

SUSTAINABLE LANDSCAPE GUIDELINES



CONTENTS



INTRODUCTION	3
CHAPTER 1: SITE SELECTION AND PLANNING	7
CHAPTER 2: HUMAN HEALTH AND WELL-BEING	11
CHAPTER 3: VEGETATION	13
CHAPTER 4: TREES	26
CHAPTER 5: SOILS	32
CHAPTER 6: WATER CONSERVATION	35
CHAPTER 7: GREEN INFRASTRUCTURE + STORMWATER MANAGEMENT	37
CHAPTER 8: GREEN ROOFS	45
CHAPTER 9: CARBON SEQUESTRATION	48
CHAPTER 10: MATERIAL SELECTION	50
CHAPTER 11: CONSTRUCTION	53
CHAPTER 12: MAINTENANCE	56
CHAPTER 13: EDUCATION AND ENGAGEMENT	59
REFERENCES	62
APPENDIX A: RELATED POLICIES AND STANDARDS	
APPENDIX B: PLANT LIST	
APPENDIX C: LANDSCAPE MAINTENANCE CHECKLISTS	



This document was produced by Emmons & Olivier Resources, Inc. and Hennepin County exclusively for Hennepin County’s Department of Facility Services. 2023.
 All photos are the property of EOR and Hennepin County unless otherwise noted.
 Cover photo courtesy Damon Farber Landscape Architects.

INTRODUCTION

CREATING SUSTAINABLE LANDSCAPES

Sustainable landscapes are responsive to the environment and can actively contribute to the development of healthy communities.

According to the American Society of Landscape Architects (ASLA), “sustainable landscapes are responsive to the environment, regenerative, and can actively contribute to the development of healthy communities. Sustainable landscapes sequester carbon, clean the air and water, increase energy efficiency, restore habitats, and create value through significant economic, social, and environmental benefits.”

To support the [Hennepin County Climate Action Plan](#) designers and landscape managers are encouraged to employ resilient design principles and practices when planning new facilities or renovating old ones. Resilient design means working with nature – not in opposition to it – to help communities withstand and recover more quickly from disruptive natural events that are expected to occur more frequently, and with greater intensity, due to climate change. Resilient design strategies that create sustainable landscapes will help Hennepin County ensure the health and safety of residents while also safeguarding facilities and assets in the decades to come.

This document lays out guidelines in twelve categories to help guide sustainable design and management to make landscapes more resilient across Hennepin County.





INTRODUCTION

CLIMATE ACTION PLAN GOALS

This document supports many of the Hennepin County Climate Action Plan goals including the goal to *Increase the resilience of the built environment and protect natural resources* by implementing green infrastructure (GI) and other resilient building techniques that address increased stormwater runoff and sequester carbon.

This guideline also addresses actions from the Hennepin County Facility Services Climate Action Plan within the Water and Green Infrastructure sections, outlined in the table below.

GOAL	ACTION	HOW THIS GUIDE WILL ADDRESS IT
WATER GOAL 10: Update Policies Standards and Practices	Update stormwater design standards for increased rainfall intensities incorporating B3 Site and Water Guidelines	This guideline supports using updated design standards for retaining increased rainfall intensities and links to B3 Site and Water Guidelines. It also recommends more ambitious stormwater management goals for Hennepin County sites.
	Reduce salt use and update vendor contracts	This guideline supports the reduction in salt use by promoting fewer impervious sites and creating snow management areas treated with green infrastructure (GI).
	Create strategies and design guidelines to reduce water use	This guideline focuses on reducing water use by promoting drought resistant planting and implementing GI BMPs.
GREEN INFRASTRUCTURE GOAL 11: Increase Green Infrastructure	Update Sustainable Landscape Guidelines to prioritize green infrastructure and water management	This guideline will prioritize GI and water management.
GREEN INFRASTRUCTURE GOAL 12: Reduce Heat Island Effect	Evaluate county facilities and hardscapes for hot spots (Heat Island Effects) under the racial impact map and develop strategies to reduce these impacts	This guideline promotes landscaping practices that mitigate the urban heat island effect.
GREEN INFRASTRUCTURE GOAL 13: Increase Carbon Sequestration	Support efforts to identify opportunities and strategies that increase carbon sequestration on county property by 2023	This guideline promotes landscape practices that increase carbon sequestration on county properties such as adding trees and using biochar.

INTRODUCTION

STRUCTURE AND INTENDED USAGE OF THIS DOCUMENT

This guideline is primarily intended for Hennepin County staff and hired design professionals and contractors who are planning, designing, constructing, or maintaining Hennepin County properties. It can also be referenced by local municipalities within and around Hennepin County for best practices and information about sustainable landscapes.

This guide is divided into 12 chapters, each with information on best practices related to resilient and sustainable landscape design. Though it does not provide specifications or benchmarks for design, it does link to Minnesota's [B3 Design Standards Site & Water Guidelines](#) to provide guidance for measuring success in each area. Look for **B3** call out boxes in each chapter for related standards and performance criteria.

An example B3 call out box. These call out boxes specify which B3 guideline to follow and include a reference to the relevant section.

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.4 VEGETATION

- A. "New construction projects shall not select sites containing any of the following critical sites:
1. Prime farmland (as defined by NRCS WSS).
 2. Farmland of state significance (as defined by NRCS WSS).
 3. Former municipal, township or county parkland.
 4. Former federally protected lands.
 5. Areas covered by a conservation easement."

INTRODUCTION

SUSTAINABLE LANDSCAPE DESIGN PROCESS

The figure below outlines each phase of the project life cycle and notes the relevant chapters within this guide for each stage.

STAGE	Select and Evaluate the Site	Determine Site Goals	Design the Site	Build the Site	Maintain the Site
ACTIONS	<ul style="list-style-type: none"> Review prospective sites with Landscape Architect Select brownfields where possible Document site details Conduct a site survey to identify constraints and opportunities 	<ul style="list-style-type: none"> Consider site constraints and opportunities Work with all relevant stakeholders to determine site goals, including main and secondary goals Work with stakeholders to establish realistic long-term maintenance budgets 	<ul style="list-style-type: none"> Incorporate essential design elements (safety, maintenance, budget, Better Site Design) Select appropriate materials Confirm performance specifications and standards to be met Review design with stakeholders Determine roles and responsibilities 	<ul style="list-style-type: none"> Protect existing site resources (sediment and erosion control, tree protection) Conduct regular site inspections Monitor establishment period Incorporate educational elements Create final asset list 	<ul style="list-style-type: none"> Incorporate assets into relevant budgets Follow maintenance standards Train consultants and staff on maintenance standards
GUIDE	Ch. 1: Site Selection and Planning	Ch. 1: Site Selection and Planning	Ch. 2: Health and Wellbeing Ch. 3: Vegetation Ch. 4: Trees Ch. 5: Soil Ch. 6: Water / Irrigation Ch. 7: Green Infrastructure and Stormwater Management Ch. 8: Carbon Sequestration Ch. 9: Material Selection Ch.12: Education and Engagement	Ch. 3: Vegetation Ch. 4: Trees Ch. 5: Soil Ch. 6: Water / Irrigation Ch. 7: Green Infrastructure and Stormwater Management Ch. 8: Carbon Sequestration Ch. 10: Construction	Ch. 3: Vegetation Ch. 4: Trees Ch. 5: Soil Ch. 6: Water / Irrigation Ch. 7: Green Infrastructure and Stormwater Management Ch. 8: Carbon Sequestration Ch. 11: Maintenance

CHAPTER 1: SITE SELECTION AND PLANNING

BEGINNING THE SUSTAINABLE LANDSCAPE DESIGN PROCESS

The resilient design process starts with site selection and planning. Consider all sections of the Sustainable Landscape Guidelines at the beginning of the design process and employ **BETTER SITE DESIGN** (page 10) principles to create more sustainable landscapes.

Keep visitor experience in mind. Analyze accessibility, safety, and the intended function of the site to maximize user benefit.



Photo: Knutson Construction

TASK	RECOMMENDATION
Site Selection	Include a landscape architect when selecting a new site or choosing between available sites.
	Consult with a landscape architect when locating new buildings, infrastructure, traffic circulation, etc. to ensure landscape efficiencies are considered up front.
	Choose brownfield redevelopment where possible to minimize disturbance to natural areas and drainage ways.
Roles and Responsibilities	Ask the following questions to determine the roles and responsibilities and who should be involved in the design process from the beginning: <ul style="list-style-type: none"> • Who will use the site? • Who will operate the site? • Who will maintain the site? • Who will fund maintenance and rehabilitation?

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE 5.4 VEGETATION

- A. "New construction projects shall not select sites containing any of the following critical sites:
1. Prime farmland (as defined by NRCS WSS).
 2. Farmland of state significance (as defined by NRCS WSS).
 3. Former municipal, township or county parkland.
 4. Former federally protected lands.
 5. Areas covered by a conservation easement."

CHAPTER 1: SITE SELECTION AND PLANNING

SITE GOALS

All green spaces should be designed to be more than “just landscaping” and support Hennepin County’s established site goals. Early in the site design process the design team will establish site goals. Along with designing to meet the identified goals for the site, the following elements should be planned for within every design:

- Stormwater management
- Safety
- Heat
- Carbon Sequestration
- Maintenance



Stormwater landscaping is aesthetically pleasing while providing pollinator habitat and filtering runoff on site.

TASK	RECOMMENDATION
Plan for Stormwater Management	Landscapes should enhance ecosystem function through the incorporation of stormwater best management practices (BMPs). BMPs reduce stormwater runoff and improve water quality while providing irrigation to the landscape by retaining water that would otherwise be piped untreated directly into rivers and other water bodies. <i>See Chapter 7: Green Infrastructure and Stormwater Management for more information.</i>
Plan for Safety	Develop a security diagram that includes sight lines, potential hazards (slopes), and lighting that shows plantings at maturity. This will aid in the design of plantings that will not grow to cover lights or create hazardous conditions that limit sight lines. <i>See Chapter 2: Human Health and Well-being for more information.</i>
Plan for Heat	Mitigate heat island effects through the reduction of dark colored surfaces in the landscape. Preserve trees wherever possible and plant more trees. Aim to shade both buildings and impervious surfaces as much as possible. <i>See Chapter 4: Trees for more information.</i>
Plan for Carbon Storage	Consider how to increase the carbon storage capacity of the site from the beginning. Protect prime soils and trees wherever possible. <i>See Chapter 8: Carbon Sequestration for more information.</i>
Plan for Maintenance and Rehabilitation	Landscapes should only be designed to an extent that maintenance resources are available to support that landscape. Appropriate long-term maintenance budgets must be assured prior to landscape construction so that areas do not become neglected and unsightly, or for when they no longer function as designed. Create a maintenance plan for each project early in the planning process. Update throughout the process and share with facilities staff for feedback and to ensure the budget is in place. <i>See Chapter 11: Maintenance for more information.</i>

CHAPTER 1: SITE SELECTION AND PLANNING

SITE PLANNING BEST PRACTICES



Identify any distinctive site features. Natural formations or rare and unique plants can make the site design special. Populations of unique native species should be protected.

CONSTRAINTS	OPPORTUNITIES
Soils - HSG C or D	Soils - HSG A or B
Invasive Species	Specimen Species
Negative Human Interactions Damage / Vandalism	Natural Features Water features, rock formations, etc.
Protected Species or Habitats	Unique plant communities

TASK	RECOMMENDATION
Site Survey	<p>Assess site conditions and natural resources prior to design. Protect and conserve undisturbed soils and native plant communities wherever possible. A site survey should include the following:</p> <ul style="list-style-type: none"> Existing Vegetation and Tree Maps - refer to HC tree survey Soils Assessment / Maps identifying hydrologic soil groups (HSGs) Identification of protected natural features - refer to HC natural resources web map Topography Underground Utilities Building Boundaries, easements, and ROWs
Site Selection	Create a list of Site Constraints and Opportunities similar to the table at the left.
Identify Removals	Identify existing invasive or noxious plant species and plan for their removal pursuant to the County's Integrated Pest Management Plan and Minnesota's Noxious and Invasive Weed program .
Protect Assets	Protect existing trees and soils by indicating construction limits on all plan sets and enforce throughout construction. Protecting existing trees and soil results in long-lived plantings and reduces maintenance and replacement budgets.
Use Better Site Design	Utilize BETTER SITE DESIGN strategies during the planning and design stage for any new or redevelopment project. Better Site Design strategies help to protect sensitive ecosystems and treat stormwater naturally. See the BETTER SITE DESIGN recommendations on page 10.
Plan for Maintenance	Develop a maintenance plan for each project site during the planning phase. This focuses the design on the site's long-term success and allows for an understanding of the necessary maintenance budget.

CHAPTER 1: SITE SELECTION AND PLANNING

SITE PLANNING BEST PRACTICES

Apply Better Site Design techniques during the planning and design process. These methods can reduce stormwater runoff and pollutants, and reduce the size/cost of required stormwater management systems and BMPs. It is recommended that every site planning process start with Better Site Design.



ABOVE
Using natural drainage systems like this bioretention basin helps remove pollutants and reduce stress on county and municipal storm sewer systems.

RIGHT
Increasing the number of trees on a site is a great way to increase site sustainability. Trees provide shade, create habitat value, and store carbon.

Replacing impervious cover with vegetated stormwater management systems like rain gardens and tree trenches improves air and water quality, reduces the urban heat island effect, and creates habitat for pollinators.

BETTER SITE DESIGN FOR STORMWATER MANAGEMENT	
Preserve Natural Areas	Natural Area Conservation
	Site reforestation
	Stream and shoreline buffers
	Open space design
Use Natural Drainage Systems	Soil Amendments (Compost and/or Tilling)
	Disconnection of Impervious Surfaces (Downspouts)
	Grass Channels
	Stormwater Landscaping
Reduce Impervious Cover	Narrower Streets
	Slimmer Sidewalks
	Smaller Cul-de-sacs
	Shorter Driveways
	Smaller Parking Lots



HOW TO MEASURE SUCCESS

- Area of green space preserved**
(Square feet or acres)
- Impervious surface reduction**
(Square feet or acres)

CHAPTER 2: HUMAN HEALTH AND WELL-BEING

DESIGN FOR SAFETY

Landscaping should enhance enjoyment of the site through aesthetics and place-making while minimizing risk to personal health and safety.

REDUCING WINTER SALT USE

Appropriate salt application is sometimes necessary to ensure safety on driving and walking surfaces in the winter. However, too much salt shortens the life of pavement and building materials. Salt also runs off paved surfaces into streams and rivers where it harms aquatic life. Efficient use of de-icing salts can reduce damage to property and protect the environment.

Reduce the use of salt through training with the Minnesota Pollution Control Agency. Make sure all staff and contractors who apply salt for winter ice management understand the best practices for procurement and application.

Visit <https://www.pca.state.mn.us/business-with-us/smart-salting-training> for more information.



Keep wildlife and visitors safe from exposure to chemicals.

GOAL	RECOMMENDATION
Keep sight lines clear	Consider sight distances along roadways. Specify low growing plants along building entrances and walkways to eliminate potential hiding places. Keep vegetation low at pedestrian crossings to ensure drivers and pedestrians can clearly see each other.
Consider future growth	Ensure tree growth will not disrupt original lighting schemes. Plant trees and shrubs away from lamp posts and ground lighting so they do not grow to block them.
Prevent slips and falls	Consider materials that don't accumulate ice. <u>Permeable pavers decrease winter ice accumulation</u> , reducing risk of pedestrian slips and the need for salt application.
Plan for snow storage	Plan for snow storage adjacent to walks and drives. Snow melt should drain away from walkways, preferably into a green infrastructure facility (rain garden or other).
	Avoid storing snow at high points of parking lots or walkways to minimize drainage and ice formation across pedestrian surfaces that require salt. Prevent the need to haul snow off site to reduce fuel consumption.
Limit pesticide use	Reduce harmful chemicals that staff, site users and animals could be exposed to. Follow the <u>Hennepin County Integrated Pest Management (IPM) Policy</u> .

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.1 SITE AND WATER CONNECTIONS

- C. "Human system connections: The project design should include appropriate connections to any of the relevant systems in response to the following criteria:
 - 5. If the project is within 0.25 miles of an existing or planned transit stop, local transit officials should be consulted to assist in the creation of a pedestrian path and waiting shelter at the stop (if none exist)."

