubs between 1/2 inch and 2 inches in diameter in lengths slightly longer than needed for installation.

Table 4A-3.
Iowa Native Woody Species Adaptable for Use as Dormant Cuttings[1]

Woody Species for Dormant Cuttings

Common Name	Botanical Name	Mature Height (ft)
Eastern cottonwood	Populus deltoides	100’
Black willow	Salix nigra	50’
Sandbar willow	Salix interior	25’
Pussy willow	Salix discolor	20’
Gray dogwood	Cornus racemosa	10’
Ninebark	Physocarpus opulifolius	10’
Redosier dogwood	Cornus sericea	10’
Silky dogwood	Cornus amomum	10’
Buttonbush	Cephalanthus occidentalis	8’
Elderberry	Sambucus nigra ssp.canadensis	8’
Arrowwood viburnum	Viburnum dentatum	7’

Adequate soil moisture and effective drainage are required to establish dormant cuttings. Cuttings up to 4 inches in diameter can be used on sites with medium-textured soils and a high water table. Coarse, sandy soils have the potential to dry out but still fare better than fine-grained, silty soils, which hold moisture and contain less pore space for oxygen. Potentially drier applications, such as in sandy soil or with a low water table, will probably establish more successfully with smaller, 1- to 2-inch diameter material.

Avoid bark damage while preparing live stakes. Soaking cut branches in the stream overnight before planting increases root establishment. Use a water jet/probe or metal stake, such as a rock bar or pipe, to create a hole 2 to 4 feet deep and the same width as the cutting. Insert the cutting into the hole, putting the base of the cutting down. Water well, and fill all voids in the opening with soil to ensure the cutting has contact with soil for its entire length. Trim excess stake material to allow between 1 and 2 inches of stake above the soil level.

Soil bioengineering practices such as live stakes and fascines, discussed in the stream-edge section, have been successfully established by trained volunteer groups in Iowa and offer a low- or no-cost opportunity to re-vegetate slopes and stream edges. An early example of bioengineering techniques developed in Iowa focused on gully reclamation during the Great Depression as a part of the Iowa Engineering Experiment Station at Iowa State College (now Iowa State University). (See Quincy 1935.)

[1]Note that some species listed are only regionally appropriate within the state. Plant species chosen for a project represent those growing close to the project site.

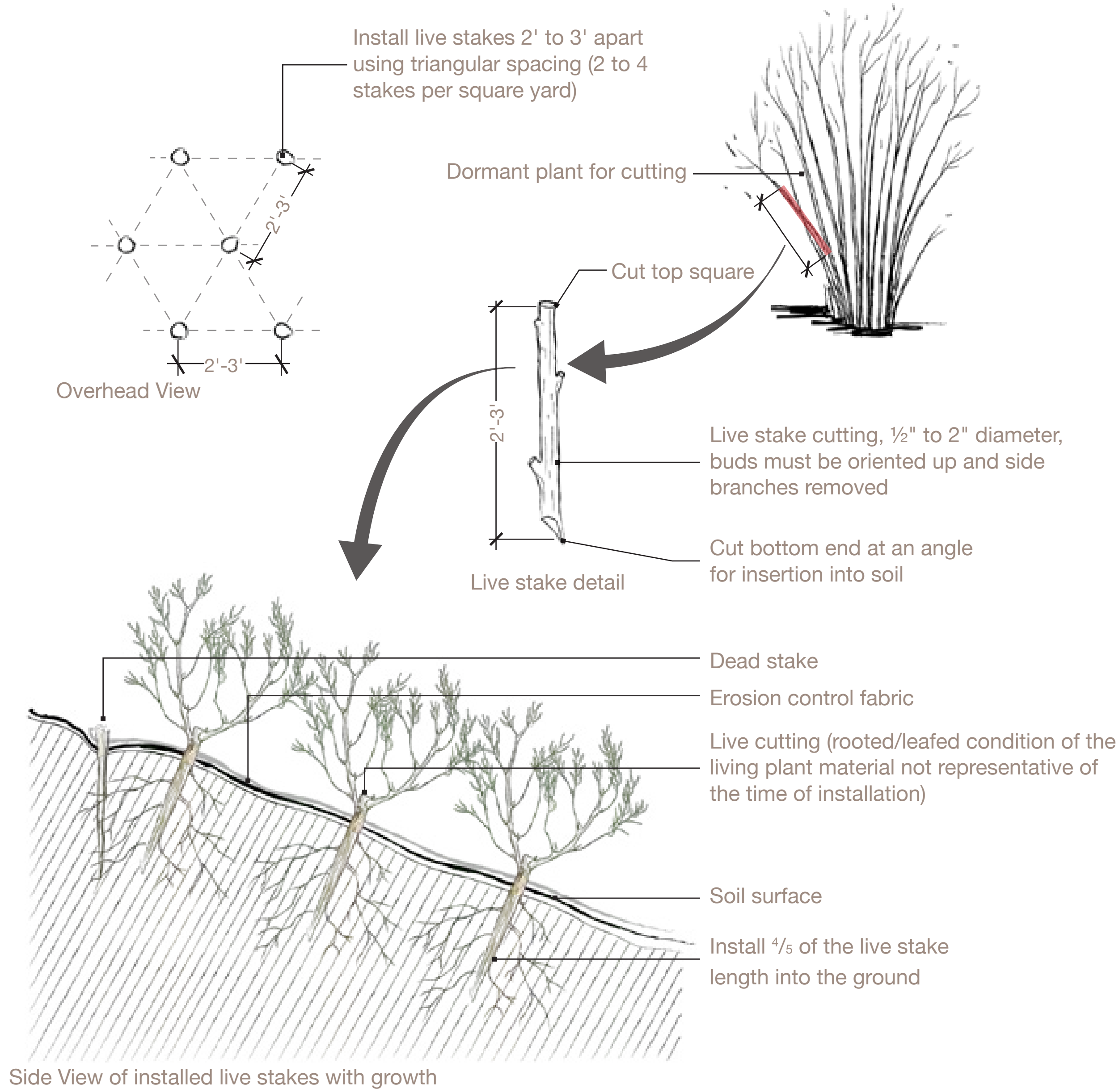


Figure 4A-1.
Live Stakes

ESTABLISHING PLANTS WITH BARE-ROOT OR CONTAINER-GROWN MATERIAL

Bare-root shrubs and trees are both commercially available and economically efficient. Using container-grown plants is also a common way to establish herbaceous plants. Container-grown trees and shrubs are more expensive to purchase compared with bare-root and may be less suitable for large sites. Tables 4A-4 and 4A-5 include native woody species recommended by the DNR that are adaptable and suggested for near-stream areas. Native, herbaceous plants recommended for near-stream areas can be established with small container-grown plants, plant divisions from existing plantings, or seeding. Table 4A-1 and 4A-2 includes recommended herbaceous species. Figure 4A-2 illustrates establishment of vegetation using bare-root and container-grown material. With permission of land managers, some shrubs, such as dogwoods, young willows, buttonbush, and ninebark, may also be uprooted with machinery already mobilized for project construction and transplanted to disturbed zones. Care should be taken to properly identify that invasive shrubs are not used.

Woody species selected for planting are determined by considering field-based knowledge of the project site. New plantings should match those at or near the site. Native range maps, when used to identify what species are found in an area, are often not accurate indicators.