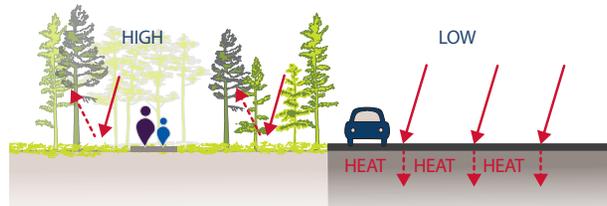
CHAPTER 2: HUMAN HEALTH AND WELL-BEING

DESIGN FOR WELL-BEING

Landscaping should enhance enjoyment of the site for all users by ensuring spaces have accessible and comfortable natural areas for outdoor recreation.

WHAT IS ALBEDO?

Albedo is the amount of light that a surface reflects compared to the total sunlight that falls on it. Surfaces that reflect a lot of light are bright and have a high albedo. Dark surfaces don't reflect as much and have a low albedo.
From [NASA Earth Observations](#)



Higher albedo means more light is reflected. Reflective surfaces, like light pavers or vegetation do not get as hot, helping moderate the urban heat island effect.

HOW TO MEASURE SUCCESS

- Length of trail added** (linear feet)
- Site albedo score**
- Area of green space added** (square feet or acres)

GOAL	RECOMMENDATION
Ensure accessibility	Maintain accessibility through proper grading to reduce dips and hills on walking surfaces, ensure surfaces are smooth and bumps reduced, and provide seating and railings for those with limited mobility. Follow current ADA standards when designing all outdoor spaces.
Support social interaction	Create spaces for gathering and social interaction in the shade, away from car fumes and loud noises. Outdoor spaces are proven to be regenerative for people, helping to increase work productivity and improve mental health.
Provide green spaces	Provide adequate green spaces for people to gather, walk, and rest. Access to the natural world has a positive impact on physical and mental health.
Provide shade	Plant trees to shade buildings and parking lots in order to minimize the need for air conditioning and to reduce the urban heat island effect.

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.4 VEGETATION

- F. "The following provisions for animal habitat should be included in the design:
 - "Site should be designed so that the entire site albedo is at least 0.25 (25%) as evaluated using the B3 Albedo Calculator."

CHAPTER 3: VEGETATION

SELECTING VEGETATION: NATIVE SPECIES

Choose the right plants for the project and soil conditions. Choose the planting method that fits project budget and timeline and create a plan for site maintenance and rehabilitation.

NATIVE PLANTS

“Native is defined as a plant originating from within a 200-mile radius of the site prior to human intervention, considered to be 1840 in Minnesota.”

-B3 Guidelines



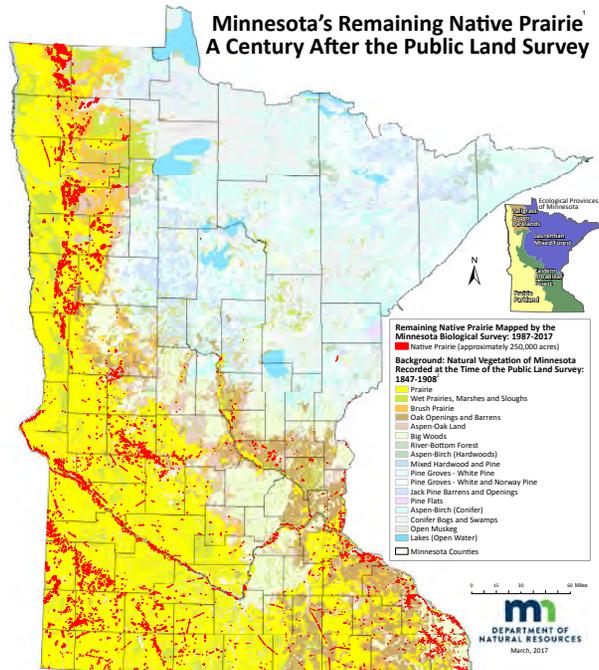
Native plants are excellent for creating healthy and attractive shoreline buffers.

GOAL	RECOMMENDATION
Select native species	Select native, locally sourced plants when possible. Choose species that are adaptable to changing climates. Native grasses and wildflowers are low maintenance and drought tolerant but require time and attention during the establishment period, which can last between 3-5 years. It is important to have ecologically educated maintenance professionals available during the establishment period for native vegetation. This can be incorporated into the construction contract through an extended 3-year establishment and warranty period with the contractor.
Choose hardy and adaptable plants	Keep in mind that with changing climates, some native plants that have thrived before may not thrive in the future. Choose plants based on their ability to adapt to changing conditions as well as their established presence and suitability in Minnesota.
Restore native plant communities	Restore native plant communities on large sites where space is available to have a positive ecological impact. Prairie or woodland plantings are environmentally sound alternatives to large lawns. Native plantings provide habitat for pollinators, birds, and other fauna, improve soil porosity, contribute to stormwater management, and act as a regional carbon sink.

Refer to [“Living Landscapes in Minnesota: A guide to Native Plantscaping”](#) 2007, NRCS for more information.

CHAPTER 3: VEGETATION

SELECTING VEGETATION: NATIVE SPECIES



The prairies that covered Hennepin County prior to the 1880's are largely gone. Restoring these biologically diverse ecosystems will help retain biodiversity, store carbon, and reduce the impacts of climate change.

Select species native to the site to maximize ecological benefits and create habitat value.

Native plants will also be more sustainable and resilient to changing climates.

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.1 SITE AND WATER CONNECTIONS

- A. "Plant network connections: Establish plant selection to reinforce existing plant networks and to support and expand existing conservation, and natural and native species networks.
 - 1. The greater of either 25% of the project site area (excluding the building footprint), or 70% of the project site area (excluding the building footprint and code-minimum parking) should be planted using native species listed in the class factsheet for applicable class.
 - i. Native is defined as a plant originating from within a 200-mile radius of the site prior to human intervention, considered to be 1840 in Minnesota. Cultivars (CVs) of native species may be used if they do not appear on the Minnesota Native Plant Society or Minnesota Invasive Terrestrial Plants and Pests Center Prioritized list of terrestrial invasive plants, or on the Minnesota Department of Agriculture Noxious Weeds list.
 - ii. Ecological class shall be determined from the province, section, and subsection of the site listed under the Minnesota Department of Natural Resources (DNR) Ecological Classification System (ECS).
 - iii. The most advantageous plant species prevalent in the listed ecological class of the site shall be determined for use in re-vegetation."

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.4 VEGETATION

- C. "The vegetation selected shall be subject to the following and selected in coordination with the animal and vegetation requirements listed under S.1 and animal habitat requirements listed under S.5:
 - 2. The selection of herbaceous plantings for prairies, wetlands, savannas, parklands and forests shall use the methodology (steps 1-5) found in MnDOT's [Native Seed Mix Design for Roadways](#) (2014)."

CHAPTER 3: VEGETATION

SELECTING VEGETATION: LOW MAINTENANCE



Gro-Low Sumac (*Rhus aromatica* 'Gro-Low') is a cultivar of a native shrub species. It is low growing, hardy, and features bright fall color and attractive berries. It is suitable for planting in harsh parking lot conditions.



Planting similar species in groups (massing) creates a tidy, low-maintenance wildlife-friendly garden area.

GOAL	RECOMMENDATION
Select for low maintenance	Select species that are low maintenance including drought tolerant plants and plants that form dense masses to prevent weed growth. Many native prairie species and turf alternatives such as fescue are naturally drought tolerant and do not require supplemental irrigation after the initial establishment period.
Minimize mess	Choose seedless varieties of trees and shrubs when planting near walkways to prevent mess and hazards from falling fruit.
Simplify planting plans	Keep planting plans simple (use large masses of a few species) except in pre-designated highly visible areas to minimize maintenance.
Avoid complexity	Intricate planting designs can be maintenance intensive. Simple arrangements of drought tolerant shrubs, grasses and forbs are more appropriate.
Minimize irrigation	Design planting areas to eliminate the need for permanent irrigation. Temporary irrigation may be used in the establishment period. This can be achieved by installing a drip irrigation line on the surface of a planting area and removing it after the plants become fully established.

**B3 REQUIRED PERFORMANCE CRITERIA
GUIDELINE S.2 SITE WATER QUALITY AND EFFICIENCY**

C. "No potable water shall be used for irrigation after a 5-year plant establishment period except for periods when actual rainfall for the month is less than 30% of the average rainfall for that month. Collected roof rainwater and gray water may be used for plant irrigation at any time. Turf grass integral to the program of the site, such as athletic fields or school recreational fields are excluded from the calculation for this requirement."

CHAPTER 3: VEGETATION

SELECTING VEGETATION: SALT TOLERANCE / DISEASE RESISTANCE



Prairie Dropseed is a hardy and salt-tolerant grass well-suited for boulevards and medians.

GOAL	RECOMMENDATION
Select for salt tolerance	Plant salt-tolerant species near walkways and paved areas that will require snow removal. Many native grass species are attractive, hardy, and salt tolerant, including little bluestem (<i>Schizachyrium scoparium</i>) and prairie dropseed (<i>Sporobolus heterolepis</i>). There are also salt-tolerant turf grass mixes available.
Select for disease resistance	Select plant species for disease and insect resistance. Do not plant ash trees (<i>Fraxinus</i>) which are now susceptible to emerald ash borer, or non-resistant elm trees which are mortally impacted by Dutch elm disease.
Choose diversity	Plant a diversity of tree species on each project, rather than a monoculture. Species diversity improves habitat and makes the trees less susceptible to future diseases and pests.
Alternate species	Use at least three different species per block when planting along roadways. Alternating species will prevent the total loss of trees if a future disease or pest becomes an issue for one of the species.

SELECTING VEGETATION: SEASONAL INTEREST



Winterberry fruits provide a striking contrast to the freshly fallen snow. Photo credit: University of Minnesota Extension

GOAL	RECOMMENDATION
Select for color/texture	Utilize plants that provide interesting colors and textures throughout the year.
Maintain winter interest	Maintain decorative seed heads throughout the winter to provide contrast to the snow. Prune perennial forbs and grasses in early spring rather than late fall.
Select for full seasonality	Plant a variety of flowering species to provide blooms throughout spring, summer, and fall. This will improve the landscape aesthetic across all seasons while also providing forage for wildlife and pollinators.

CHAPTER 3: VEGETATION

SELECTING VEGETATION: WILDLIFE AND POLLINATION



Photo: Brett Stolpestad

Endangered species, such as this Monarch caterpillar feeding on Whorled Milkweed, rely on native plants for multiple stages of life.

**HENNEPIN COUNTY
POLLINATOR RESOLUTION**

Resolution #16-0105

A resolution approved in 2016 which declared Hennepin County a Pollinator-friendly community and directed staff to limit use of systemic insecticides, such as neonicotinoids, on county-owned property and to require that new plants and trees installed on county-owned property are neonicotinoid free.

GOAL	RECOMMENDATION
Attract wildlife	Specify plants that attract wildlife (especially birds, bees, butterflies and other beneficial pollinators) where appropriate.
Provide forage	Incorporate forbs into native seeding mixes to provide adequate forage for pollinator insects. As a rule of thumb, at least 40% of species within a native seed mix should be flowering forbs.
Plant in groupings	Plant masses of native forbs together to make them easier to find for pollinators and assist with foraging efficiency.
Select for full seasonality	Plant forbs that flower in spring, summer, and fall to provide forage for pollinators throughout the year.
Maintain for winter	Do not cut down the stalks of native plants in the fall. Leave stalks, stems, and leaf litter in place until late spring to provide a safe nesting place for pollinators and insects. If needed, cut stalks to no less than 12" in late spring.
Add trees and shrubs	Plant flowering trees and shrubs to provide additional nectar sources for pollinators.
Maintain pollinator health	Minnesota Executive Order 16-07 'Directing Steps to Reverse Pollinator Decline and Restore Pollinator Health in Minnesota' provides direction to ensure sites maintain pollinator health. B3 Guideline around providing pollinator friendly vegetation has been developed in response to this.

CHAPTER 3: VEGETATION

SELECTING VEGETATION: WILDLIFE AND POLLINATION



Photo: Brett Stolpestad

Blooming pollinator plants and habitat structures can be incorporated into garden designs. Bird, bee, and insect nesting features should be provided to maximize wildlife health and viability.

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.4 VEGETATION

D. "Pollinator friendly vegetation:

1. Neonicotinoid-free sites: All project plantings must use a written chain of custody method to verify neonicotinoid-free claims. Reject plants that have been neonicotinoid treated, or that do not have a clear, verifiable chain of custody of being neonicotinoid-free. This requirement also applies to trees, shrubs, and vines.
2. Site plantings should be selected so that at least 50% by quantity of all trees, shrubs, groundcovers, vines, and herbaceous perennials are insect pollinated, and rich in pollen and/or nectar.
3. Blooming pollinator plants should be provided for all three seasons of blooms (spring, summer, fall), with at least two different species blooming during each season. Coincidentally blooming pollinator plants should be clustered in large groupings to reduce expended energy of insect pollinators.
5. Abundant human and natural structural enhancements should be provided for insect pollinators (e.g., dead tree snags, downed tree logs, sand baths, bee skeps, solitary beehives, mason bee houses, green roofs, and green walls).
6. Cultivars with double and triple petal flowers that do not produce pollen or nectar should be minimized.

Note: This guideline has been developed in response to Minnesota Executive Order 16-07, which also outlines requirements of specific state agencies, departments, boards, and committees not listed here."

CHAPTER 3: VEGETATION

SELECTING VEGETATION: WILDLIFE AND POLLINATION



Open water features incorporated into the design should also provide ample reptile and amphibian habitat, including breeding sites.

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.5 ANIMAL HABITAT SUPPORT

- H. The following provisions for animal habitat should be included in the design:
1. Integration of an open year-round water feature with the area determined by the size of the site.
 2. For larger projects (min. 3 acres) that adjoin a surface water body, natural bat habitat enhancement should be installed.
 3. Creation of reptile and amphibian habitat and breeding sites created with natural and man-made structures to achieve at least one amphibian and one reptile by the fifth growing season.
 4. Creation of insect pollinator habitat so that during the fifth growing season at least one butterfly, one bee and one other insect pollinator shall be found on site.

Note: The above is a concise summary of B3 Guideline S.5 Animal Habitat: H. 1-4, [see guideline for full details](#).

CHAPTER 3: VEGETATION

SELECTING VEGETATION: ALTERNATIVES TO TURFGRASS



Pollinator friendly “bee lawns” feature elements like white clover and fescue.

GOAL	RECOMMENDATION
Use alternative groundcovers	Consider alternative ground covers for lawns and passive recreation spaces. Traditional turf lawns require high resource inputs in the form of mowing and irrigation. Alternative plantings mimic the look and functionality of turf while adding habitat value and reducing inputs. Some spreading groundcovers can also serve as an alternative to mulched landscape beds.
Consider bee lawns	“Bee lawns” are comprised of a variety of fescues, clover, and other creeping forbs that are mow-able and provide valuable forage and habitat for pollinators.
Use native fescue blends	Many fescue mixes are available that mimic the look and feel of traditional turf lawns but are significantly more drought tolerant.

HOW TO MEASURE SUCCESS

- Area of restored native vegetation**
(Square feet or acres)
- Area of conventional turfgrass converted to native vegetation or no-mow turf**
(Square feet or acres)

**HENNEPIN COUNTY CLIMATE ACTION GOAL
INCREASE CARBON SEQUESTRATION**

Hennepin County set the goal to increase carbon sequestration on county-owned properties. One strategy to increase carbon sequestration prioritizes native plants over turfgrass in landscape designs.

Low-mow or no-mow fescue mixes are a sustainable alternative to traditional turf lawns since they require less mowing and irrigation than typical turf mixes. Additionally, converting from turfgrass to native landscape types improves carbon sequestration.

CHAPTER 3: VEGETATION

TYPES OF VEGETATION ESTABLISHMENT

Permanent perennial vegetation can be established through four main methods. Each method has benefits and challenges to consider prior to preparing a planting plan. Budget for installation and long-term maintenance resources are important to consider when choosing a method to establish vegetation.



Native seeding accompanied by an erosion control blanket and growing cover crop.

METHOD	RECOMMENDATION
Native Seeding	Native seeding involves spreading the native seed mix on site and covering the area with erosion control to prevent seed and soil loss during the establishment period. Native plants from seed develop their root systems over 2-3 years.
Native Seeding with Plugs	Native seeding plans can be enhanced by adding native perennial plugs within the seeding area. The native plugs are planted directly into the seeded area through the erosion control mat.
Native Vegetated Mat	Pre-Vegetated Blankets or Native Vegetated Mats (NVM) are proprietary products grown to order. Once installed, the pre-vegetated native plant blankets provide almost instant vegetated cover.
Planting Container Material	Detailed planting plans specify plant species, location, and spacing. Native container-grown perennials, trees, and shrubs are available in multiple sizes and B&B nursery stock.



Plugs are planted through the blanket to supplement the seeding.



Blankets of pre-grown vegetation are rolled onto the site for instant native plant cover.



Container-grown plants create an immediate garden effect for aesthetic value.

CHAPTER 3: VEGETATION

NATIVE SEEDING

1. Prepare soil bed
2. Broadcast or drill native seed
3. Cover with erosion control
4. Perform maintenance during 1-3 year establishment period

Establishing native seed into a healthy stand of permanent vegetation takes 3-5 years.



Drill seeding

Native seeding involves preparing the soil bed in the project area, spreading (by broadcast or drill method) a diverse native seed mix evenly across the soil surface, and covering the area with an erosion control blanket or bonded fiber matrix to prevent washouts and seed/soil loss during the establishment period. Native seed mixes typically contain a cover crop which germinates much more quickly than the native seeds and will hold soil in place while the native plants develop their root systems over the next 2-3 years.

Establishing the native seed into a healthy stand of low-maintenance, native vegetation takes 3-5 years. During the first 1-3 years the seeded area can look deceptively weedy and unkempt. Maintenance activities need to be completed during the first three years to prevent the establishment of unwanted invasive species. Maintenance during the establishment period should be completed by trained professionals with plant identification knowledge and weed management skills.

Costs associated with this approach include the seed mix, soil preparation, seeding operations, erosion control blanket, and 3 years of extended maintenance.

SEED MIXES FOR PRAIRIE RESTORATION

General rules for prairie restoration seed mixes to increase established diversity:

- Minimum total seeding rate of 40 seeds per sq ft.
- At least 40% of the total seeding rate should be composed of perennial forbs
- 7 or more native grass or sedge species with at least 2 species of bunchgrass.
- Limit dominant species
- Fulfill the guilds: cool-season and warm-season grasses; sedges/rushes; legume and non-legume forbs.
- Include species from different families
- 20 or more native forbs with at least 5 species in each bloom period: early, middle, and late.

Source: Prairie Restoration Diversity, Minnesota Department of Natural Resources

CHAPTER 3: VEGETATION

NATIVE SEEDING WITH PLUGS

1. Prepare soil bed
2. Broadcast or drill native seed
3. Cover with erosion control
4. Install plugs through erosion control mat according to plans
5. Cluster species together to create beneficial massings
6. Perform maintenance during 1-3 year establishment period

Native seed restoration plans can be enhanced by adding native perennial plugs within the seeding area. This method is identical to the seeding approach outlined in the previous section, except that native plugs (typically 2" – 4" in size) are planted in addition to the seed. The erosion control blanket is cut at intervals and the plugs are planted directly into the seeded area. Plugs are often placed at 12" or 24" on center. Each species of plug should be clustered together to create more discernible patches of desired plant material, which is aesthetically pleasing and also beneficial for attracting pollinators.

This approach retains the cost effectiveness of the seed-only approach while enhancing the establishment of native species through the addition of plugs. The multi-year maintenance approach described above is also required when plugs are added to the seeding area.

Costs associated with this approach include the seed mix, soil preparation, seeding operations, perennial plugs, planting operations, erosion control blanket, and three years of extended maintenance.

Native seeding planting area enhanced with native plugs.



CHAPTER 3: VEGETATION

NATIVE VEGETATED MAT

1. Prepare soil bed
2. Install NVM according to manufacturer specifications
3. Water thoroughly
4. Perform maintenance for a 1-year establishment period

Pre-vegetated native plant blankets provide almost instant vegetated cover once installed. Pre-Vegetated Blankets or Native Vegetated Mats (NVM) are proprietary products that are grown to order for specific projects. The supplier grows native seeds in a soil matrix within an erosion control blanket in a greenhouse or outdoor setting. The blankets are available during a relatively short window each year, from July through September. When the blankets are installed, the native seed mix has already germinated and the result is an instant cover of green, native plants.

Watering is required to aid in root establishment for the first few weeks after planting. After rooting, the maintenance required is the same as a mature stand of native vegetation. The intensive 3-year vegetation establishment period is not required with this approach.



Pre-vegetated mats are easy to install for quick native plant cover.

CHAPTER 3: VEGETATION

PLANTING CONTAINER MATERIAL

1. Prepare planting bed
2. Install plants according to landscape plans
3. Apply 2"-3" hardwood mulch
4. Water thoroughly
5. Perform maintenance for a 1-year establishment period

With this approach a detailed planting plan is prepared using a variety of container stock sizes and B&B nursery stock trees or shrubs. The planting bed is prepared, the plants are installed, and a 2-3" layer of hardwood mulch is applied to all exposed soil around the plantings. Plants need to be watered during the first growing season after planting to ensure robust root establishment. This approach typically involves a 1-year plant warranty with no extended maintenance contract.

This approach to native plantings is generally considered the most expensive, but also the most impressive. The public tends to react positively to facilities planted in this way because of the almost instant aesthetic appeal. Many plants flower within the first year and the overall look is well-kept and intentional.

Containerized plants bloom within one year after installation.



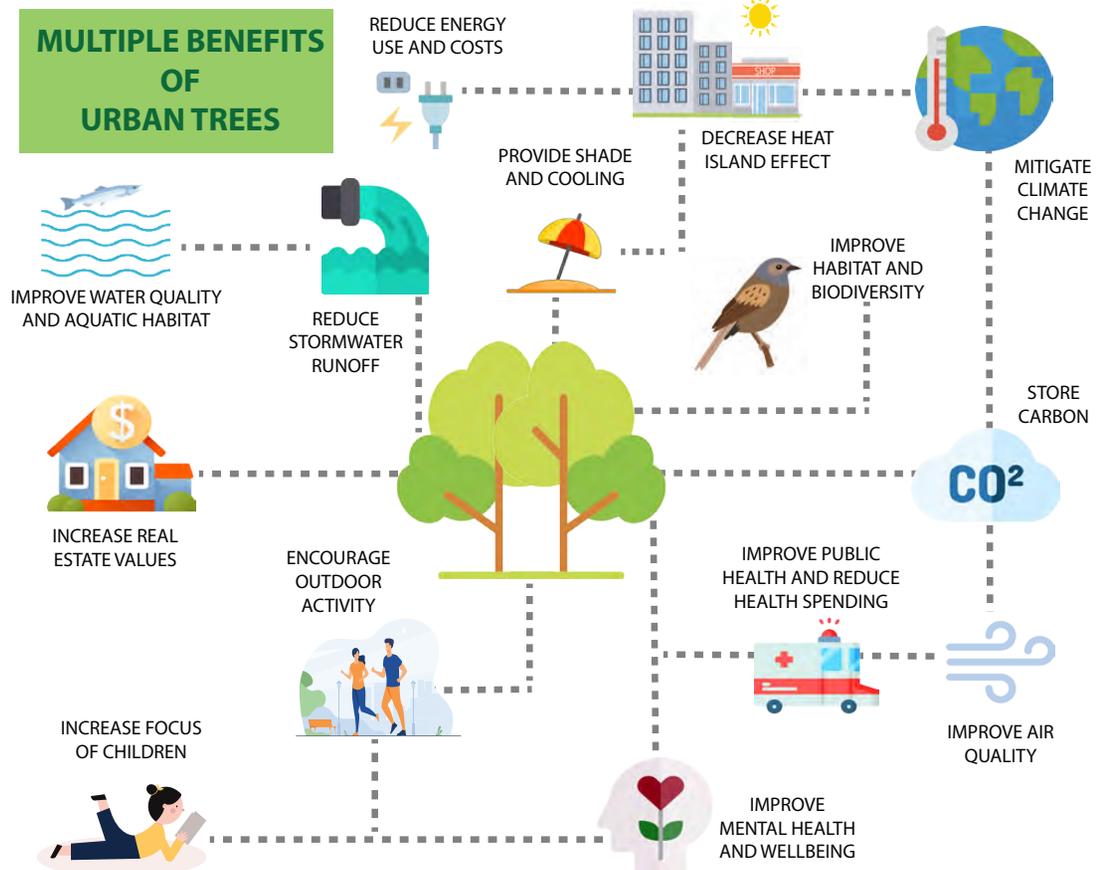
CHAPTER 4: TREES

BENEFITS OF URBAN TREES

Trees can take decades to mature, but they provide immense benefit. These benefits include carbon sequestration, shade, heat moderation, stormwater runoff reduction, pollutant filtering, wildlife habitat, and others shown in the figure below.

To realize these benefits, Hennepin County set the goal to achieve no net loss of trees on county property. This means that every tree removed must be replaced, and remaining trees must be maintained and protected ([Climate Action Plan](#)).

GOAL	RECOMMENDATION
Protect Existing Trees	Survey existing trees prior to development and preserve mature signature species.
Add More Trees	Replace lost trees and aim to exceed B3 tree condition requirements.
Choose the Right Trees	Use a variety of native trees sourced from local stock.
Provide Adequate Soil Volume	Provide ample soil volume and consider additional tree-trench technologies.
Follow Proper Planting Techniques	Do not plant trees too deeply or pile mulch against the trunk. Water trees regularly for a few years after planting.



CHAPTER 4: TREES

GUIDELINES FOR URBAN TREES

PROTECT EXISTING TREES

Perform a tree survey of every site prior to development. Plan improvements around existing trees where possible.

Refer to the Hennepin County Tree Survey via the iTree tool to check on the existence and condition of site trees before proceeding with design work.

Preserve and protect mature signature species. Identify and design sites around special trees such as 100+ year old oaks.

Do not disturb soil within the driplines of trees during construction. Install protective fencing around trees within the project area during construction.

ADD MORE TREES

Replace those trees that must be removed and meet, or exceed, the tree condition requirements within B3 guidelines or local municipal requirements.

Hennepin County has the goal of planting 1,000,000 more trees by 2030.

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.3 SOIL

- C. "The following provisions for animal habitat should be included in the design:
 - 2. Soil in the following areas should not be disturbed:
 - iv. Any area under or closer than 1 ft of tree driplines per 1 in. diameter of breast height (DBH) trunk diameter. (E.g., 12-in. DBH will require tree protection fences at least 12 ft from trunk)."

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.4 VEGETATION

- B. "The following tree conditions shall be established:
 - 1. Minimum combined trunk areas of all trees (including deciduous and coniferous) as evaluated at 10-year estimated maturity post construction and measured by calculating the trunk area at 4.5 ft. above the ground (i.e., DBH) for the site's tree plant community. Tree trunk area must be at least:
 - i. Tall grass aspen parkland and savanna: 2 sq. ft. of trunk area per acre.
 - ii. Southern and southeastern hardwood deciduous: 4 sq. ft. of trunk area per acre.
 - iii. Northern deciduous: 3 sq. ft. of trunk area per acre.
 - iv. Boreal conifers: 4 sq. ft. of trunk area per acre."

Note: See B3 guideline [S.4 Vegetation](#) B. 2-5 for further tree conditions to meet.

CHAPTER 4: TREES

GUIDELINES FOR URBAN TREES

CHOOSE THE RIGHT TREE

Plant native trees sourced from local stock. These trees are hardy to the local climate and more likely to survive long term. See [Hennepin County Forester](#) for information on sourcing trees from the Hennepin County Tree Nursery.

With expected changes in climate, trees native to USDA Zone 5 may be considered for appropriate sites.

Plant healthy trees. Inspect all trees before planting to make sure they are free from disease, pests, and deformities. Ensure trees conform to the [American Standard for Nursery Stock](#) requirements.

Plant a variety of tree species to ensure biodiversity across Hennepin County.



B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.4 VEGETATION

- B. "The following tree conditions shall be established:
4. Adequate tree diversity should be achieved to limit susceptibility of the site to disease and increase ecological resilience: Tree genera of like form should be planted in large single species tree plantings, such as allees or formal groupings. For example, Kentucky Coffeetree (*Gymnocladus*), honey locust (*Gleditsia*), and black locust (*Robinia*) are similar in form, structure, and leaf texture but are three different genera not susceptible to the same pests and diseases. The following numbers of tree genera should be achieved:
 - i. Three genera on sites of fewer than 2 acres.
 - ii. Five genera or more on sites of 2 to 5 acres.
 - iii. Seven genera or more on sites of 5 to 10 acres.
 - iv. Nine genera or more on sites of 10 to 15 acres.
 - v. Twelve genera or more on sites of 15 to 20 acres.
 - vi. Fifteen genera or more on sites of 20 to 40 acres.
 - vii. Eighteen genera or more on sites of 40 to 100 acres.
 - viii. Twenty genera or more for sites of greater than 100 acres."

HENNEPIN COUNTY CLIMATE ACTION GOAL REDUCE URBAN HEAT ISLAND EFFECT

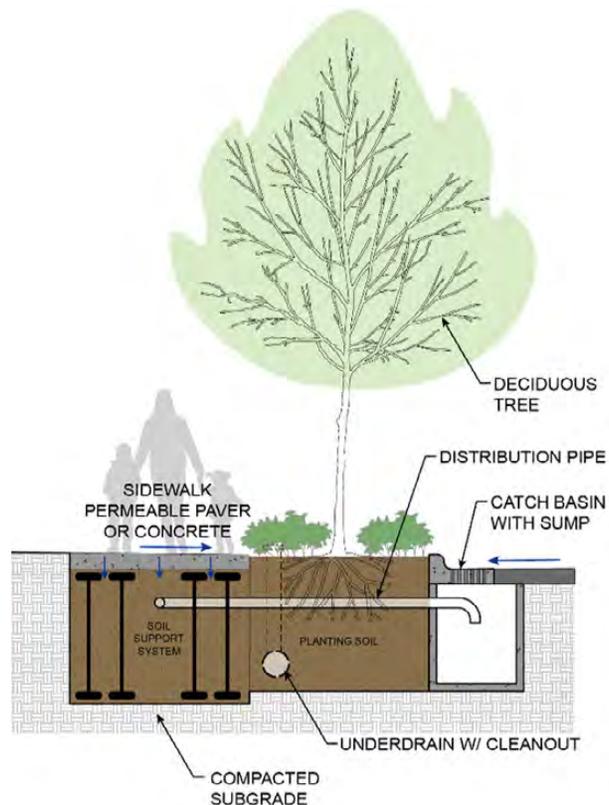
Hennepin County set the goal to add 1 million trees to the community forest by 2030. Protecting existing trees, replacing trees that have been removed, and adding more trees to a site are all effective ways to increase comfort for site users.

In addition to reducing heat island effect, adding trees and converting hardscape to green infrastructure, trees and landscaped areas improve local habitat, store carbon, and reduce stormwater runoff.

Trees native to the region will thrive and benefit the local ecosystem for years to come.

CHAPTER 4: TREES

GUIDELINES FOR URBAN TREES



Soil cells under the sidewalk adjacent to tree planting pit allow tree roots to spread out beyond the confines of the planting pit.

PROVIDE ADEQUATE SOIL VOLUME

Trees need adequate soil volume to thrive. Tree root systems grow to roughly the same size as the tree canopy. A mature deciduous tree typically needs at least 1000-2000 cubic feet of soil volume to mature.

When space is limited, such as in urban plazas or road rights-of-way, consider under-pavement tree trench technologies such as Deep Root soil cells (or similar). These allow tree roots to grow freely under sidewalks and other paved areas.

Structural soils are engineered media that contain a large percentage of void space for tree roots to grow through. These soils also provide space for stormwater management. See the GI and Stormwater Section for more information about incorporating trees into stormwater management features.

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.4 VEGETATION

- B. "The following tree conditions shall be established:
 - 3. Adequate tree soil volumes should be achieved. Where trees are surrounded by hard surfaces (e.g., sidewalks, patios, driveways, car parks, plazas, parking islands), suspended pavement techniques, structural soils, or other comparable methods such as larger tree openings to provide adequate root-able soil volumes should be used. Minimum volume of root-able soil volume per tree is:
 - i. Small trees (e.g., Serviceberry - Amelanchier): 400 cu. ft.
 - ii. Medium trees (e.g., Ironwood - Ostrya): 800 cu. ft.
 - iii. Large trees (e.g., Hackberry - Celtis): 1,200 cu. ft."

If using structural soils, multiply the total soil volumes above by five to obtain equivalent volume of soil usable by the tree. If above soil volumes cannot be met, tree species requiring smaller soil volumes should be selected. Where applicable, suspended pavement or comparable methods should be utilized to allow tree roots under hard surfaces to access adjacent open space.