Table 4A-4. Native Trees and Shrubs Suitable for Near-Stream Areas[1]

Somewhat Wet Soil Conditions

Common Name	Botanical Name	Mature Height (ft)	Growth Rate	Shade Tolerance
Yellow birch	Betula alleghaniensis	100’	medium	intermediate
American basswood	Tilia americana	80’	fast	tolerant
Black walnut	Juglans nigra	80’	fast	intolerant
Paper birch	Betula papyrifera	70’	fast	intolerant
Pecan	Carya illinoensis	70’	slow	intolerant
Red oak	Quercus rubra	70’	medium	intermediate
Black maple	Acer nigrum	60’	medium	very tolerant
Kentucky coffeetree	Gymnocladus dioicus	60’	medium	intolerant
Sugar maple	Acer saccharum	60’	medium	very tolerant
Black cherry	Prunus serotina	50’	medium	intolerant
Ohio buckeye	Aesculus glabra	50’	medium	tolerant
Red maple	Acer rubrum	50’	medium	tolerant
Bigtooth aspen	Populus grandidentata	45’	fast	very intolerant
Shingle oak	Quercus imbricaria	45’	slow	intermediate
Quaking aspen	Populus tremuloides	40’	fast	very intolerant
American hornbeam	Carpinus caroliniana	35’	slow	very tolerant
Downy hawthorn	Crataegus mollis	30’	slow	intermediate
Fleshy hawthorn	Crataegus succulenta	30’	slow	intermediate
Margaret’s hawthorn	Crataegus margaretta	30’	slow	intermediate
Pear hawthorn	Crataegus calpodendron	30’	slow	intermediate
Pin cherry	Prunus pensylvanica	30’	fast	very intolerant
Prairie crabapple	Malus ioensis	22’	medium	intolerant
Chokecherry	Prunus virginiana	20’	medium	very intolerant
Mountain maple	Acer spicatum	20’	slow	tolerant
Pagoda dogwood	Cornus alternifolia	20’	slow	tolerant
Wild plum	Prunus americana	20’	fast	very intolerant
Saskatoon serviceberry	Amelanchier alnifolia	18’	medium	tolerant
American hazelnut	Corylus americana	15’	medium	intermediate
Eastern redbud	Cercis canadensis	15’	slow	tolerant
Eastern wahoo	Euonymus atropurpureus	15’	medium	tolerant
Nannyberry	Viburnum lentago	15’	medium	intermediate
Blackhaw viburnum	Viburnum prunifolium	12’	slow	intermediate
Elderberry	Sambucus canadensis	8’	fast	intermediate
Roundleaf dogwood	Cornus rugosa	8’	medium	tolerant

[1]*List compiled using Iowa DNR (2005).*

Work 1 to 2 inches of compost into the top 6 inches of soil before planting unless soils are already high in organic content. A 4-foot-by-4-foot section of landscape fabric placed around trees and shrubs reduces weed competition during plant establishment and makes plantings identifiable during summer months. Bare-root plants, in particular, greatly benefit from reduced weed competition.

Wet Soil Conditions

Common Name	Botanical Name	Mature Height (ft)	Growth Rate	Shade Tolerance
Silver maple	Acer saccharinum	120’	very fast	tolerant
Cottonwood	Populus deltoides	100’	very fast	very intolerant
Sycamore	Platanus occidentalis	100’	fast	intermediate
River birch	Betula nigra	80’	fast	intolerant
Swamp white oak	Quercus bicolor	70’	slow	intermediate
Hackberry	Celtis occidentalis	60’	slow	intermediate
Pin oak	Quercus palustris	60’	slow	intolerant
Black willow	Salix nigra	50’	fast	very intolerant
Boxelder	Acer negundo	50’	fast	tolerant
Peachleaf willow	Salix amygdaloides	40’	fast	intolerant
Sandbar willow	Salix interior	30’	fast	intolerant
Speckled alder	Alnus incana	30’	medium	intermediate
Bebb willow	Salix bebbiana	25’	fast	intolerant
Coyote willow	Salix exigua	25’	fast	intolerant
Downy serviceberry	Amelanchier arborea	25’	medium	tolerant
Shining willow	Salix lucida	25’	fast	intolerant
Hoptree/water ash	Ptelea trifoliata	15’	slow	intermediate
Pussy willow	Salix discolor	15’	fast	intolerant
Gray dogwood	Cornus racemosa	10’	medium	tolerant
Heart-leaved willow	Salix rigida	10’	fast	very intolerant
Meadow willow	Salix petiolaris	10’	fast	very intolerant
Silky dogwood	Cornus obliqua	10’	medium	tolerant
Witchhazel	Hamamelis virginiana	10’	medium	intermediate
Redosier dogwood	Cornus sericea	8’	fast	tolerant
Rough-leaf dogwood	Cornus drummondii	8’	medium	tolerant

Table 4A-5.
Native Trees and Shrubs Suitable for Near-Stream Areas[1]

[1]*List compiled using Iowa DNR (2005).*

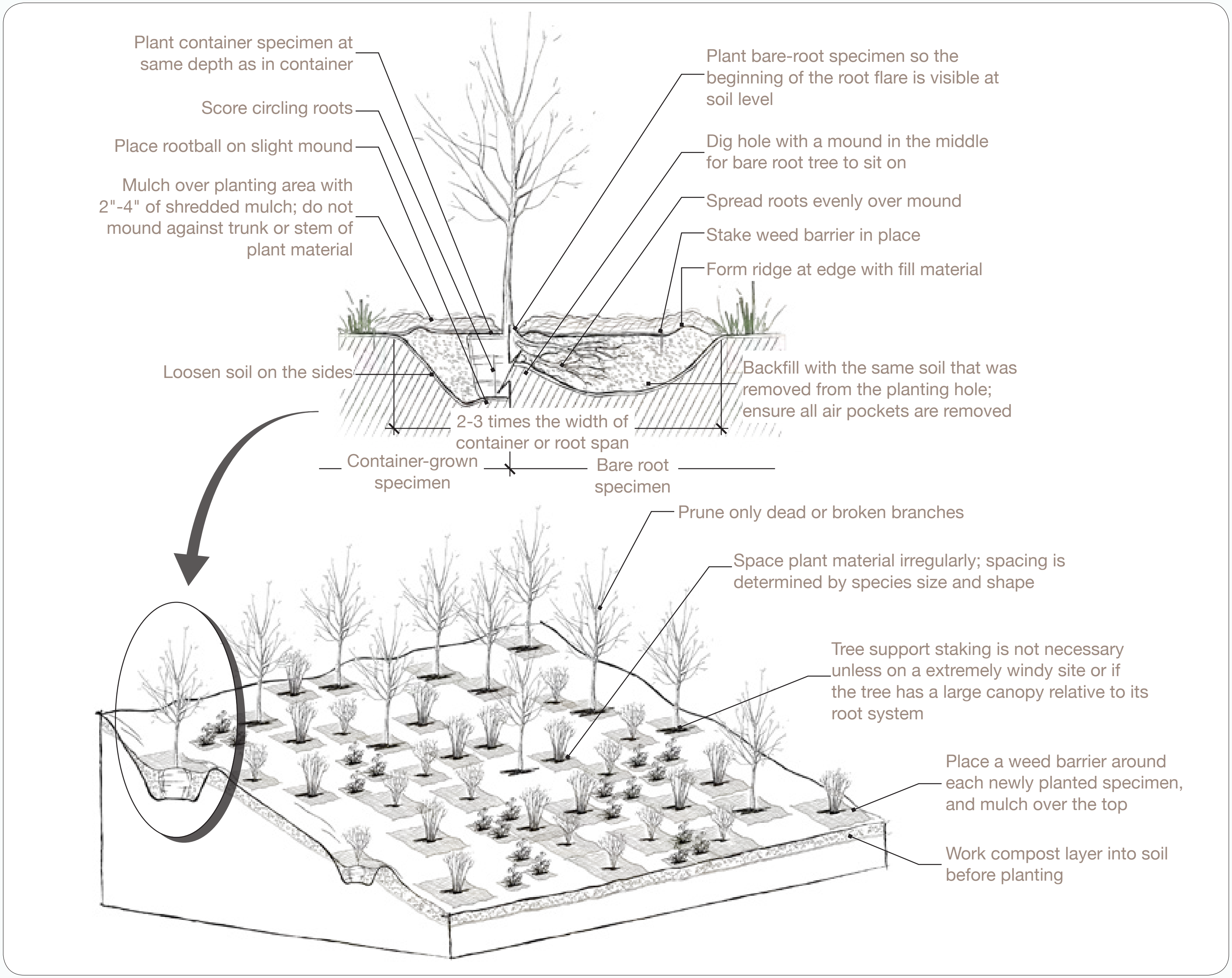


Table 4A-2.
Vegetation Establishment Using Bare-Root or Container-Grown Material

SLOPE PROTECTION WITH VEGETATION – ROCK COMBINATION

Consider including a combination of vegetation and rock when slopes are too steep to be protected by vegetation alone. Slopes greater than 2:1 can have mixed results, especially when soils are unconsolidated. Slopes between 2:1 and 1:1 generally require the addition of rock stabilization. Slopes exceeding 1:1 are too steep for construction. Live stakes can be installed at the time of rock placement or on slopes with existing rock protection (Figure 4A-3). Note that stakes must be installed deep enough to be in contact with underlying soils. Stake orientation should be perpendicular to the rock slope face.

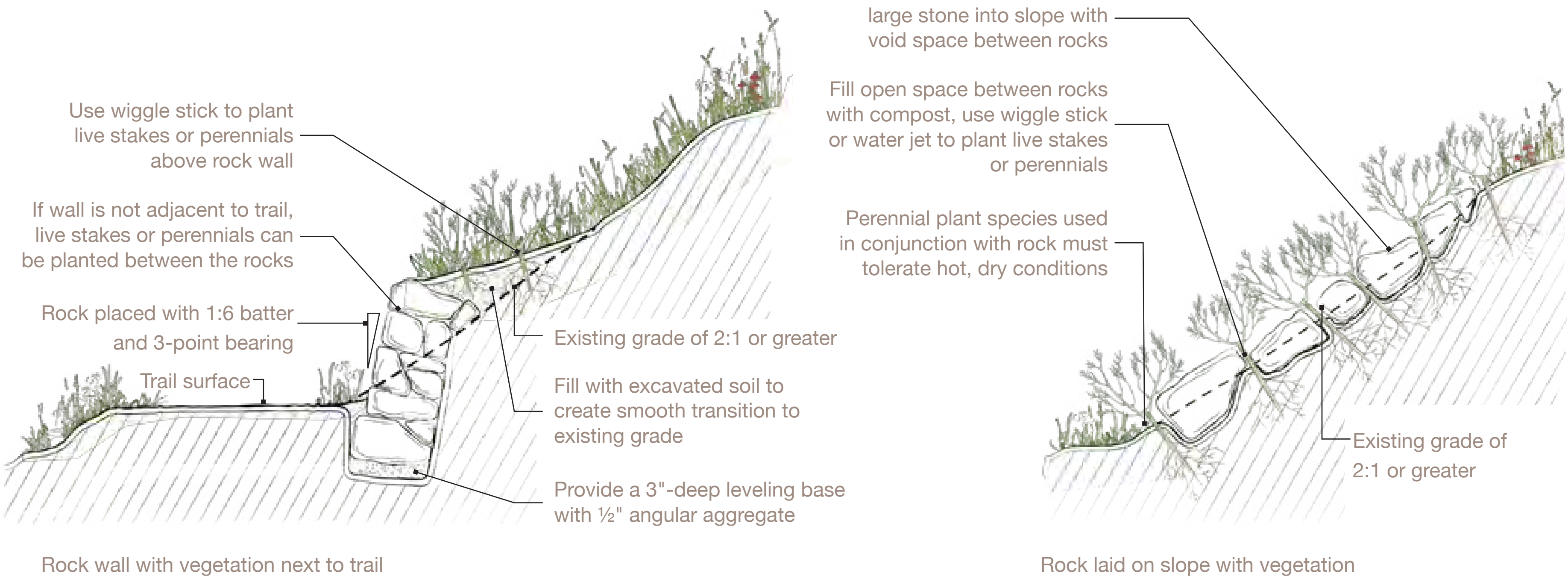


Figure 4A-3.
Slope Protection with Vegetation - Rock Combination

GULLY REPAIR DESIGN

Concentrated stormwater flowing through gullies may contribute some of the highest sediment yields of any source to Iowa streams and lakes. Once a gully is established, runoff widens and deepens the channel, causing more erosion and short-circuiting the filtering intentions of stream-edge vegetative buffers. Existing gullies on a launch site must be repaired and stabilized before additional drainage from parking areas or trails is directed toward them. Gully repair can be accomplished using highly engineered and constructed approaches, as well as with properly designed vegetative practices led by trained volunteers.

If the slope of the gully is greater than 6 percent, gully repair includes some form of check-dam construction. Highly engineered and constructed check dams generally are impermeable. Vegetative check dams are porous, substantially slowing water movement through the gully. All gully repair projects require technical knowledge and oversight, as improperly designed check dams can increase erosion and instability.

Check dams should be configured or spaced to accommodate specific site conditions (Figure 4A-4). Several general recommendations that minimize check-dam failure apply to all designs. Maintain a check-dam height of no greater than 3 feet. Ensure the top and bottom of all check dams in a series have the appropriate vertical relationship to each other. Install a rock splash point at the bottom of each check dam to absorb the energy of the overflow water. Local boulders and large stones, cobble, or shot rock are used when rock is needed to stabilize a waterway.

Check dams called willow walls, built with cuttings from willow trees adjacent to the site, can also be used (Figure 4A-5). Live cuttings installed when dormant, before buds and break and leaves are present, have the added value of sprouting and becoming a living, growing structure.

Swales or waterways with less than 6 percent slope can often be built without check dams and planted with native warm- and cool-season grasses. Refer to the Iowa Stormwater Management Manual for swale sizing calculations.