CHAPTER 4: TREES

GUIDELINES FOR URBAN TREES

FOLLOW PROPER PLANTING TECHNIQUES

Plant trees so that the first lateral root is flush with surrounding grade. Planting trees too deeply can lead to stem girdling roots which can slow tree growth and eventually kill the tree.

Place a 4-6" deep layer of mulch around each tree at planting. Mulch should be placed in a donut shape, leaving 2" of bare ground around the trunk. Do not pile mulch against the tree trunk. This can lead to stem girdling roots and tree death.

Water new trees deeply immediately after planting. Keep trees watered regularly for the first few years after planting to ensure root growth and establishment. Trees should be watered twice weekly at a rate of 15-20 gallons per watering. Consider using Gator bags to maintain a steady source of water for new trees.

Do not prune trees at the time of planting, except to remove dead or overlapping branches.

Site trees strategically to reduce the site's albedo score.



Stem girdling roots around the base of a tree threaten its health and longevity.

Photo: J. Hannibal Hayes



Tree gator bags help to ensure new trees receive adequate water during the establishment period after planting.

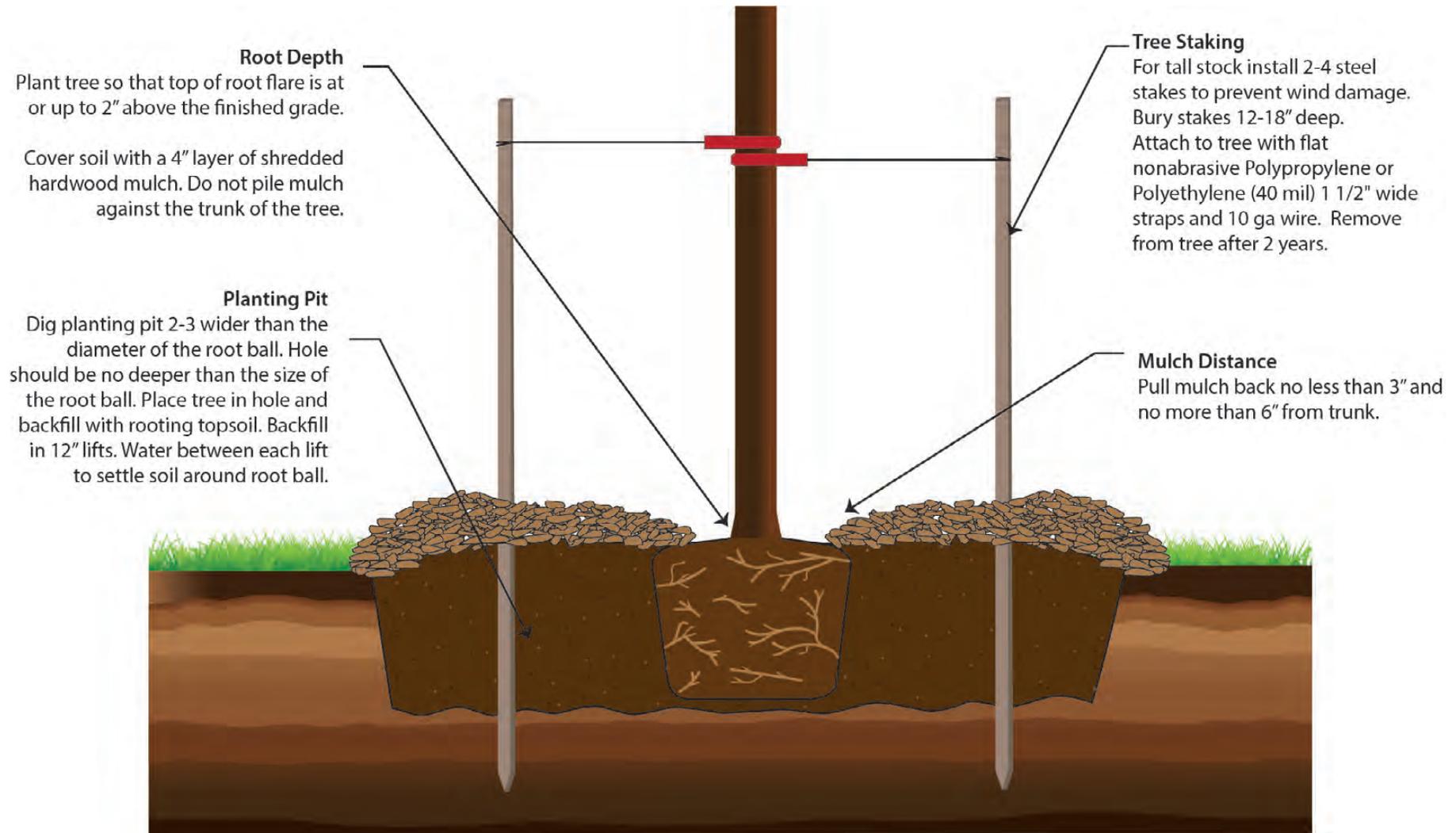
HOW TO MEASURE SUCCESS

Number of trees planted

% Canopy increase

CHAPTER 4: TREES

TREE PLANTING DIAGRAM



CHAPTER 5: SOILS

GUIDELINES FOR HEALTHY SOILS

Soil supports plants by providing structure, nutrients, and water storage. Healthy soils also assist stormwater management by holding and infiltrating runoff.

It is important to understand which soils exist on site before development.

Review soil maps and perform soil testing during the planning phase of each project.

PROTECT EXISTING SOIL
Protect existing, undisturbed soils wherever possible. Uncompacted soil supports plant growth better than disturbed and compacted soils.
Develop on brownfield sites instead of greenfield sites where possible.
Salvaging and reusing existing soil is more cost effective than importing new soil. Provide soil amendments to salvaged topsoil based on soil test results to support healthy plant growth.
Restrict soil disturbance to the construction areas to protect site soils.

B3 REQUIRED PERFORMANCE CRITERIA
GUIDELINE S.3 SOILS

B. "For projects developing on a greenfield site, the following should be submitted:

1. A written rationale of the need to develop a greenfield site rather than a previously developed site
2. A plan for minimizing the disruption of existing, native, noninvasive vegetation."

B3 REQUIRED PERFORMANCE CRITERIA
GUIDELINE S.3 SOILS

C. "Soil disturbance defined as grading, compacting, piling, tilling, scraping, storing, should be limited and the removal of soil within natural and agricultural human soil development spectrum areas should be ensured by the following and included in the Stormwater Pollution Protection Plan (SWPPP) for the project:

1. Protecting intact soil with intact soil horizons using Site Soil Protection Zones (SSPZ); delineating exclusion barriers for these areas to ensure soil protection during construction.
2. Soil in the following areas should not be disturbed:
 - i. 40 ft. beyond the building perimeter.
 - ii. 15 ft. beyond the primary roadway curbs, parking lots, main utility branch trenches, or impervious areas.
 - iii. 5 ft. beyond walkways.
 - iv. Any area under or closer than 1 ft. of tree driplines per 1 in. of diameter at breast height (DBH) trunk diameter (e.g., 12-in. DBH will require tree protection fence at least 12 ft. from the trunk).
 - v. Areas within any identified stormwater management features.
 - vi. Retaining walls within these areas may be employed as needed to maintain necessary grades.
3. Trees shall be protected as individuals with the tree protection fence located outside the drip line, as defined above in C.2.iv, prior to site activities. Trees may be protected as groups if their canopies are within 1 ft. of each other, with tree fence protection zone distances as defined above in C.2.iv."

D. "Soil management and erosion control plans should be created and implemented to protect the soil profile of the current site before, during and after construction."

CHAPTER 5: SOILS

GUIDELINES FOR HEALTHY SOILS

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.3 SOIL

G. "Topsoil from the project site shall not be sold or exported until all landscaped areas (tree, shrub, perennial, annual, or lawn plantings) have received an average 12-in. deep re-spread using soil from the project site.

Existing site topsoil shall be stockpiled and protected, or topsoil should be imported for an average re-spread depth of 12 in. in all proposed planting and seeding areas. No topsoil should be screened with less than a 3-in. screen. Minimum re-spread depth is not required for green roofs."



PROTECT EXISTING SOIL

Do not export soil from the site unless necessary.

Avoid soil compaction by keeping heavy equipment off the green space (including lawns). Soil compaction is a primary obstacle to plant success on developed sites.

Where compaction is unavoidable or compacted soils currently exist, implement core aeration or similar de-compaction method.

Don't work with wet soils, as this leads to compaction and smearing seals the surface.

Don't leave exposed soil in planting beds. Mulch should be used to keep the ground continually covered. (See [Mulch on page 51](#) in the Materials section)

Establish permanent vegetation on exposed soils as soon as possible after completing ground disturbing activities.

ENSURE HEALTHY SOILS

Ensure introduced and imported soils are environmentally clean.

Test existing and introduced topsoil for proper pH, bulk density, percent organic matter, and soil nutrients prior to planting to determine if amendments or total soil replacement is necessary.

The following parameters represent ideal soil specifications:

pH between 4.5 and 8.5

Maximum bulk density for each soil type

- I. Clays and silts: 1.25 g/cm³
- II. Loams: 1.25 g/cm³
- III. Sands: 1.25 g/cm³

Organic matter percentage of 3.5% or greater (by weight)

Soil Nutrient Levels: Nitrogen-Phosphorous-Potassium (NPK) fertility greater than medium, as tested by [University of Minnesota Soil Testing Laboratory "Lawn, Garden, and Landscape" Soil Analysis Request Sheet](#).

CHAPTER 5: SOILS

GUIDELINES FOR HEALTHY SOILS

HOW TO MEASURE SUCCESS

Area of protected soils

(Square feet or acres)

Provide soil report for protected and/or amended soils

AMEND SOILS

Add amendments to soils as needed to reach the standards/specs outlined above. For soil that can not be economically brought to standards consider creating 'No Planting Zones' where plant success would be limited.

Soils amendments should be fully decomposed and meet MN DOT standard specifications. Undecomposed soil amendments consume oxygen and nitrogen through microbial activity resulting in plant death. Soil Amendments can include the following:

- a. US Composting Council STA Certified Compost, preferably compost made from Source-Separated Organic Materials
- b. Class A Biosolids
- c. Activated Biochar

SSOM

Compost made from Source Separated Organic Material (SSOM) prevents valuable nutrients and organic matter from ending up in the trash. Organic waste such as food scraps are collected from homes and businesses throughout Hennepin County. These materials are then processed into SSOM compost for use as a renewable soil amendment.

There are two Mn-DOT approved vendors of certified Grade 2 compost made from SSOM: [SMSC Organics Recycling Facility](#) and [SET/ The Mulch Store](#)

BIOCHAR

Biochar is black carbon produced from a biomass source [i.e., wood chips, plant residues, manure, or other agricultural waste products] for the purpose of transforming the carbon into a more stable form (carbon sequestration). Any solid residual products resulting from the chemical and/or thermal conversion of carbon containing material (e.g., fossil fuels and biomass) is known as black carbon.

Biochar does not refer to a singular product. Biochar has multiple black carbon forms, each chemically and physically unique depending on the source, creation process (pyrolysis unit), cooling, and storage conditions.

<https://www.ars.usda.gov/midwest-area/stpaul/swmr/people/kurt-spokas/biochar/>

CHAPTER 6: WATER CONSERVATION

SUSTAINABLE WATER USE

Water is essential for healthy landscapes.

Designers should plan for increased heat and drought by minimizing irrigation needs and harvesting available water through stormwater BMPs and green infrastructure (see section 7).

Planning for increased heat and decreased rainfall also means building resilience by minimizing irrigation needs and taking advantage of available water on the site.

1. Plant drought-tolerant species
2. Harvest and re-use stormwater
3. Mow only to 3" or taller
4. Allow turf to go dormant

An interior cistern captures roof water for irrigation and other internal uses at Capitol Region Watershed District



TASK	RECOMMENDATION
Establishment	Plan to irrigate plantings for the first two years during establishment, using a temporary irrigation system. Once plants are established, eliminate all irrigation except in times of severe drought.
	Employ smart sensors and drip irrigation to reduce water use during the establishment period.
	Where turf is necessary, plant drought-tolerant turf grass species. Drought (and salt) tolerant turf seed and sod will reduce irrigation needs and increase turf survival during drought. In other cases, consider alternatives to turf such as fescue or native grass mixes.
Long Term Maintenance	Plant drought-tolerant native species in landscaped areas. Many native plants are both attractive and drought tolerant, reducing long term water use.
	Make a 'Drought Plan' for times when water may be required but is not available through precipitation. Many established plantings in urban areas may require some irrigation during times of intense drought.

**B3 REQUIRED PERFORMANCE CRITERIA
GUIDELINE S.2 SITE WATER QUALITY AND EFFICIENCY**

C. "No potable water shall be used for irrigation after a 5-year plant establishment period except for periods when actual rainfall for the month is less than 30% of the average rainfall for that month. Collected roof rainwater and graywater may be used for plant irrigation at any time. Turf grass integral to the program of the site, such as athletic fields or school recreational fields are excluded from the calculation for this requirement."

CHAPTER 6: WATER CONSERVATION

SUSTAINABLE WATER USE



Allowing turf to go dormant during hot summer months reduces unnecessary water use.
Photo: City of Spokane

GOAL	RECOMMENDATION
Conserve Water	Choose vegetation that does not need regular irrigation. Many native plant species are naturally drought tolerant.
	Consider soil type when choosing vegetation for a site. Choosing highly drought tolerant plants is extremely critical in northern, western, and southern portion of Hennepin County where soils are primarily sandy.
	Allow turf to go dormant in summer to reduce the need for irrigation. Golden lawns are not dead, as many turf grasses naturally go dormant in the heat of summer. During extreme drought, light sprinkling once every few weeks may be necessary to prevent the turf from dying.
	Do not mow grass too short to avoid stressing turf. Mow to a height of 3.0" or more. Leave mowed clippings on the lawn rather than removing them. This provides a natural source of compost and makes grass healthier and more drought tolerant over time. See the University of Minnesota Extension Service ‘Mowing Practices for Healthy Lawns’ .

HOW TO MEASURE SUCCESS

- Amount of water harvested**
(Gallons)
- Amount of potable irrigation water reduced**
(Gallons)

STORMWATER HARVESTING FOR IRRIGATION

Water can be captured and stored for later use in landscape irrigation. Water can be harvested from a variety of sources like rooftops, parking lots, or other impervious surfaces. The water may need to be treated depending on its source and intended use.

New US guidelines provide clear standards and give municipalities confidence when approving these systems.

[Rainwater Harvesting Systems | ICC Digital Codes](#)

CHAPTER 7: GREEN INFRASTRUCTURE + STORMWATER MANAGEMENT



Tree trenches are an example of Green Stormwater Infrastructure. The trees slow down the rate of runoff while the structural elements below the surface store and infiltrate stormwater back into the ground.

Landscaping can play an integral role in managing stormwater runoff. Landscaped areas can store and infiltrate stormwater runoff, reducing water leaving a site. Plants also help reduce runoff through evapotranspiration.

Green infrastructure includes a range of technologies and landscape practices that mimic natural drainage patterns and functions. Using green infrastructure can make a site more resilient and help improve water quality in downstream resources.

DEFINITIONS

Green Infrastructure (GI)

A range of vegetative and pervious practices that mimic the natural, pre-development conditions of the area.

Sustainable Landscaping (SL)

Set of practices that work with the natural environment to sustain local habitat, conserve energy and water, improve air and water quality, and enhance user experience.

Examples include trees, grasses, impervious conversions, and native plantings

Green Stormwater Infrastructure (GSI)

Set of GI practices that also provide stormwater management by detention, infiltration, and filtration.

Minneapolis GI Website: [Green Infrastructure - City of Minneapolis \(minneapolismn.gov\)](https://www.minneapolis.gov/green-infrastructure)

CHAPTER 7: GREEN INFRASTRUCTURE + STORMWATER MANAGEMENT

BENEFITS OF GREEN INFRASTRUCTURE



Biofiltration basins have the capacity to store stormwater as they treat it. Green stormwater systems create native habitat, increase the tree canopy, and improve water quality.



Stormwater can be conveyed from one area to another for treatment through artistic elements like this grate.