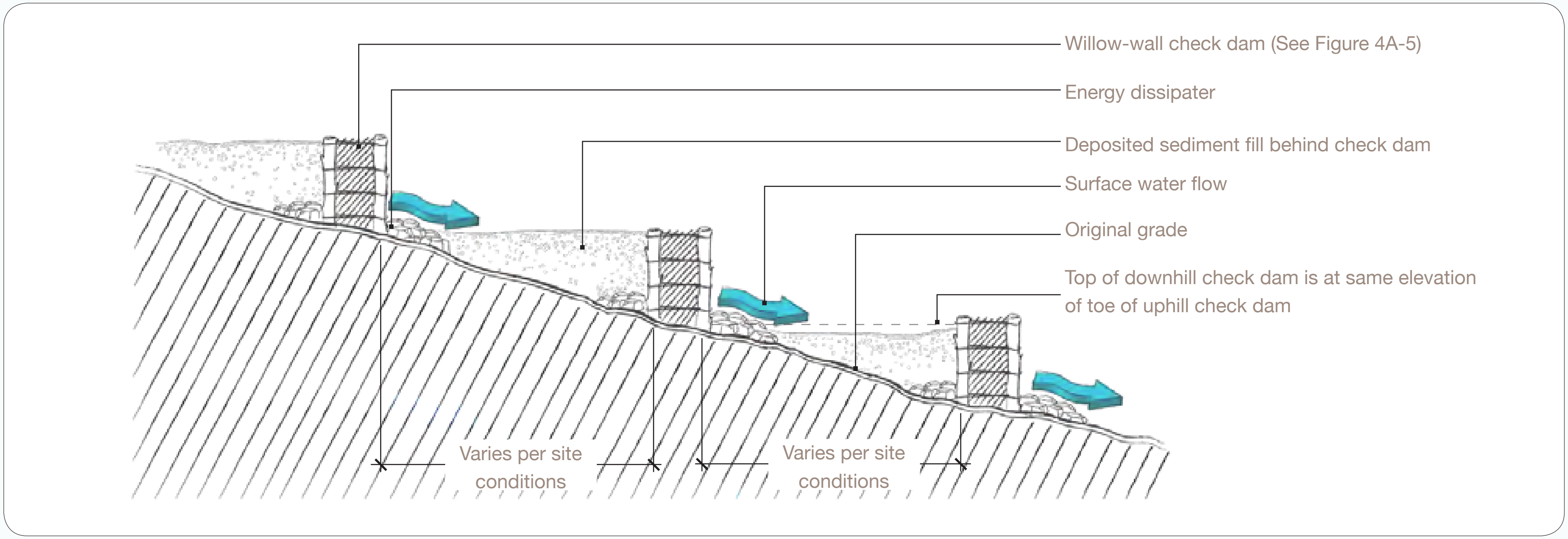


Figure 4A-4.
Check-Dam Alignment

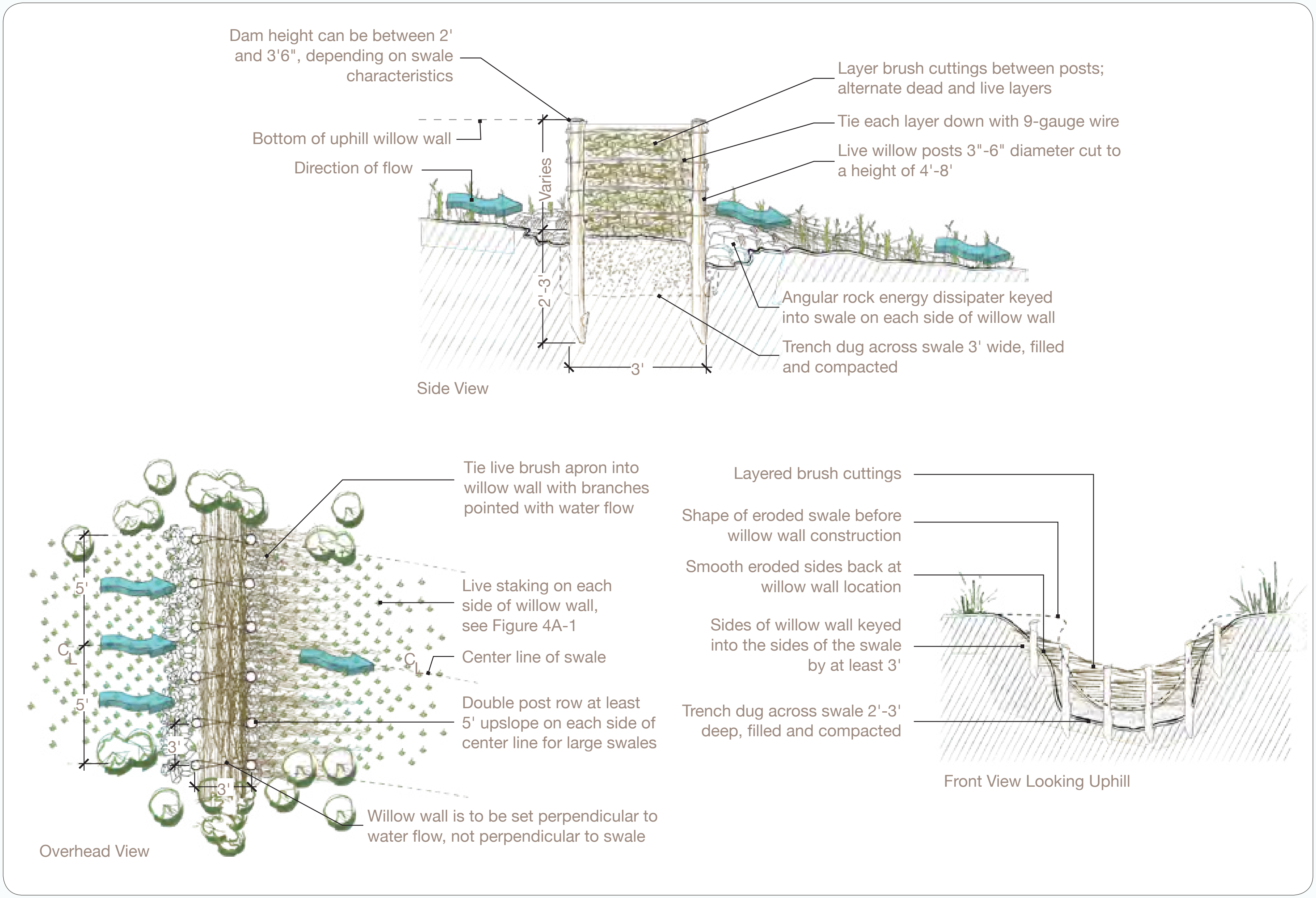


Figure 4A-5.
Willow-Wall Construction Sequence for Reducing Gully Erosion at Construction Sites

VEGETATION MANAGEMENT

Functional wildlife areas require regular observation and occasional maintenance. While leaving woodlands and pastures “to nature” may sound like an earth-friendly and attractive idea, a lack of management in the Iowa landscape unquestionably allows undesirable, invasive plant species to establish and spread. Plants native to Iowa evolved with disturbances such as grazing and fire that eliminate invasive plants. When they are protected from such disturbances, invasive plants that would otherwise be kept in check are able to out-compete the native plants. Some invasive plants, such as honeysuckle, may exacerbate waterway sedimentation. Plants categorized as invasive often resemble native plants to the untrained eye, and some actually are native or hybrids of exotic and native species. However, their dominance crowds out a more diverse plant community. Thirty-seven plants appear on the Iowa State Noxious Weeds List. Iowa has woody, herbaceous, and aquatic forms of invasive plants (Tables 4A-6, 4A-7, 4A-8).

Woody Invasive Plants

Common Name	Botanical Name
Buckthorn	Rhamnus cathartica, Rhamnus frangula
Honeysuckle	Lonicera x bella, Lonicera maackii, Lonicera morrowii, Lonicera tatarica
Multiflora Rose	Rosa multiflora
White Mulberry	Morus alba
Autumn Olive	Elaeagnus umbellata
*Eastern Red Cedar	Juniperus virginiana

*Species invasive in prairie landscapes, especially on dry slopes. Easter red cedars on rocky promontories along streams are in their native setting, were historically protected from fire, and should not be disturbed.

Table 4A-6.
Woody Invasive Plant Species Common in Riparian Areas in Iowa

Herbaceous Invasive Plants

Common Name	Botanical Name
Leafy Spurge	Euphorbia Esula
Reed Canary Grass	Phalaris arundinacea
Garlic Mustard	Alliaria petiolata
Cattail	Typha latifolia, Typha angustifolia
Stinging Nettle	Urtica dioica

Table 4A-7.
Herbaceous Invasive Plant Species to the Prairie Landscape Common in Riparian Areas in Iowa

Aquatic Invasive Plants

Common Name	Botanical Name
Purple Loosestrife	Lythrum salicaria
Eurasian Watermilfoil	Myriophyllum spicatum

Table 4A-8.
Aquatic Invasive Plant Species Common in Riparian Areas in Iowa

Invasive plants can become established in urban, as well as rural, sites, particularly when an existing shade canopy is disrupted or removed. Examples of this include edges of streams or ponds with bare soil, cleared sections of woodland in which desirable species have not been successfully replanted, and areas cleared for overhead utility easements. The additional sunlight reaching the ground surface allows invasive plants to establish. Clearing the land to build a water trail launch and/or parking area presents a similar potential for invasive plants to establish or spread.

Use caution removing any plant cover, including invasives, from stream bank areas. Stream bank areas quickly become unstable when vegetation is removed. Resulting bank failure can be minimized in cleared areas when native plants with a quickly developing root structure are immediately established.

County conservation boards, federal agencies, state agencies, and nonprofit organizations in Iowa frequently enlist volunteer participation to control invasive species. Common practices in Iowa include controlled burning, cutting with herbicide treatment, and physical removal.

Additional information on identifying and managing invasive species is available from state and nonprofit organizations, the Iowa DNR Aquatic Invasive Species program, and the state weed commissioner in the Iowa Department of Agriculture and Land Stewardship. County conservation and soil and water conservation districts may provide localized information.

MANAGEMENT FOR VISUAL ACCESS

People often use water trails to reduce stress and experience landscape areas they perceive as more remote than parks. Visually successful experiences require a balance between providing interesting views with some elements of mystery and helping users understand and make sense of their surroundings. Interesting rock formations, streambank shapes, and unusual trees are examples of enjoyable landmarks that contribute to how people remember water trail corridors. Paddling on water trails creates opportunities to experience a sense of mystery, particularly when channel curves, landforms, and vegetation create temporary visual barriers. Water trail projects build relationships with adjacent landowners early in project development to communicate about stream and stream-edge management and access purpose. While riparian-area management always responds to the objectives of the landowner, state-recognized water trail users enjoy stream segments with minimal disturbance and good stewardship practices.

Litter and other dumped materials can have negative effects on wildlife and plant communities, although it may not be significant enough to impact populations of any given species. However, litter in and along the water's edge significantly disturbs most water trail users. Larger pieces of trash dumped intentionally or moved downstream by high flows are likewise discouraging to users because, similar to erosion, they represent mismanagement and a lack of stewardship. Campaigns to pack out trash are recommended for all water trails. Volunteer cleanup efforts are recommended for each water trail. Cleanups increase the sense of waterway ownership for volunteers and create better experiences for water trail users. It's important to coordinate trash pickup with the entities responsible for removing trash for recycling or disposal.

Traditional riprap bank stabilization and obvious human development, such as housing, are among the least desirable views noted by water trail users. Contemporary designs for bank stabilization, such as those included in this manual, make it possible to avoid constructing entire banks with rock. Not only are the contemporary designs effective at controlling erosion, they also add habitat value to riparian areas and streams and add visual value from the water.

Views of wildlife, spring flower blooms, and fall color are strong motivators for Iowa paddlers to use or select specific water trails. Diverse riparian plant communities, as opposed to landscapes with only a few species, provide the best opportunities for year-round variety. Diverse plant communities also provide a variety of view types—such as closed-forest canopy and openings—which adds visual interest for users.

4B

STREAM RESTORATION
PRACTICES IN WATER TRAIL CONSTRUCTION

Recent estimates suggest streambank erosion contributes 25% to 50% of the annual sediment load in Iowa. Siltation and turbidity are common causes of impairments in Iowa's Section 303(d) list. If left unchecked, erosion of the toe, or bottom of the bank where it makes contact with stream water, leads to mass slope failure and undercut banks. Mass failures often suggest a stream is unstable and attempting to adjust to external changes. Causes could include stormwater delivered to the stream, a channelization project downstream of failing banks, past oversupplies of sediments, or removal of deep-rooted vegetation along the streambank.

Developing water trail launches at vertical cut banks is a common challenge in Iowa. Cut banks, named for their characteristic bare-soil surfaces, are often located on the outside bends of streams. These vertical streambanks, if not densely vegetated with well-established trees, can be extremely unstable during small and large floods. Launch construction is generally discouraged on these types of banks when it can be avoided. In some highly entrenched stream systems, such as certain Western Iowa streams, finding low-slope banks can be difficult. When necessary, a vertical bank can often be modified to provide a somewhat stable launch location or portage landing, using stream restoration or streambank practices.

Stream and streambank restoration practices most commonly associated with water trails include designing natural channels to redirect stream energy and protect streambanks that are clearly in flux at launch points. Streambank protection includes reshaping, minimal streambank armoring, and bioengineering. Both natural channel design and streambank protection reduce erosion and protect the construction investment. Streambank protection on other sections of water trails is also encouraged, particularly when mass slope failure is present. All stabilization practices associated with water trails favor minimal use of rock or hard surfaces.

Incorporating stream restoration principles and practices into designs can:

- enhance the long-term stability of projects
- enhance aesthetics
- provide improved fish habitat at access points where people would tend to fish
- provide cost-effective alternatives to standard riprap revetments, especially for demonstration projects

IDENTIFYING BANKFULL ELEVATION ON A STREAM

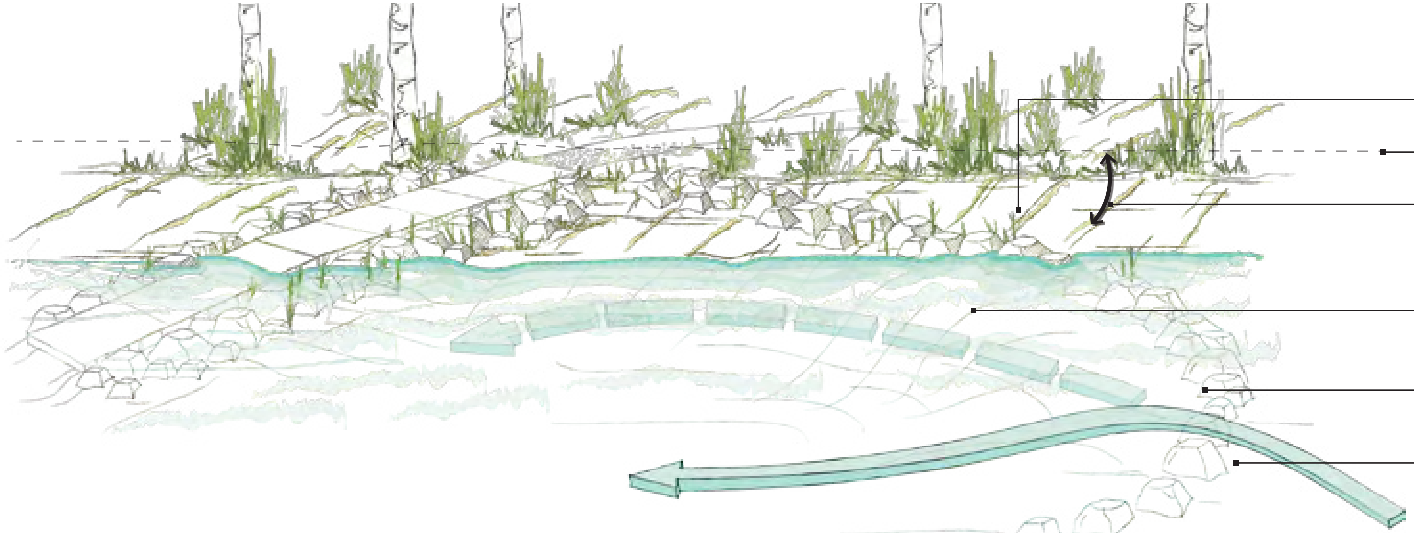
For many rivers and streams, bankfull elevation above a given water surface can be estimated in the field by setting up a laser level and walking at least two meanders with a rod. Record elevations of the lowest flat areas (often, the bankfull floodplain is most obvious on insides of bends), paired with an adjacent water-surface elevation. Subtract the water-surface elevation from each bankfull elevation. Correct readings should not vary more than 0.2 feet. Discard any outliers, and average the remaining readings. At your project area, record the elevation for the same height above the water surface as that average, and establish a benchmark that will allow the construction crew to easily determine the correct elevation for the later project.