GOAL	RECOMMENDATIONS
Water Quality	Reduce runoff rates from the site to improve local water quality and reduce downstream flooding
Water Resource Protection	Increase water available for landscaping
	Minimize use of potable water for irrigation
	Restore groundwater resources through stormwater infiltration
Resilient Landscapes	Increase quantity of landscaping that can be incorporated into a site <ul style="list-style-type: none"> • Bioretention areas • Tree trenches in urban areas
	Increase presence of native species to create habitat
	Increase tree canopy cover with tree trenches in areas that could otherwise not support trees
Climate	Increase carbon sequestration with more plant material and green space
	Mitigate impacts of urban heat island effect through increased plants and green space

**HENNEPIN COUNTY CLIMATE ACTION GOAL
REDUCE FLOODING**

Hennepin County has set the goal to exceed current runoff rate requirements to reduce flooding. As more rainwater is retained on site through infiltration, evapotranspiration, or storage in the soils, less is directed off site thereby reducing the potential for flooding.

Rainwater is typically directed to aging municipal systems and conveyed to local watercourses. Flooding occurs when these watercourses become overwhelmed during times of heavy rain. Minimizing the volume of water directed to these systems can alleviate downstream flooding and create more resilient systems as our precipitation patterns change and become more extreme with climate change.

CHAPTER 7: GREEN INFRASTRUCTURE + STORMWATER MANAGEMENT

STORMWATER MANAGEMENT

STORMWATER MANAGEMENT GOALS

1. Reduce runoff water volume
2. Slow runoff rate
3. Ensure high water quality

Stormwater management goals for most sites include:

- Reducing the overall volume of water leaving the site through retention (Water Volume)
- Slowing the rate at which unretained water leaves the site (Runoff Rate)
- Ensuring the cleanliness of water leaving a site (Water Quality)

These goals are determined by the watershed management organization or municipality and have specific metrics tailored to the site's size, use, and watershed requirements. Stormwater management requirements vary for each Hennepin County project site based on which city and WMO it is located within.

NOTE: Please refer to your municipal or township engineering guidelines and watershed management organization for requirements and design specifications.



photo: MWMO

DEFINITIONS

Stormwater BMPs

'Best Management Practices' (BMPs) are devices, practices, or methods that are used to manage stormwater runoff by controlling peak runoff rate, managing runoff volume, and improving water quality.

Structural BMPs

Built facilities that capture, filter, and infiltrate stormwater runoff to reduce erosion and sedimentation and improve water quality.

Non-Structural BMPs

Design approaches and practices that are used to prevent the occurrence of stormwater runoff.

CHAPTER 7: GREEN INFRASTRUCTURE + STORMWATER MANAGEMENT

STORMWATER MANAGEMENT

Implementation of green stormwater infrastructure (GSI) BMPs is the best way to reduce site runoff and improve water quality in Hennepin County. There are a wide variety of BMPs to choose from that can work in almost any site. It is important to conduct site design with the collaboration of a stormwater engineer who is experienced specifically in GSI BMP design and implementation.

There are two main categories of GSI BMPs: structural and non-structural. Structural practices are built into the landscape. They are stationary and permanent features that are designed, constructed, and operated to prevent or reduce the discharge of pollutants in stormwater runoff. Non-structural BMPs include those procedures, programs, and practices that work in partnership with structural BMPs to support stormwater management goals and include municipal ‘housekeeping’ programs, regulations, ordinances, and education programs & training. Examples of each type of BMP are listed below:

See the [Minnesota Stormwater Manual](#) online for more information on these and other stormwater best management practices.



photo: MWMO

GOAL	GSI BMP RECOMMENDATIONS
Site Design	Choose volume reduction BMPs that typically include a vegetation component for stormwater management to capture and infiltrate stormwater on site.
	Disperse stormwater BMPs across the site to treat water where it lands using a “treatment train” approach.
	Avoid concentrating stormwater treatment in one area to prevent large treatment facilities that cannot infiltrate stormwater and accumulate large quantities of sediment, which may lead to premature failure and/or high maintenance.
Vegetation Cover	Drainage should not be directed over walking or driving surfaces to ensure safety and proper stormwater management.
	Preserve and increase areas of vegetation. Design sites to preserve valuable existing vegetation and soil structure that reduces runoff.
Maintenance	Design sites to reduce the size of hard surfaces that shed stormwater.
	Design GSI facilities with maintenance in mind to ensure easy and effective ongoing care. Effective pre-treatment strategies will extend the life of GSI facilities.
	Include costs for long-term maintenance of GI features within all budgets and planning decisions.

CHAPTER 7: GREEN INFRASTRUCTURE + STORMWATER MANAGEMENT

STORMWATER MANAGEMENT: BMPS

STRUCTURAL PRACTICES



Rain Gardens



Bioswales



Trees



Tree Trenches



Permeable Pavement

STRUCTURAL PRACTICES



Green Roofs



Rainwater Harvest/Use



Iron-Enhanced Sand Filters



Infiltration Trenches



Infiltration Chambers

NON-STRUCTURAL PRACTICES



Pollution Prevention



Better Site Design



Street Sweeping



Soil Conservation



Turf Conversion

CHAPTER 7: GREEN INFRASTRUCTURE + STORMWATER MANAGEMENT

TABLE OF BENEFITS: STRUCTURAL STORMWATER BMPs*

Green Stormwater Infrastructure (GSI) Best Management Practices (BMPs)	Location in the Landscape	Hydrologic Benefits			Surface Water Pollutant Removal				Ancillary Benefits					
		Infiltration	Evapo-transpiration	Runoff Volume Reduction	Total Phosphorous (TP)*	Total Nitrogen (TN)*	Total Suspended Solids (TSS)	Metals*	Improve Air Quality	Reduce Urban Heat Island	Reduce Energy	Reduce CO2	Create Habitat	
SOURCE CONTROL		Impervious Cover Reduction	●	●	40%	30-55%	64%			✓	✓			
		Soil Amendments/ Decompaction	●	●	75-90%	50-75%	50-75%		25-90%					
		Native Ground Cover	●	●	40%				25-90%	✓	✓		✓	✓
		Impervious Disconnection	●	●	25-50%	25-50%	25-50%							
		Urban Tree Canopy	●	●						✓	✓	✓	✓	✓
		Permeable Pavement	●		45-85%	40-55%	50-55%	60-80%	<0-90%					
		Green Roof		●	45-90%	highly variable	20-90%	70-90%	80%	✓	✓	✓	✓	✓
		Blue Roof		●	45-90%			70-90%				✓		
ROUTING		Level Spreaders	•	•	50-75%	50-75%	50-75%							
		Filter Strips	•	•	25-75%	<0-45%	<0-15%	80-85%	<0-80%				✓	✓
		Dry Swales & Enhanced Grass Swales	•	•	10-60%	<0-10%	<0-10%	0-30%	<0-70%	✓	✓		✓	✓
SURFACE TREATMENT		Bioretention (without underdrain)	●	●	65-85%	<0-30%	<0-30%	70-90%	<0-90%	✓	✓		✓	✓
		Biofiltration (with underdrain)		●	40-45%	<0-30%	<0-30%	70-85%	<0-90%	✓	✓		✓	✓
		Stormwater Tree Trenches / Soil Cells	●	●	50-90%	44%	50%	85%	35%	✓	✓	✓	✓	✓
		Infiltration Basins	●	●	50-90%	15-90%	60-90%						✓	✓
SUB-SURFACE TREATMENT		Infiltration Trenches	●	●	50-90%	15-90%	60-90%							
		Sub-surface Infiltration Practices	●		85%	50-80%	40-70%	70-90%	70-90%					
RAINFALL HARVEST		Roofwater Harvesting		•	20-75%	40%	40%					✓		
		Stormwater Harvesting	•	●	20-75%	45-95%		65-80%				✓		
NOTES	<p>LEGEND</p> <ul style="list-style-type: none"> ● High • Low 	<p>Reduction ranges represent variations in design and site conditions across multiple studies. As a result, comparisons between BMPs across different studies may not reflect true performance. Please refer to the individual references reported for more information on how the volume and pollutant reductions were calculated. Utilizing good design practices will generally achieve removals toward the top end of the range.</p> <p>*Effluent concentrations can be greater than influent, depending on facility soils and design.</p> <p>**Relative effectiveness estimated based on average runoff volume reduction as a surrogate for thermal load reduction. Reductions are also dependent on thermal load from catchment.</p>							<p>Extent of benefits depend on a variety of factors including size of BMP, pre-development condition, construction and maintenance methods, etc.</p>					
SOURCE:		WERF 2016; WERF 2014; Dane County; USEPA 2017; EOR; UNH 2012												

*Table is for reference purposes only. Refer to the Minnesota Stormwater Manual for the most up-to-date information on expected pollutant removals.

CHAPTER 7: GREEN INFRASTRUCTURE + STORMWATER MANAGEMENT

CLIMATE CHANGE AND STORMWATER MANAGEMENT

The rate and intensity of rainfall is expected to increase substantially over the next century due to climate change. This will place increased burden on Hennepin County to manage site stormwater effectively in order to minimize flooding and pollution downstream caused by higher flows.

In order to create sites today that perform well under future conditions, it is important to provide more than the minimum required amounts of stormwater capture and treatment. The MS4 permit and local municipalities and watershed management organizations tend to set the minimum requirements based on historic rainfall events. Permitting entities understand the need to account for climate variability and that standards will benefit from forward-looking perspectives - but they have not yet adopted formal standards. It is recommended that all sites (excluding linear, roadway projects) managed by Hennepin County (whether through development or retrofit scenario) be designed to exceed these past standards.



photo: MWMO

For example, Hennepin County sites with less than 30% impervious cover could be designed to retain and/or infiltrate the excess runoff (difference between pre-developed and post-developed runoff volume) for a 10-year storm event (typical storm size for internal conveyance system design) with an added 20% safety factor (to account for increased duration and intensity of future rainfall events). This means that sites should be designed to manage the excess runoff created by development for a 5.1" rainfall.

For a typical developed site in Hennepin County with hydrologic soil group C soils and high impervious cover (CN 91), the additional runoff beyond natural/undeveloped runoff corresponds to approximately a runoff volume of 2.4" for the developed portion of the site. We suggest the County use this approach, pending Atlas 14 updates.

ATLAS 14

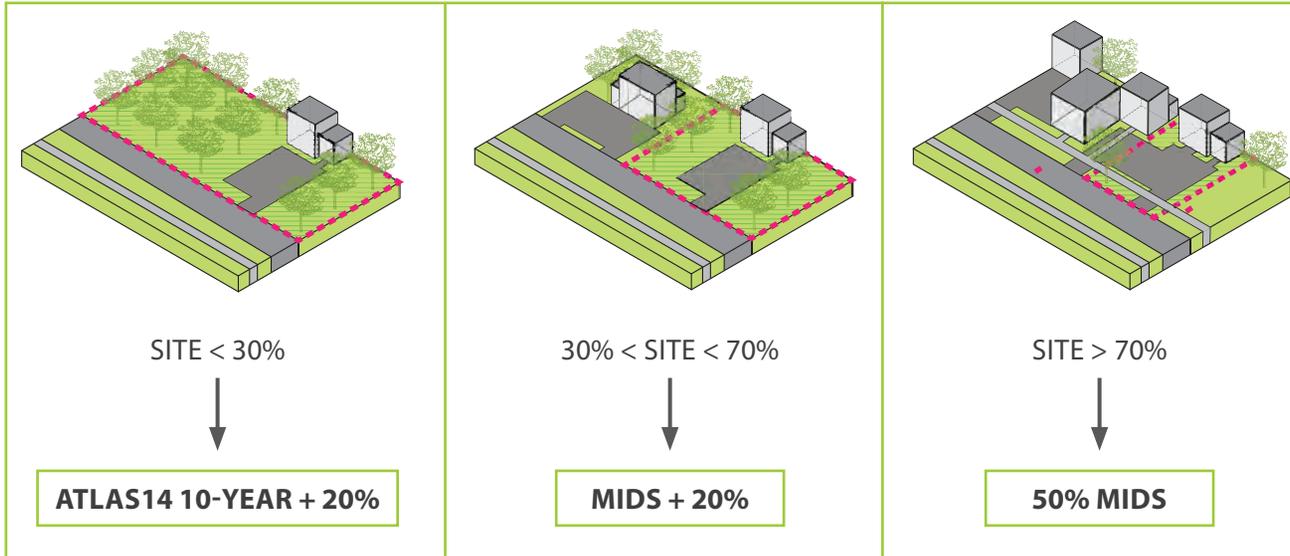
Atlas 14 Standards

A set of federal rainfall estimates, most recently recalculated for Minnesota by the National Oceanic and Atmospheric Administration (NOAA) in 2013.

Upcoming Atlas 14 updates are part of the state and national initiative to redefine predicted rainfall depths for different probabilities (10-yr, 50-yr, 100-yr events) with more recent data. Further guidance and streamlining language with other entity's standards shall be developed in the future.

CHAPTER 7: GREEN INFRASTRUCTURE + STORMWATER MANAGEMENT

CLIMATE CHANGE AND STORMWATER MANAGEMENT



STORMWATER MANAGEMENT RECOMMENDATIONS BASED ON SITE CONTEXT

% IMPERVIOUS

VOLUME CONTROL RECOMMENDATION

VOLUME CONTROL STORMWATER MANAGEMENT RECOMMENDATIONS

Adopt an interim goal, pending Atlas 14 updates, that proposes County facility projects meet a reduction in runoff generated by development (over natural conditions), using the site conveyance 10-yr design storm.

- For most sites this would correspond to a volume reduction of 2.4" over the area of the developed site.

For project sites in heavily developed areas that are within existing space-limited corridors, it can be challenging to meet the full goal.

- Use the 10-yr pre/post runoff volume goal for a typical full site development or redevelopment.

For intense sites, apply alternative goals:

- On sites with program needs for more impervious space (e.g. Brookdale Service Center site), meet MIDS + 20%.
- For small and heavily developed parcels in the urban core, with no plans for redevelopment (e.g. Washburn Library), meet 50% of MIDS standard to improve stormwater management.

Linear sites have greater restrictions that limit what is attainable and should have further collaboration with the highway group before a goal can be established.

HOW TO MEASURE SUCCESS

Volume of reduced runoff
(Cubic feet or acre-feet)

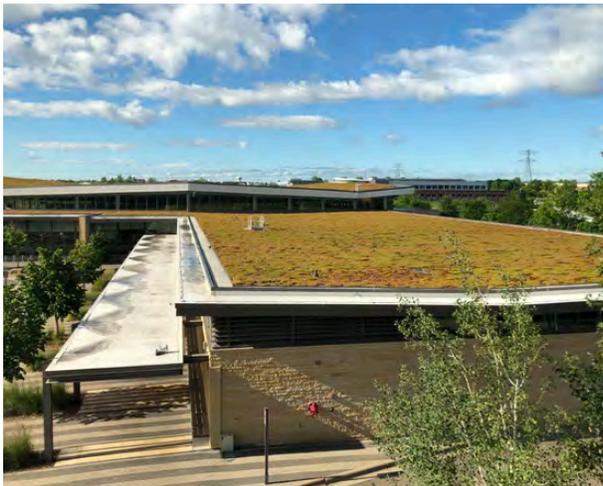
Rate control goal met
(Atlas 14, MIDS)

CHAPTER 8: GREEN ROOFS

GREEN ROOF TYPES

Green roof benefits:

1. Improved stormwater management
2. Reduced urban heat island effect
3. Habitat creation
4. Greenspace for passive recreation and aesthetic value
5. Improved energy efficiency



Green roofs reduce runoff by storing and absorbing rainwater where it falls, while also filtering excess water as it drains through the plant layer.

Green roofs are ballasted roofs consisting of a waterproof membrane on top of a structural deck, with growing medium and plant material. Successful green roof projects provide multiple environmental benefits. Green roofs should be considered for installation on space-limited sites in order to reduce stormwater runoff as well as on buildings with large expanses of flat roof.

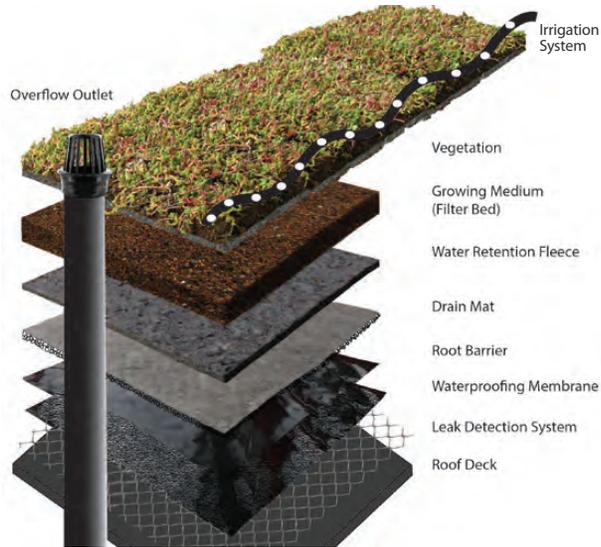
Green roofs are a practical stormwater BMP for cold climates. Snow protects the vegetation during winter and percolates into the growing medium as it thaws. Any water not absorbed by the vegetation drains as it would during a rain event.