Natural channel designs derived from stream restoration include:

- **J-hook vanes or straight vanes:** Rock structures begin on the bank at the bankfull elevation, point upstream at a 20 degree to 30 degree angle of departure from the bank, and disappear beneath the water surface to the stream bottom (Figure 4B-1). This arrangement moves the fastest flow of the water away from banks and directs energy to the channel bottom, creating favorable scour holes for habitat. On many streams, much of the structure can be invisible at normal flows, making it visually more subtle than many "rock wing" structures.
- **Log J-hooks:** On smaller streams, logs can be embedded in banks and used in the same way as j-hooks to move the main flow away from the bank. At bankfull flows, both log and rock j-hooks contribute to sediment equilibrium. Strategically placed j-hooks may also be able to direct scour to a boat ramp downstream to assist with self-cleaning of fine sediments (silt) from ramps.
- **Bankfull bench**: Creation of an active floodplain at the bankfull level in the project area increases roughness on the bench and reduces bank erosion from water scouring the toe of the slope. Excavate a narrow, lower floodplain on a steep or vertical bank, and use a stone toe, bare-root shrub plantings, and/or live stakes (Figure 4B-2). Although technique is not yet common in the Midwest, it is used frequently in other parts of the United States and has been successfully tested in Minnesota. The bankfull bench design, coupled with a concrete walkway, can make an appropriate canoe launch in and of itself.

Minnesota example of a bankfull bench construction
Photo Credits: Luther Aadland

Figure 4B-1.
Streambank Protection at Eroding Launch Site



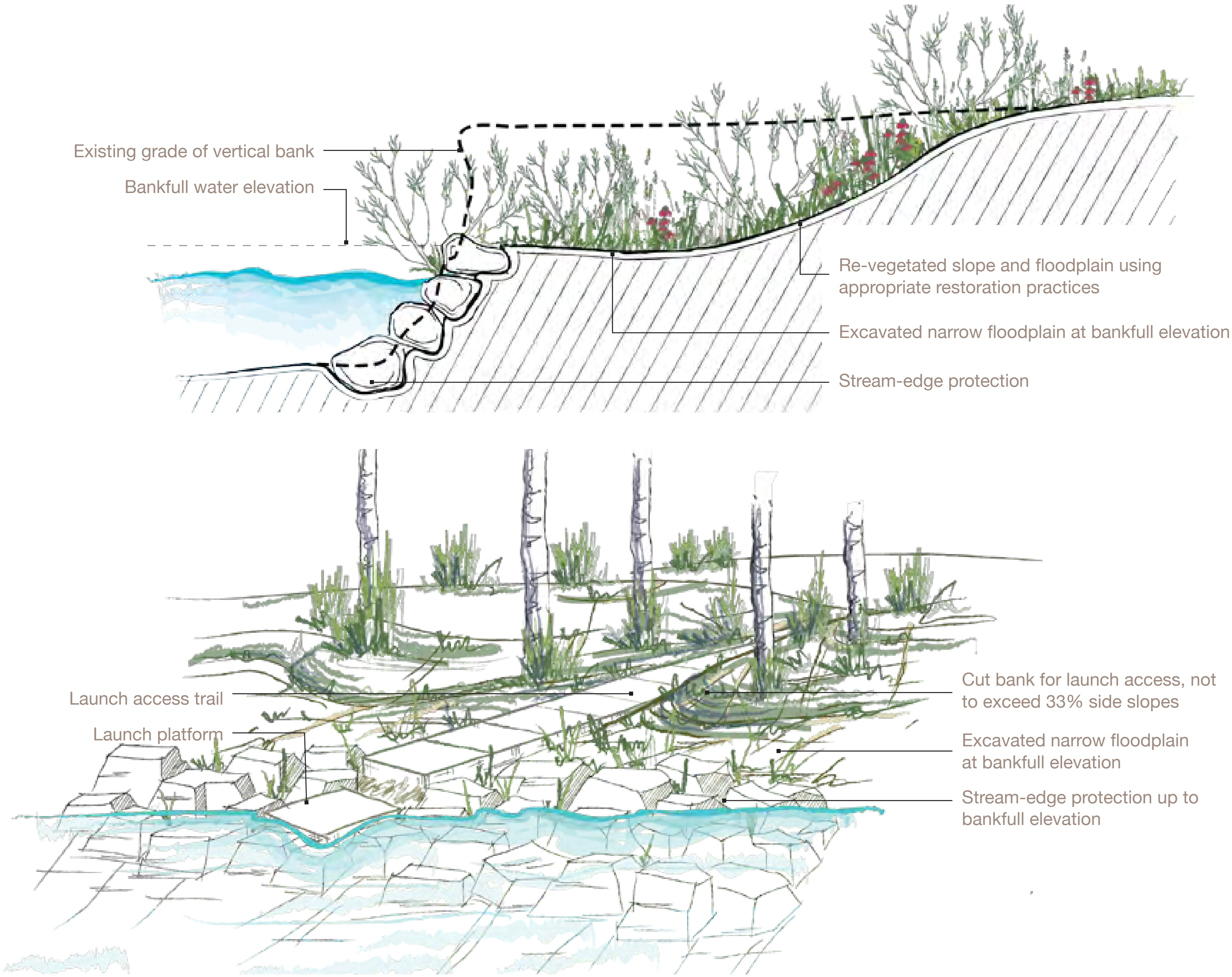


Figure 4B-2.
Bank Reshaping With Narrow Floodplain

STREAMBANK ARMORING THROUGH BIOENGINEERING AND MINIMAL ROCK PLACEMENT

Reactions to landscape changes are most evident near stream edges. Even a seemingly small change, such as reverting a CRP grassland tract back to cropland, increases the volume of stormwater, as well as the amount of sediment leaving the tract and being delivered to the stream. Urban development of cropland, likewise, generally increases stormwater volumes and decreases the amount of sediment. Stream channels react to landscape changes because they manage the volume of water and the amount of sediment delivered to them, as well as accommodate the slope gradient. As the volume of stormwater runoff reaching them increases, the additional channel space required to convey this runoff is configured out of the streambanks. Therefore, continuous changes on the land common in Iowa result in constantly adjusting stream channels. The shape and stability of streambanks are excellent indicators of whether a river is stable or adjusting to change.

When space is available and excess soil can be used in upland areas, the slope of vertical banks can be reduced to between 33 percent and 50 percent, depending on soil type (Figure 4B-3). The toe of the slope, which remains at the same location and elevation as before construction, requires armoring or protection. Newly graded bank slopes also require re-vegetation.

Armor integrating vegetation and rock is useful to cover the height of the bank between low- or base-flow and bankfull elevation. Use rock in armoring judiciously and specifically to prevent undermining of concrete infrastructure or at toes of eroding streambanks. Armoring should not cover the entire height of a streambank except in special circumstances, such as above or below a dam or a water-constricting bridge. Conservation practices associated with streambank armoring include joint planting, live fascines and stakes, and wattles or coconut fiber logs. Additional streambank protection methods are described in Chapter 16, USDA NRCS Engineering Field Manual.

Stabilization with vegetation improves aquatic and terrestrial habitat more than rock stabilization alone. Stream-edge vegetation provides cover for fish, invertebrates, small mammals, and birds. Adding shade over the water usually improves stream water temperatures. Small nooks and gaps between woody and herbaceous stems at the water's edge also act as temporary storage for eroded sediment in the water.

Native, non-invasive plant species are always recommended, particularly those already occurring on other sections of the same stream. Broken concrete is never recommended as armoring material. Bank stabilization practices including vegetation are more susceptible to damage if high flows occur before the plant material becomes established. Vegetation also requires observation, particularly during establishment, to mitigate potential damage from insect pests and excessive eating by rabbits and other small mammals.

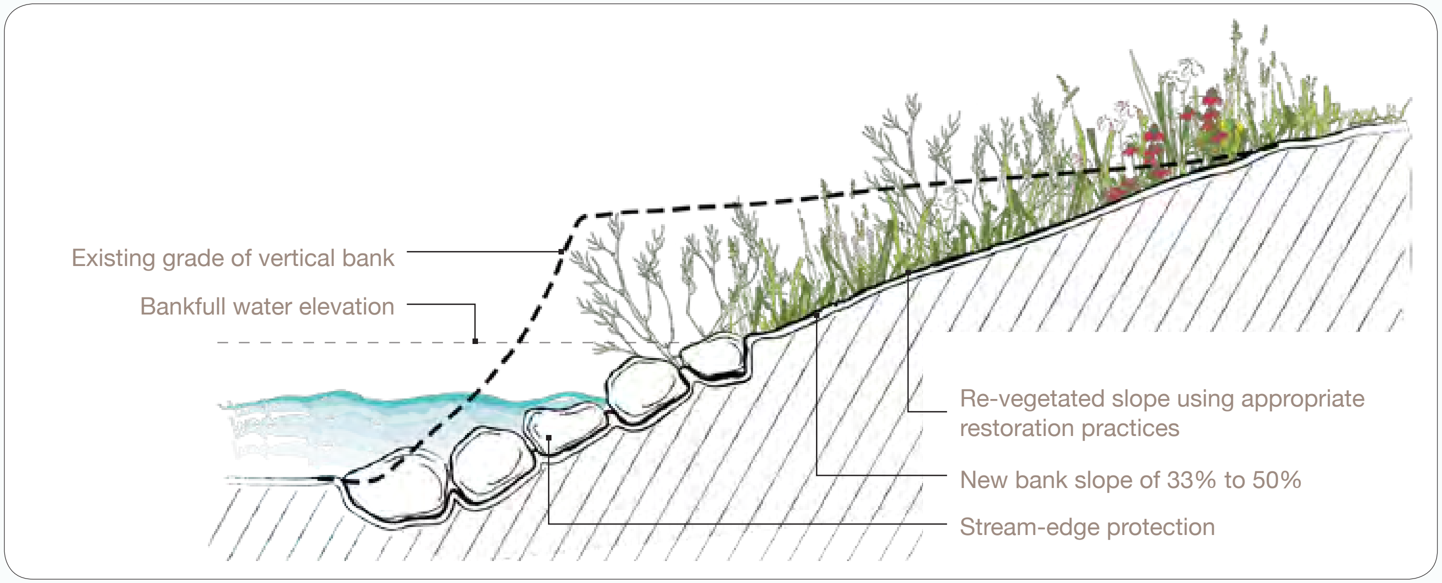


Figure 4B-3.
Reducing Vertical Bank Slopes

Stream-edge protection using rock. Vegetation with rock (Figure 4B-4) stabilizes by combining the immediate physical mass of the rock with development of stabilizing roots of woody cuttings. Local boulders and large stones are sized to withstand typical high flows and are most commonly of 2 feet to 3.5 feet in diameter. Live plant cuttings used for joint planting, such as live stakes, must be cut when dormant. Branch diameter of cut material is between ½ inch and 4 inches, depending on soil wetness. Cuttings between ½ inch and 2 inches in diameter are the most likely to succeed. Soak cuttings overnight in the stream before planting. Create openings between the rocks to plant the cuttings. Water, tamp, and trim as described for the live stakes (Figure 4A-1).

Stream-edge protection using vegetation. Fascines, or bundles of dormant live cuttings, can also be used in combination with a rock toe on slopes not greater than 33 percent (3:1). Seeding, erosion-control fabric, live stakes, and dead stakes are used in conjunction with fascine installation. Fascine bundles are installed slightly exposed in prepared trenches (Figure 4B-5). Trenches are hand-dug and spaced 3 feet to 5 feet upslope from each other, beginning slightly above bankfull elevation. Cut dormant branches less than 2 inches in diameter and 5 feet to 10 feet in length, and immediately soak overnight in the stream. Tightly bind final bundles of 6 inches to 8 inches in diameter with biodegradable twine, and install in trenches as shown. Erosion-control netting is placed under each trench and over the seeded bank above and below the trench.

Other stream-edge protection. Coconut fiber logs can be used as an alternative to live fascines (Figure 4B-6). Coconut fiber rolls are 12 inches in diameter and 20 feet long, and they are usually installed at water's edge then the roll is dry. Native perennial plants and woody cuttings are sprigged into rolls after they become saturated. Rolls degrade much more quickly at the edge of moving water, compared with live fascines. Therefore, fiber rolls are most effective on low-order stream and lake edges.