Green roofs are categorized by their construction components and structure. Hennepin County prefers extensive green roof systems build with a modular tray system for ease of maintenance.

TYPE	STRUCTURE
Extensive	<p>Consists of a thin growing media (2-4") with shallow-rooted, drought tolerant herbaceous vegetative cover. Modular tray systems available.</p> <p>This guide focuses on extensive green roofs.</p>
Intensive	<p>Contain more than 6" growing media, and can be planted with deeply rooted plants with permanent irrigation.</p> <p>Often designed to include pedestrian pathways and outdoor gathering areas.</p>
Semi-Intensive	<p>Provides additional plant diversity by increasing the growing media depth (up to 6-8"). Growing media can be bermed on areas of the roof designated to support the additional load.</p> <p>There is some added maintenance, but less than required by intensive roof systems.</p>
Blue & Hybrid	<p>A related type of roof system used for stormwater management. Roof drains are plugged to retain and evaporate water for a calculated period of time, and are released by a smart drain to the designated water egress point.</p> <p>A hybrid roof incorporates blue roof technology with a vegetated overburden design above the water storage layer.</p>

CHAPTER 8: GREEN ROOFS

GREEN ROOF INSTALLATION + VEGETATION



ABOVE The typical structure of a green roof utilizes multiple layers to support plant growth and protect the underlying roof structure from water or root damage. (credit: Toronto and Region Conservation Authority)

BELOW Installation of a modular green roof system provides complete coverage of the area. Modules can be removed for maintenance or replaced if unhealthy.



INSTALLATION

Trays of vegetation in planting medium are prepared and grown off-site and can be placed on the roof for complete coverage. There are also pre-cultivated vegetation blankets grown in flexible planting media structures, allowing them to be rolled out onto the green roof assembly.

A built-in-place (or contiguous) system provides the most flexibility in design and longevity. These pre-cultivated vegetation blankets can be planted with additional perennials according to the planting design. Modular (or tray) systems combine a drainage box for growing media with pre-grown sedum. The module may be more economical for small roof areas, and these systems can be easily installed and removed for maintenance.

VEGETATION

Extreme growing conditions on rooftops have a big impact on green roof plant survival. Appropriate plant selection will help to ensure plant survival during weather extremes. Plants should be low growing, drought tolerant, and able to survive short periods of inundation. Sedum species are the most common choice, demonstrating excellent longevity in systems with or without irrigation. Mixing sedum with native species adds biodiversity and pollinator habitat benefits in semi-intensive green roof designs.

Irrigation during the first year may be necessary to establish vegetation. Overhead watering (tripods, long sprinklers, etc.) may be set up after the green roof is installed for temporary irrigation during the first growing season to ensure root establishment. Long term drip irrigation systems may be beneficial for green roofs to supply water during periods of drought or for very thin soil profiles. If permanent irrigation systems are installed, use a non-potable water source whenever possible. Irrigation should be coupled with soil moisture sensors to suppress irrigation after rain events and trigger irrigation during dry times. Regular irrigation has been shown to reduce the runoff reduction performance of extensive green roofs, so irrigation should not be used unless specifically needed based on soil moisture conditions.

Electronic leak detection is recommended for all green roofs and must be installed prior to the green roof system.

Regular inspections should be included in the facility's annual budget. A minimum two-year warranty on vegetation should be included in the construction contract.

CHAPTER 8: GREEN ROOFS

GREEN ROOF MAINTENANCE



Photo: Angie Durham

Sedum species are hardy enough to survive the extreme conditions on a green roof.

OPERATION AND MAINTENANCE

Green roof maintenance is typically greatest in the first two years as plants are becoming established. Maintenance typically decreases after establishment if the roof sustains no further disturbance. A documented inspection should occur at the same time each year to observe any differences in vegetation.

Routine maintenance should occur every 4-8 weeks and should include weeding to remove tree and shrub volunteer seedlings and any debris. The overflow conveyance system should be monitored and kept clear of obstructions.

If an irrigation system is utilized, include irrigation system adjustments into the maintenance schedule. Irrigation systems need to be disconnected from the water supply and distribution lines blown dry in the fall before the on-set of freezing winter temperatures, and reconnected in the spring.

See [Appendix C for Green Roof Maintenance Tasks and Checklists](#)

HOW TO MEASURE SUCCESS

Area of green roof installed
(Square feet or acres)

COOL ROOFS

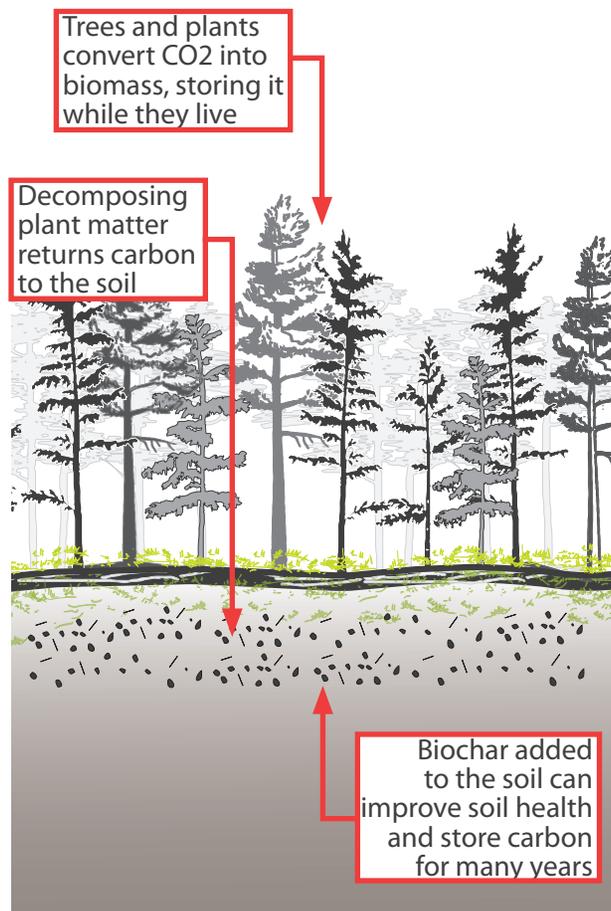
Cool roofs are made of highly reflective and emissive materials that remain cooler than traditional materials during peak temperatures.

Designed to reflect more sunlight than a conventional roof, a cool roof absorbs less solar energy and lowers building temperature. Conventional roofs can reach temperatures of 150°F or more on a sunny summer afternoon, but a reflective roof may stay more than 50°F cooler under the same conditions. This saves energy and money in buildings with air conditioning, and improves comfort and safety in buildings without air conditioning.



CHAPTER 9: CARBON SEQUESTRATION

THE ROLE OF LANDSCAPING IN SEQUESTERING CARBON



Carbon sequestration is the process of capturing and storing carbon dioxide (CO₂) from the atmosphere. Greater carbon sequestration is achieved on sites by incorporating more trees and vegetation, restoring natural ecosystems, and improving soil capacity to hold carbon.

**HC FACILITY SERVICES CLIMATE ACTION GOAL
INCREASE CARBON SEQUESTRATION**

Action

Support efforts to identify opportunities and strategies that increase carbon sequestration on Hennepin County property.

FEATURE	EFFECT ON CARBON SEQUESTRATION
Trees and Vegetation	Trees and vegetation remove CO ₂ through photosynthesis, store it in biomass, and return it to the soil when they decompose.
Soil	Soil stores carbon in dead organic biomass.
Biochar	Biochar stores carbon in a stable state for centuries in the soil, reducing the amount of CO ₂ released into the atmosphere. Biochar reduces the need for chemical fertilizers and improves soil health, which improves plant health. Healthier plants can absorb more CO ₂ and provide greater benefits to air quality.

CHAPTER 9: CARBON SEQUESTRATION

IMPROVING CARBON SEQUESTRATION ON SITE



GOAL	RECOMMENDATION
Maximize Native Trees and Plants	Prioritize trees and native plants over turfgrass
	Save existing trees and vegetation and plant more
Reforestation	Convert non-forested land to forest where appropriate
Use Biochar	Add biochar as a soil amendment

HOW TO MEASURE SUCCESS

Stored carbon*
(Tons)

*Each 10-year-old tree can be expected to sequester between 3-18 pounds of carbon per year

*Each acre of restored prairie sequesters between 0.3-1.7 tons of carbon annually

**B3 REQUIRED PERFORMANCE CRITERIA
GUIDELINE S.4 VEGETATION**

E. "Achieve biomass target according to the major ecosystem of site, measured in biomass per area of vegetated site area, estimated at ten years post-occupancy according to the major ecosystem characterization from DNR."

Note: See B3 guideline S.4 Vegetation B. 2-5 for further tree conditions to meet.

CHAPTER 10: MATERIAL SELECTION

SOURCING MATERIAL

Sourcing and selecting appropriate, high-quality materials is important during the sustainable design process.

Reputable and local suppliers support projects by providing high quality materials under warranty. Sourcing from local suppliers also minimizes a project’s carbon footprint by reducing shipping distance.

GOAL	RECOMMENDATION
Source Local	Select plants that have been grown locally <ul style="list-style-type: none"> • Hennepin County Forestry division operates a tree nursery which makes trees available for HC projects. Contact them to see a list of available species
	Select local/regional materials Buying from local vendors supports business and reduces carbon footprint by decreasing transportation needs
Re-Use	Re-use materials from the existing site whenever possible
Durability and Longevity	Choose materials that are robust and adaptable to changing climates (increased heat and precipitation) to ensure their long-term function and reduce the need for future replacement or rehabilitation

Use the sustainable guidelines when sourcing landscape materials

1. Topsoil
2. Soil Amendments
3. Mulch
4. Paving

MATERIAL	WHAT TO LOOK FOR
Topsoil	Salvage and re-use existing topsoil in the project area.
	Test all salvaged soil to confirm retention of organic properties that make it suitable for planting or seeding.
	Salvaged topsoil shall be taken from the top 15 cm (maximum) of the soil horizon on site, be black or dark brown in color, have granular structure, and shall not ribbon out more than one inch when pinched between fingers.
	Stockpiling topsoil in large piles during construction can kill beneficial organic matter and diminish soil health and viability. To avoid this, topsoil stockpiles should be mixed and moved regularly.
	Test stockpiled topsoil prior to re-spreading on site.
	Obtain soil test results for any imported topsoil indicating pH, organic content, and nutrients in the soil

CHAPTER 10: MATERIAL SELECTION

SOURCING MATERIAL

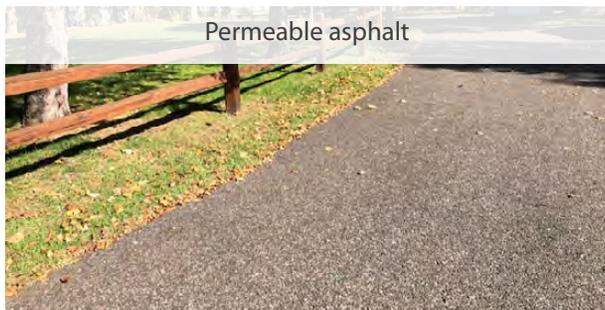


Locally sourced hardwood mulch adds a finished look to planting areas. Mulch helps retain moisture in the soil, inhibits weed growth, and minimizes topsoil erosion. Contain mulch in planting beds with steel edging or other permanent barrier. Topdress mulch beds yearly, as needed.

MATERIAL	WHAT TO LOOK FOR
Soil Amendments: Compost	Only mature compost, obtained from MNDOT-approved local sources, should be used.
	Compost made from Source Separated Organic Material is encouraged.
	Obtain STA test results prior to bringing compost on site.
	Compost should be well decomposed, stable, and weed free. Compost with an organic matter content greater than 65% may not be fully decomposed.
Soil Amendments: Biochar	Compost should be thoroughly screened and should not contain debris.
	Biochar is a carbon-rich charcoal made by heating solid agricultural and forestry waste in a low oxygen environment. When added to soil it can drastically improve soil health. Biochar acts as a long-term carbon sink and can sequester carbon in the soil for centuries. Biochar - City of Minneapolis (minneapolismn.gov)
Mulch	Mulch material shall be locally sourced
	Mulch material shall be derived from hardwood species, excluding Walnut or Ash.
	Mulch shall be un-dyed material.
	Mulch shall be double shredded, the product of a mechanical chipper, hammermill, or tub grinder.
	No portion of the material shall be in an advanced state of decomposition.
	Mulch material should be screened and free of large wood chips/chunks, mold, dirt, sawdust, and other debris.

CHAPTER 10: MATERIAL SELECTION

PAVING



MATERIAL	WHAT TO LOOK FOR
Paving	Re-use existing materials on site whenever possible
	Use reclaimed or re-purposed materials where available <ul style="list-style-type: none"> • "Urbanite" salvaged from demolished concrete slabs can be re-purposed for features like walkways or patios • Concrete from previously developed sites can be crushed and used for base material under new pavements or retaining walls • Reclaimed asphalt pavement can be transformed into like-new paving material
	"Green concrete," an eco-friendly alternative to traditional concrete, is manufactured using waste or residual material from other industries. "Green concrete" requires less energy for production and is considered more long lasting than traditional concrete
	Use concrete with a light color (and high albedo score) to reduce the heat island effect better than when using dark colored paving
	Install permeable paving instead of impervious surfaces to reduce stormwater runoff. Permeable paving options include permeable concrete, permeable asphalt, and many types of modular concrete pavers. Note that permeable pavers have different maintenance requirements than concrete or asphalt paving

HOW TO MEASURE SUCCESS
<p>Recycled materials (Tons)</p>

CHAPTER 11: CONSTRUCTION

BEFORE CONSTRUCTION

Create clear expectations about the requirements for landscape construction methods. Follow up with the landscape contractor throughout the construction process with thorough inspections and consistent communication to ensure contractors follow all requirements.

See table of referenced documents in Appendix A for list of applicable state and county standards, specifications, and regulations related to landscape construction.

**B3 REQUIRED PERFORMANCE CRITERIA
GUIDELINE S.3 SOIL**

D. "Soil management and erosion control plans should be created and implemented to protect the soil profile of the current site before, during, and after construction."

PHASE	RECOMMENDATION
<p>Before Construction</p>	<p>Create / confirm performance specifications</p> <p>Include performance specifications for the site and materials in any contract agreements to ensure that landscape installation standards are clear. Specifications on the following should be included:</p> <ol style="list-style-type: none"> 1. Soils preparation and movement 2. Erosion and sediment control 3. Tree protection 4. Planting, including species list and size of material 5. Mulching and amendments 6. Establishment and maintenance
	<p>Ensure clear communication channels</p> <ul style="list-style-type: none"> • Clearly communicate best practice expectations to the landscape contractor. This is communicated within specifications but should also be communicated in pre-bid and pre-construction meetings, as well as in field directives as needed. • Be sure to keep all interested parties informed of decisions in the field. • Provide a list of contact information for all contractors, sub-contractors, consultants, and owners' representatives on a project at the beginning of the construction period. • Distribute this at the pre-construction meeting • Keep all parties updated on the status of construction through regular meetings and status update emails • Copy all parties on project-related emails so everyone has the information needed to complete the job safely and effectively

CHAPTER 11: CONSTRUCTION

DURING CONSTRUCTION



Silt fence perimeter protection installed around project site before construction



Tree protection fence in place during construction

PHASE	RECOMMENDATION
<p>During Construction</p>	<p>Follow proper site protection techniques</p> <ul style="list-style-type: none"> • Ensure erosion control perimeter protection and tree fencing is in place prior to the start of construction. • Provide adequate staging area for equipment. Do not park heavy equipment on unprotected soils. This may compact the soil and negatively impact plant health. • Use proper equipment for constructing planting beds and green infrastructure. Heavy equipment can compact the soil and threaten the functionality / performance of stormwater BMPs. • Do not work wet soils. This can damage soil structure which can have long term negative impacts on plant health and drainage function
	<p>Conduct regular inspections</p> <ul style="list-style-type: none"> • Provide regular site inspections to verify proper soil preparation and planting practices. Good timing of inspections prevents improper work. • Provide regular site inspections during the planting process to ensure proper erosion control methods are installed and maintained.

CHAPTER 11: CONSTRUCTION

AFTER CONSTRUCTION



PHASE	RECOMMENDATION
<p style="text-align: center;">After Construction</p>	<p>Ensure support during the establishment period</p> <ul style="list-style-type: none"> • Modify contractor payment schedules to incentivize appropriate maintenance through the plant establishment period. <p>Create a separate maintenance agreement after planting may be the most effective contracting method to achieve appropriate maintenance. This also allows the general contractor to close out the project after planting is complete.</p> <ul style="list-style-type: none"> • Consider a post-construction rest period of up to one year before installing vegetation to promote soil stabilization and provide time for careful contractor selection. <p>Better selection and oversight of the landscape contractor can be achieved through a direct contract with Hennepin County.</p> <ul style="list-style-type: none"> • If utilizing a landscape rest period, make sure to install a short-term cover crop such as oats or winter wheat to secure soil in place and prevent erosion during this time. <p>Also make plans to control invasive and unwanted species during the rest period</p> <ul style="list-style-type: none"> • Inspect the site at the end of the warranty period to ensure contractors complete all necessary plant replacements.

CHAPTER 12: MAINTENANCE

MAINTENANCE PLANNING

Maintenance is as important to establishing healthy and long-lasting landscapes as proper construction.

Make sure to have detailed establishment and long-term maintenance activities planned and budgeted for prior to project implementation.

Refer to Appendix C - Landscape Maintenance Checklists for more guidance.



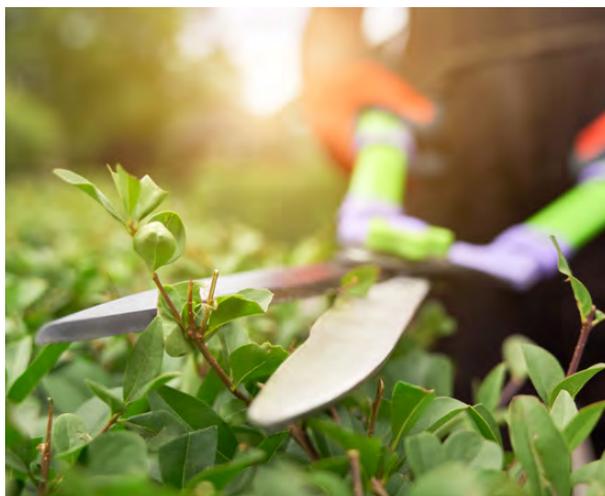
TASK	RECOMMENDATION
Confirm the Budget	Include a three-year establishment period for plant establishment in the construction budget for projects featuring native seeding
	Ensure a long-term maintenance budget is allocated for each site appropriate for the type of planting implemented (turf, native seeding, container material, vegetated mat, or other).
Clearly Define Roles and Responsibilities	Clearly define roles, responsibilities, and budgets for maintenance and rehabilitation tasks during design approval.
	Ensure all parties responsible for future maintenance are identified from the beginning. This may include facilities management, parks staff, or other hired contractors. Include these people in design and planning discussions.
	Contractors should be provided with proper training and subject to periodic inspections.
	Conduct a hand-off meeting at the completion of the construction and establishment period to officially move responsibility for site maintenance from the contractor to Hennepin County staff.
Create an Operation and Maintenance (O&M) Plan	Create operation and maintenance plans for each site with clearly defined tasks, expectations, and schedules <ul style="list-style-type: none"> • Include details for maintenance contractors: name and contact information for the project designer, construction contractor, and owner/operator • Include an overview of the site and planting plans, including species lists • Include a plant replacement cycle Ex: Foundation plantings typically last 15 years, at which point they may need replacement
	Maintenance activities should begin right away. Once weeds are established they can be very difficult to eliminate.
	The O&M Plan should include information about the design, operation, and maintenance of any structural stormwater management practices at the site
Integrate All Assets within the Asset Management System	Ensure all assets (trees, plants, green infrastructure, BMPs) are included within the Facilities Services Asset Manager Planning. Map assets with GIS.
	Evaluate and document site performance to improve the site and learn for future projects. Develop a consistent record-keeping system to understand maintenance history.

CHAPTER 12: MAINTENANCE

MAINTENANCE IMPLEMENTATION

B3 REQUIRED PERFORMANCE CRITERIA GUIDELINE S.4 VEGETATION

- B. "The following tree conditions shall be established:
 - 5. Tree planting requirements: At the time of planting, the following criteria should be met:
 - ix. Crowns should not be pruned at planting to balance root and crown volumes
 - x. Broken branches should be pruned and removed to develop a single central leader."



TASK	RECOMMENDATION
Weed Management and Plant Diversity	Control noxious and invasive weeds, per Minnesota Department of Agriculture guidance. See the Noxious and Invasive Weed Program .
	Invasive weeds can take over a planting area quickly and prevent desirable native species from establishing.
	Identify and eliminate weeds before they can set seeds.
	Implement a monitoring program to identify and track the presence of desirable and invasive plant material in native planting areas. This will allow for early detection of weed infestations and allow management to take place in a timely manner.
	Annual weeds are an expected and healthy part of a newly established native plant community. With proper maintenance during the establishment period annual weeds will be reduced and eventually eliminated as native species take over.
Plant Replacements	It is critical to train staff and employ contractors with experience in native plant and weed identification for establishment and long-term maintenance tasks.
	Replace all dead plant material at the end of the one-year plant warranty following site construction
	Inspect the site yearly and replace dead and missing plants as needed. Open spots left by dead plants can be a host for weeds.
Pruning	Split existing plants for plant replacements (when possible) rather than buying and installing new material.
	Do not prune shrubs or trees unless needed to remove dead and/or crossing branches
	Never prune oak trees during oak wilt season (April - July), when they are susceptible to fatal infection by oak wilt. Refer to Appendix C for maintenance schedules.
Pest Management	Pruning hedges makes a landscape high maintenance. Plant shrubs that naturally grow to the desired height to avoid regular pruning
	Follow Integrated Pest Management (IPM) approach to controlling pests on Hennepin County property (updated 2023).

CHAPTER 12: MAINTENANCE

MAINTENANCE IMPLEMENTATION



TASK	RECOMMENDATION
Pest Management	Train building and field staff in pest identification.
	Only use pesticides when strictly required to control an identified pest. Follow all manufacturer guidance for chemical applications.
	Only individuals with a current Commercial or Noncommercial Pesticide Applicator's License issued through the Minnesota Department of Agriculture are allowed to apply pesticides on Hennepin County property.
	Refer to the Hennepin County Integrated Pest Management Policy (2002) for more information.
Fertilizer	Fertilizers should only be used in cases of inadequate soil fertility as these can contribute to pollution and reduced water quality in downstream water bodies.
	Test soils on all new sites and in areas where plant health is compromised. Amend soils based on soil report recommendations using the minimum amount of fertilizer specified. Soil tests can be obtained through the University of Minnesota Soil Testing Laboratory .
	Do not use fertilizer on turf lawns or recreation areas.
Leaf Management	Follow the leaf management recommendations below to provide natural compost to each site in lieu of chemical fertilizers.
	Keep leaf litter on planting beds until late spring (end of May) to provide insect and pollinator habitat.
	Mulch leaf litter on turf areas and leave in place to provide compost which will improve turf health.
Maintenance Equipment	For sites that include burning as a plant management strategy, burn native planting areas on a 3–5-year cycle (including leaf litter where it falls) to encourage regeneration and improve soil health.
	Perform regular maintenance on all landscape maintenance equipment to prevent chemical leaks and spills in the landscape
	Switch to electric powered equipment such as mowers and trimmers when new Hennepin County-owned equipment is purchased.

CHAPTER 13: EDUCATION AND ENGAGEMENT

SUSTAINABLE LANDSCAPE TRAINING AND EDUCATION

Education about sustainable landscaping is multi-faceted. Opportunities bring educational activities to people and provide information through signage and websites.

Education also encourages homeowners to adopt similar practices, provides training for maintenance crews, and garners support for sustainable practices by ensuring people understand what they see and how the landscape is functioning.



AUDIENCE	RECOMMENDATION
<p>Hennepin County Staff / Contractors / Volunteers</p>	<p>Ongoing training related to sustainable landscape practices for Hennepin County staff is recommended.</p>
	<p>Contractors charged with installation and maintenance of sites should also receive training or provide proof of training in specific areas pertaining to landscape sustainability.</p>
	<p>Training opportunities for both groups include:</p> <ul style="list-style-type: none"> • Benefits of sustainable landscaping • Installation and maintenance techniques for sustainable landscapes • Winter pavement management to reduce use of salt • Green Stormwater Management Practices and their benefits • Maintenance practices for green infrastructure facilities
	<p>Specific training for staff should be scheduled upon (or before) completion of new green infrastructure facilities to set clear maintenance expectations from the beginning.</p>

Audiences for training and education should include:

- Maintenance teams
- Site designers
- Site users + visitors
- Residents + neighbors
- Environmental, community, + school groups

CHAPTER 13: EDUCATION AND ENGAGEMENT

SUSTAINABLE LANDSCAPE TRAINING AND EDUCATION



Passive education (site signage, websites, brochures, etc.) allows people to learn via their own initiative and is available for those who interact with the site or seek out more information.

Passive messages and informational material can be distributed throughout the community via messages on utility bills and county newsletters.

Artistic and interactive elements are other good ways to actively engage and educate site users. Working with an artist or exhibit designer on signage and educational components for a site is a good way to elevate the message aesthetically and make it more accessible and interesting.

AUDIENCE	RECOMMENDATION
<p>Site Users + Residents</p>	<p>Passive Information</p> <p>Information in these formats (site signage, websites, brochures) should include:</p> <ul style="list-style-type: none"> • Explanation of Sustainable Landscaping and its benefits • Signs to manage expectations , i.e. if the site looks more natural and unkempt than other landscaped areas (example "This is a Rain Garden" sign) • Native flower guide for species planted at the site • Green Stormwater Infrastructure explanatory signage incorporated within the site, especially for any features that may not be visible from the surface • Include a QR code on outdoor signage or brochures that links to more information about sustainable landscapes on the county's website

CHAPTER 13: EDUCATION AND ENGAGEMENT

SUSTAINABLE LANDSCAPE TRAINING AND EDUCATION



AUDIENCE	RECOMMENDATION
<p>Site Users + Residents</p>	<p>Active Education</p> <p>Active opportunities (tours, workshops, talks, etc.) bring people together to learn. Active education includes:</p> <ul style="list-style-type: none"> • Native flower tours and seed giveaways teach people about the benefits of native plants • Native plant care training workshops inform people how to plant and care for native, resilient plants on their own property • Workshops on Green Stormwater Infrastructure during installation at a site allows people to learn about the function and benefits they provide to the community • Training and demonstrations help people implement a rain garden on their own property • Opportunities also exist to create partnerships with local environmental stewardship groups to provide training or host volunteer events for maintenance <p>Partner with existing volunteer groups such as <u>Minnesota Water Stewards</u>, <u>Minnesota Native Plant Society</u>, <u>Master Gardener volunteers</u>, and various friends groups to host and lead tours and workshops for Hennepin County sites.</p>

HOW TO MEASURE SUCCESS

Engagement Rate (Visitors, Volunteers)

Installed Signage

REFERENCES

American National Standards Institute: American Standard for Nursery Stock, ANSI Z60.102014

<https://www.americanhort.org/education/american-nursery-stock-standards/>

American Society of Landscape Architects: What are Sustainable Landscapes?

<https://www.asla.org/sustainablelandscapes/about.html>

Buildings, Benchmarks & Beyond (B3) Guideline: Site and Water

https://www.b3mn.org/guidelines/3-2/s_1/

Climate Resiliency Toolbox / Minnesota Board of Water & Soil Resources

<https://bwsr.state.mn.us/bwsr-climate-resiliency-toolbox>

Envision Rating System / Institute for Sustainable Infrastructure

<https://sustainableinfrastructure.org/envision/use-envision/>

Green Stormwater Infrastructure Street Design Guide / City of Minneapolis

<https://sdg.minneapolismn.gov/design-guidance/boulevards-and-furnishings/green-stormwater-infrastructure>

Hennepin County Climate Action Plan, May 2021

<https://www.hennepin.us/climate-action/>

Hennepin County Facility Services Climate Action Plan, March 2022

REFERENCES

Integrated Vegetation and Pest Management Policy, 2002 / Hennepin County Public Works Environment and Energy

<https://www.hennepin.us/-/media/hennepinus/business/conservation/pest-management-policy.pdf>

Living Landscapes in Minnesota: A Guide to Native Landscaping / Natural Resources Conservation Service, United State Department of Agriculture

<https://www.ci.cambridge.mn.us/home/showpublisheddocument/44/636897600776570000>

Minnesota Noxious Weeds List / Minnesota Department of Agriculture

<https://www.mda.state.mn.us/plants-insects/minnesota-noxious-weed-list>

Minnesota Stormwater Manual / Minnesota Pollution Control Agency

https://stormwater.pca.state.mn.us/index.php?title=Main_Page

Native Seed Mix Design for Roadsides, 2014 / Minnesota Department of Transportation

<https://www.dot.state.mn.us/environment/erosion/pdf/native-seed-mix-dm.pdf>

Native Vegetation Establishment and Enhancement Guidelines, January 2019 / Minnesota Board of Water & Soil Resources

<https://bwsr.state.mn.us/vegetation-establishment-and-management>

Planting and Maintaining a Bee Lawn / University of Minnesota Extension

<https://extension.umn.edu/landscape-design/planting-and-maintaining-bee-lawn>

Pollinator and Biodiversity Toolbox / Minnesota Board of Water & Soil Resources

<https://bwsr.state.mn.us/pollinator-toolbox>

REFERENCES

Prairie Restoration Diversity / Minnesota Department of Natural Resources

https://files.dnr.state.mn.us/natural_resources/prairies/podcast/s1ep05-restoration.pdf

Salt Application Best Practices for Winter Maintenance Contracts / Sustainable Technologies Evaluation Program, Toronto Region Conservation Authority

<https://sustainabletechnologies.ca/app/uploads/2019/06/Salt-application-best-practices-for-winter-maintenance-contracts-brochure.pdf>

Smart Salting Training Program / Minnesota Pollution Control Agency

<https://www.pca.state.mn.us/business-with-us/smart-salting-training>

Soil and Water Management Research – Biochar / United States Department of Agriculture

<https://www.ars.usda.gov/midwest-area/stpaul/swmr/people/kurt-spokas/biochar/>

Standard Specifications for Construction. 2020 Edition / Minnesota Department of Transportation

<https://www.dot.state.mn.us/pre-letting/spec/>

APPENDIX A

RELATED POLICIES AND STANDARDS

TYPE	DOCUMENT / REFERENCE TITLE	APPLICATION	LINK
STATE POLICY GUIDELINES	B3 Guidelines V.3.2 - Site and Water Guidelines	Follow directly for those sites that are state funded Follow Best Practices / Standards for others (as outlined in this Guideline)	https://www.b3mn.org/guidelines/3-2/sw/
	Minnesota Dept. of Agriculture - Noxious and Invasive Weeds program.	Applicable to all HC projects	https://www.mda.state.mn.us/plants-insects/noxious-invasive-weed-program
	Minnesota Department of Transportation (MnDOT) - Specifications for Construction	For reference and specifications as listed below	https://www.dot.state.mn.us/pre-letting/spec/
	EPA NPDES Permit - Erosion & Sediment Control	For use during construction to protect water resources	https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates
	Minnesota Pollution Control Agency (MPCA) - Minnesota Stormwater Manual	For reference of Stormwater BMPs	https://stormwater.pca.state.mn.us/index.php?title=Main_Page
	Minnesota Pollution Control Agency - Smart Salting for Parking Lots and Sidewalks	For reference to reduce salt use on County properties	https://www.pca.state.mn.us/business-with-us/smart-salting-training
	Minnesota Board of Water and Soil Resources (BWSR) - Native Vegetation Establishment and Enhancement Guidelines (2019)	For reference and specification as listed below	https://bwsr.state.mn.us/vegetation-establishment-and-management
	ADA Accessibility Standards	Applicable to all projects within Hennepin County	ADA Accessibility Standards (enhanced single file version) (access-board.gov)

APPENDIX A

RELATED POLICIES AND STANDARDS

TYPE	DOCUMENT / REFERENCE TITLE	APPLICATION	LINK
COUNTY POLICY GUIDELINES	Integrated Pest Management Plan (2002)	Applicable to all projects within Hennepin County	https://www.hennepin.us/-/media/hennepinus/business/conservation/pest-management-policy.pdf
	Pollinator Friendly Resolution (Resolution #16-0105)	Applicable to all projects within Hennepin County	https://www.beyondpesticides.org/assets/media/documents/HennepinResolution.pdf
	HC Climate Action Goals	Applicable to all projects within Hennepin County Provide guidance on going beyond set runoff targets and carbon sequestration goals.	https://www.hennepin.us/climate-action/climate-action-plan
	HC Facility Management Climate Action Goals	Applicable to all projects within Hennepin County Provides goals specific to facility services	Obtain from County Project Manager
	HC Maps of Naturally Significant Areas	To be used during the initial site assessment to identify areas of natural significance with project sites.	(https://gis.hennepin.us/naturalresources/)

APPENDIX A

RELATED POLICIES AND STANDARDS

TYPE	DOCUMENT / REFERENCE TITLE	APPLICATION	LINK
LANDSCAPE STANDARDS	Tree and Plant lists	Choose materials from this list	See Appendix B
	Soil movement standards	As per B3 Guideline	https://www.b3mn.org/guidelines/3-2/sw/
	Erosion Control and Landscaping Product Specs	As per MnDOT	https://www.dot.state.mn.us/products/erosioncontrolandlandscaping/index.html
	Healthy Lawn Standards	University of Minnesota Extension	https://extension.umn.edu/lawn-care/mowing-practices-healthy-lawns
	Mulch Standard	As per B3 Guideline	https://www.b3mn.org/guidelines/3-2/sw/
	Compost Standard	As per B3 Guideline	https://www.b3mn.org/guidelines/3-2/sw/
	Seed Mix Standard	As per MnDOT	https://www.dot.state.mn.us/environment/erosion/vegetation.html https://bwsr.state.mn.us/seed-mixes
	Soil Composition Standards	As per B3 Guideline	https://www.b3mn.org/guidelines/3-2/sw/

APPENDIX B

PLANT LIST



Plant List

These species are great choices for gardening in Hennepin County. Most are native plants that are pollinator friendly, cold-hardy, and non-invasive. Plant selection may include species not listed in this guide. Final plant selection should consider the needs of site conditions, program, and desired plant habit (form, spreading behavior, seasonality, etc.). Consult with county staff to determine which species are suitable.