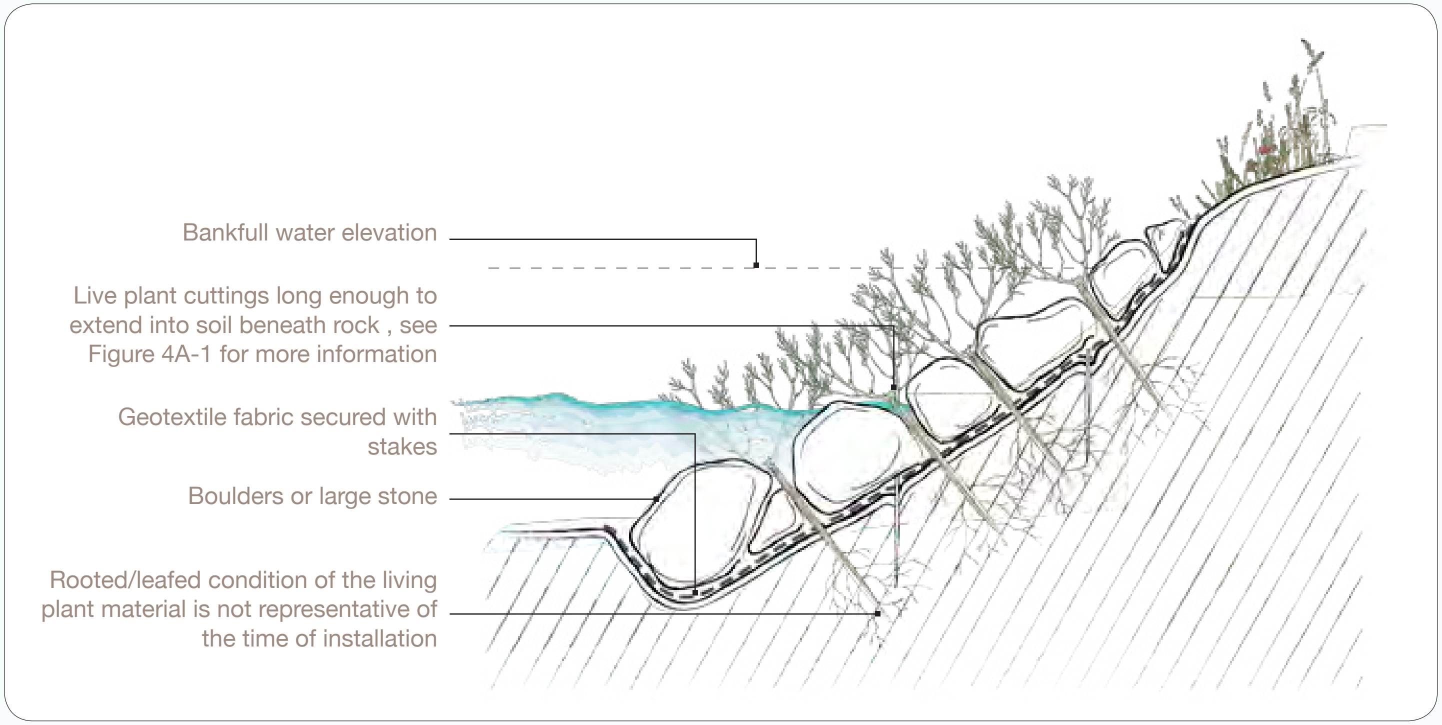
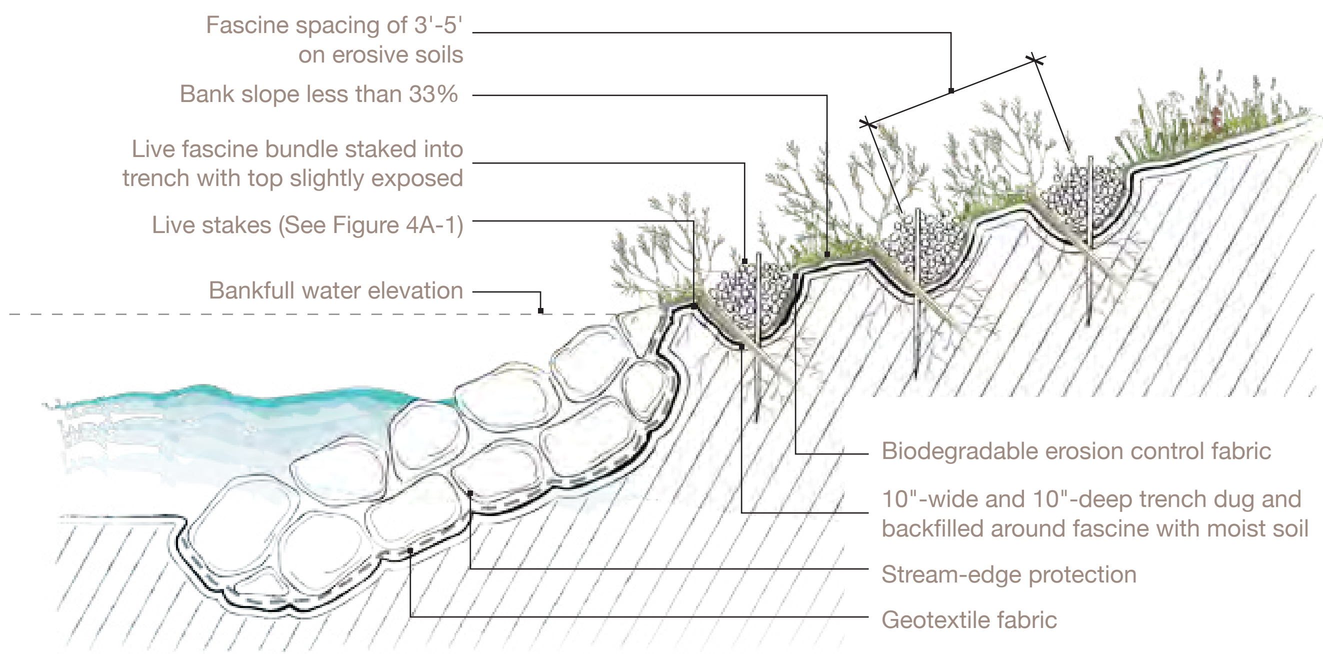
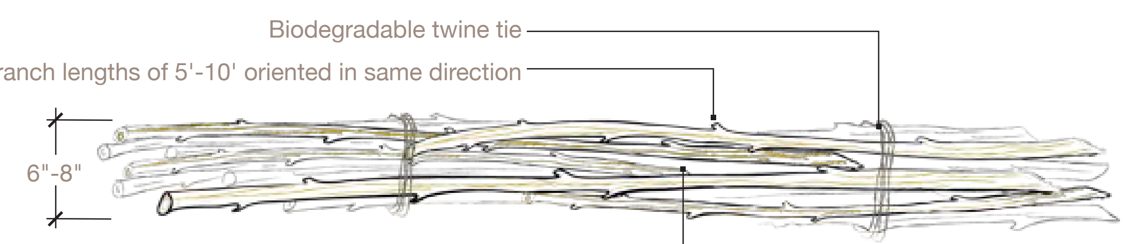


Figure 4B-4.
Stream Edge Protection Using Rock



Live Fascine Installation



Live Fascine Bundle

Figure 4B-5.
Stream Edge Protection with Live Fascine

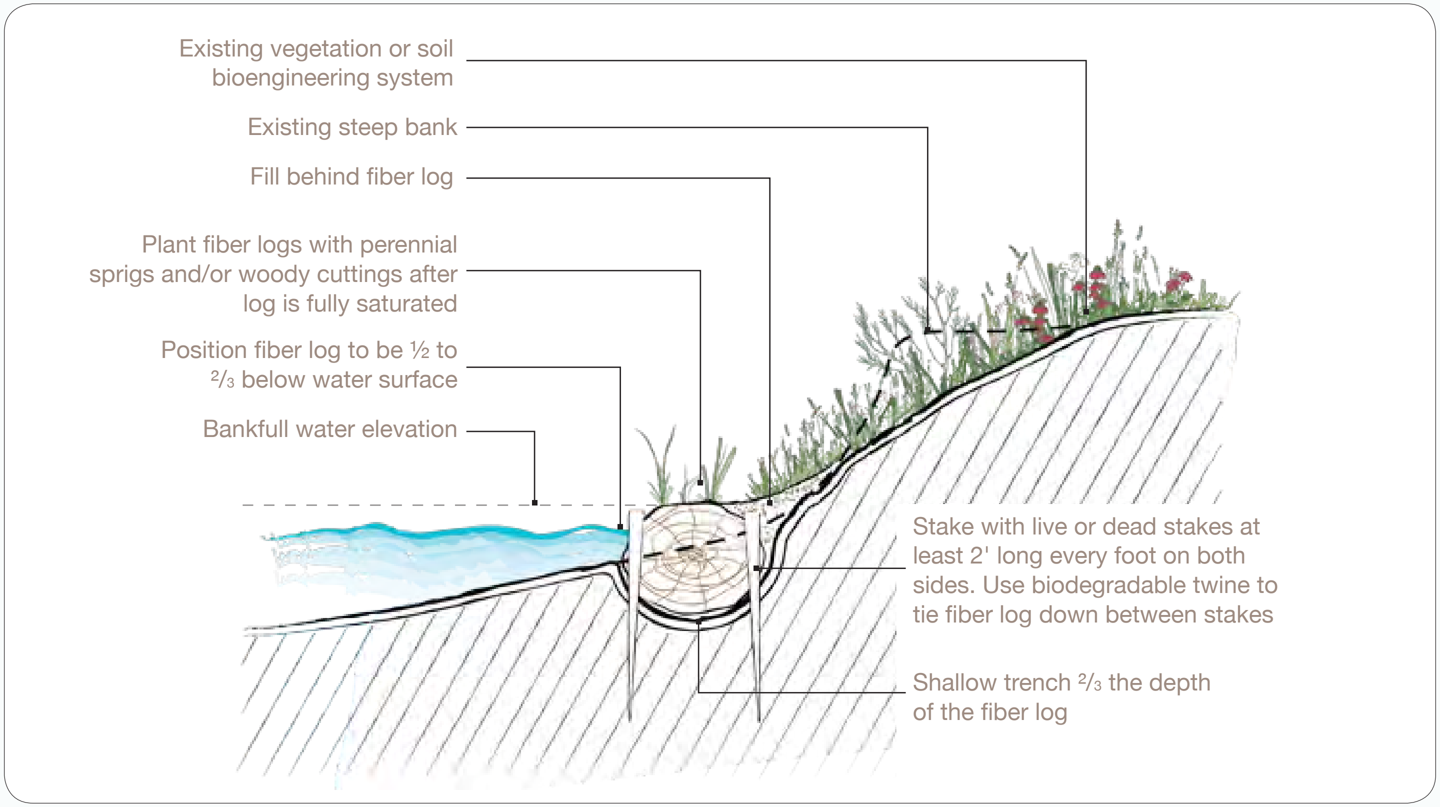


Figure 4B-6.
Stream Edge Protection with Coconut Logs

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