Perennial Forbs:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Yarrow	Ⓝ Achillea millefolium	☀			☀	☹	1-2 ft	.7 - 1 ft	Many other nice cultivars available such as 'Moonshine'	
Fragrant Giant Hyssop	Ⓝ Agastache foeniculum	☀	☾		☀	☹	2-6 ft	1.5-3 ft	Prolific seeder great for wild areas; 'Blue Fortune' is preferred cultivar	
Nodding Onion	Ⓝ Allium cernuum	☀	☾		☀	☹	1.5 ft	1 ft	Pale pink star-like flowers nod towards the ground; Great for native bees	
Prairie Onion	Ⓝ Allium stellatum	☀	☾		☀	☹	1.5 ft	1 ft	Pink-lavender star-like flowers	
Leadplant	Ⓝ Amorpha canescens	☀				☹	2-3 ft	2-2.5 ft	Great pollinator species	
Canada Anemone	Ⓝ Anemone canadensis	☀	☾		☀	☹	1 ft	1-1.5 ft	Spreads aggressively; Best suited for confined spaces	
Wild Columbine	Ⓝ Aquilegia canadensis		☾	●	☀	☹	1-2 ft	1-2 ft	Seeds freely; Great shade plant	
Aruncus 'Misty Lace'	Aruncus 'Misty Lace'	☀	☾		☀	☹	1-1.5 ft	1-1.5 ft	Tough Plant; Pollinator species	
Showy Milkweed	Ⓝ Asclepias speciosa	☀			☀	☹	4 ft	2 ft	Monarch host plant	
Butterfly Milkweed	Ⓝ Asclepias tuberosa	☀			☀	☹	2-2.5 ft	1-2 ft	Difficult to establish; Prefers sandy soil; Monarch host plant	
Whorled Milkweed	Ⓝ Asclepias verticillata	☀	☾		☀	☹	1-2 ft	1-2 ft	Spreads by rhizome; Monarch host plant	
Lady Fern	Ⓝ Athyrium filix-femina		☾	●	☀		1-3 ft	1-2 ft	Great fern for woodland gardens	
White Wild Indigo	Ⓝ Baptisia alba	☀	☾		☀	☹	3-4 ft	2-4 ft	Nitrogen fixing legume	
Blue Wild Indigo	Ⓝ Baptisia australis	☀	☾		☀	☹	3-4 ft	3-4 ft	Perennial forb with shrub-like form	
Lance-leaf Coreopsis	Ⓝ Coreopsis lanceolata	☀				☹	2 ft	1 ft	Prefers dry and sandy soils	
Purple Prairie Clover	Ⓝ Dalea purpurea	☀			☀	☹	2-3 ft	1-1.5 ft	Great pollinator species	
Narrow-Leaved Coneflower	Ⓝ Echinacea angustifolia	☀			☀	☹	1-2 ft	.75-2 ft	Great pollinator species	

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

Ⓝ Minnesota native plant species



Plant List

Perennial Forbs:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Purple Coneflower	Ⓝ Echinacea purpurea	☀	☉			☔	☕	2-5 ft	2 ft	Seeds freely, but is not an aggressive spreader
Rattlesnake Master	Ⓝ Eryngium yuccifolium	☀				☔	☕	3-4 ft	1-2 ft	Interesting bristly white flowers
Wild Geranium	Ⓝ Geranium maculatum	☀	☉			☔	☕	1 ft	1.5-2 ft	Dry shade plant with fragrant foliage; Clump forming
Prairie Smoke	Ⓝ Geum triflorum	☀	☉			☔	☕	<1 ft	<1 ft	Interesting pink seeds resemble smoke,
Maximilian's Sunflower	Ⓝ Helianthus maximiliani	☀	☉			☔	☕	6-7 ft	3-4 ft	Very showy and great for native bee species; May spread aggressively
Early Sunflower	Ⓝ Heliopsis helianthoides	☀	☉			☔	☕	3-5 ft	1-3 ft	Good for massing; Blooms summer long
Daylily Cultivars	Hemerocallis spp.	☀	☉	●		☔	☕	1-3 ft	1-3 ft	Preferred cultivars: 'Stello de Oro' and 'Happy Returns'
Prairie Alumroot	Ⓝ Heuchera richardonii	☀	☉			☔	☕	2 ft	1 ft	Attractive to hummingbirds and butterflies
Hosta Cultivars	Hosta spp.		☉	●		☔	☕	1-2 ft	1-3 ft	Many cultivars available
Sedum 'Autumn Joy'	Hylotelephium 'Herbstfreude'	☀	☉			☔	☕	1.5-2 ft	1.5-2 ft	Attractive to pollinators
Rough Blazing Star	Ⓝ Liatris aspera	☀	☉			☔	☕	2-4 ft	.5 ft	Excellent pollinator species
Meadow Blazing Star	Ⓝ Liatris ligulistylis	☀	☉		☔	☔		4-5 ft	1.5-2 ft	Provides monarch food plant
Solomon's Plume	Ⓝ Maianthemum racemosum		☉	●		☔	☕	2-3 ft	1-2 ft	Hardy shade plant
Starry Solomon's Plume	Ⓝ Maianthemum stellatum	☀	☉	●		☔	☕	1-2 ft	1-2 ft	Drought and shade tolerant ground cover
Ostrich Fern	Ⓝ Matteuccia struthiopteris	☀	☉	●	☔	☔		3-6 ft	3-5 ft	Aggressive filler; Use in contained sites only
Wild Bergamot	Ⓝ Monarda fistulosa spp.	☀	☉		☔	☔	☕	4 ft	2-3 ft	Many attractive cultivars such as 'Raspberry Wine'
Spotted Bee Balm	Ⓝ Monarda punctata	☀	☉			☔	☕	2 ft	1 ft	Drought tolerant; Good for sandy soils
Peony	Paeonia	☀	☉			☔	☕	3 ft	3 ft	Spring blooming; many cultivars available

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

Ⓝ Minnesota native plant species



Plant List

Perennial Forbs:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Prairie Phlox	Phlox pilosa	☀	☀			☀	☹	2 ft	.75-1 ft	Attractive to rabbits
Jacob's Ladder	Polemonium reptans	☀	☀			☀	☹	1 ft	.5-1 ft	Early blooming blue flower; Great for shady areas
Pasque Flower	Pulsatilla vulgaris	☀	☀				☹	0.5 ft	0.5 ft	Among the first perennial spring bloomers; Prefers alkaline soils
Yellow Coneflower	Ratibida pinnata	☀				☀	☹	3-4 ft	1-2 ft	Seeds freely; Good for naturalized areas
Wild Petunia	Ruellia humilis	☀				☀	☹	1 ft	1-2 ft	Good as a ground cover; Can be aggressive
Salvia 'Caradonna'	Salvia nemorosa 'Caradonna'	☀					☹	1-2 ft	1-2 ft	Many other nice cultivars
Salvia 'May Night'	Salvia x sylvestris 'May Night'	☀					☹	1.5-2 ft	1-1.5 ft	Drought tolerant and profusely flowering
Zig-Zag Goldenrod	Solidago flexicaulis		☀	●		☀	☹	2-3 ft	1-2 ft	Can be aggressive; Best for larger woodland restoration areas
Showy Goldenrod	Solidago speciosa	☀				☀	☹	2-3 ft	2-3 ft	Showy flowers; Best in sandy soil
Heart-leaved Aster	Symphiotrichum cordifolium		☀	●		☀	☹	2-3 ft	1-2 ft	Blue flowers attractive to pollinators; Great for shady gardens
Smooth Aster	Symphiotrichum laevis	☀	☀		☀	☀	☹	3-4 ft	2-4 ft	Seeds freely; Beautiful blue flowers
Calico Aster	Symphiotrichum lateriflorum	☀	☀	●	☀	☀	☹	2 ft	1-3 ft	Attractive white flowers with multi-colored central disks
Big Leaf Aster	Symphiotrichum macrophyllum		☀	●		☀	☹	1 ft	1-2 ft	Shade tolerant ground cover
Azure Aster	Symphiotrichum oolentangiense	☀	☀			☀	☹	3 ft	2 ft	Blue flowers are attractive to pollinators
Prairie Spiderwort	Tradescantia bracteata	☀	☀			☀	☹	2-3 ft	1-2 ft	Goes dormant in late summer
Prairie Violet	Viola pedatifida	☀	☀			☀	☹	0.5 ft	0.5 ft	Early spring bloomer; Good for small dry gardens
Hoary Vervain	Verbena stricta	☀	☀			☀	☹	2-4 ft	1-2 ft	Seeds freely; Drought tolerant

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

Ⓝ Minnesota native plant species



Plant List

Grasses and Sedges:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Side-Oats Grama	Ⓝ Bouteloua Curtipendula	☀	☾			☂	☕	2 ft	1-2 ft	Decorative grass; Preferred cultivar: "Blonde Ambition"
Blue Grama Grass	Ⓝ Bouteloua gracilis	☀				☂	☕	1 ft	1 ft	Appropriate for sandy sites
Feather Reed Grass 'Karl Foerster'	Calamagrostis × acutiflora 'Karl Foerster'	☀	☾		💧	☂	☕	3-5 ft	2-3 ft	Grows well in wide range of conditions; Stands through winter
Plains Oval Sedge	Ⓝ Carex brevior	☀	☾	●		☂	☕	2 ft	.5-1 ft	Drought tolerant
Pennsylvania Sedge	Carex pensylvanica	☀	☾	●		☂	☕	.5 ft	.5-1 ft	Grows well in wide range of conditions; Attractive foliage
Long-Beaked Sedge	Ⓝ Carex sprengeii		☾	●		☂	☕	1-2 ft	1 ft	Shade tolerant
Tufted Hair Grass	Ⓝ Deschampsia cespitosa	☀	☾			☂	☕	2.5-3 ft	2 ft	Greens up early in spring
Junegrass	Ⓝ Koeleria macrantha	☀					☕	2 ft	1 ft	Can survive on green roofs
Switch Grass	Ⓝ Panicum virgatum	☀	☾		💧	☂	☕	4-5 ft	1.5-2 ft	Preferred Cultivars: 'Shenandoah' and 'Northwind'
Little Bluestem	Ⓝ Schizachyrium scoparium	☀				☂	☕	2-4 ft	1.5-2 ft	Preferred Cultivar: 'Blue Heaven'; Stands upright throughout winter
Indian Grass	Ⓝ Sorghastrum nutans	☀	☾			☂	☕	3-5 ft	2-3 ft	Use the native form in natural areas; Seeds freely
Prairie Cordgrass	Ⓝ Spartina pectinata	☀	☾		💧	☂		4-6 ft	2-4 ft	Can spread aggressively
Prairie Dropseed	Ⓝ Sporobolus heterolepis	☀	☾			☂	☕	2-3 ft	2-3 ft	Preferred Cultivar: 'Tara'; Well behaved and showy native

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

Ⓝ Minnesota native plant species



Plant List

Shrubs:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Regent Serviceberry	Amelanchier alnifolia 'Regent'	☀	☀	●		☀	☀	4-6 ft	4-8 ft	Fruit edible to birds and people
New Jersey Tea	Ⓝ Ceanothus americanus	☀	☀			☀	☀	2-3.5 ft	3 ft	Performs best in sandy soil
Pagoda Dogwood	Ⓝ Cornus alternifolia	☀	☀	●		☀	☀	15-25 ft	20-30 ft	Beautiful native understory tree
Muskingum Grey Dogwood	Cornus racemosa 'Muszam'	☀	☀			☀	☀	3 ft	5 ft	Low growing and slowly spreading; Good for massing
American Hazelnut	Ⓝ Corylus americana	☀	☀	●		☀	☀	6-10 ft	6-10 ft	Produces edible nuts; Best for natural settings
Witch Hazel	Ⓝ Hamamelis virginiana	☀	☀	●		☀	☀	15-20 ft	15-20 ft	Fall blooming shrub
Hydrangea	Hydrangea paniculata	☀	☀			☀	☀	3-5 ft	3-5 ft	Many good cultivars; Great for massing and winter interest
Kalm's St. John's-wort	Hypericum kalmianum	☀	☀			☀	☀	1-3 ft	3-5 ft	Semi-evergreen shrub with bright yellow flowers in summer
Mint Julep Juniper	Juniperus chinensis 'Mint Julep'	☀				☀	☀	5 ft	5-8 ft	Beautiful deep green foliage year round
Calgary Carpet Juniper	Juniperus sabina 'Monna'	☀	☀			☀	☀	1 ft	5-8 ft	Beautiful deep green foliage year round
Mockorange	Philadelphus spp.	☀	☀			☀	☀	5-6 ft	3-4 ft	Good Cultivars: 'Blizzard', 'Snowbelle', 'Aureus'
Ninebark	Ⓝ Physocarpus opulifolius	☀	☀			☀	☀	5-10 ft	5-10 ft	Good Cultivars: 'Diabolo', 'Dart's Gold', 'Center Glow'
Fragrant Sumac	Ⓝ Rhus aromatica	☀	☀			☀	☀	3-6 ft	5-10 ft	Beautiful red fall color
Fragrant Sumac 'Gro-Low'	Rhus aromatica 'Gro-Low'	☀	☀			☀	☀	2-3 ft	5-8 ft	Excellent for massing; Drought tolerant; Short stature and spreading habit
Alpine Currant	Ribes alpinum	☀	☀	●		☀	☀	3-6 ft	3-6 ft	Excellent for hedging

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

Ⓝ Minnesota native plant species



Plant List

Shrubs:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Goldmound Spirea	<i>Spiraea japonica</i> 'Gold Mound'	☀			💧	👉	2-3 ft	3-4 ft	Leaves emerge gold in spring and fade to gold-green mid summer	
Snowmound Spirea	<i>Spiraea nipponica</i> 'Snowmound'	☀	🌑		💧	👉	2-4 ft	2-4 ft	Dwarf habit; Beautiful spring flowers	
White Snowberry	① <i>Symphoricarpos albus</i>	☀	🌑		💧	👉	3-5 ft	3-5 ft	Fruits persist into winter providing forage for birds and wildlife	
Coralberry	① <i>Symphoricarpos orbiculatus</i>	☀	🌑		💧	👉	2-5 ft	4-8 ft	Forms extensive colonies	
Dwarf Korean Lilac	<i>Syringa meyeri</i>	☀			💧	👉	4-5 ft	5-6 ft	Dwarf shrub; Mildew resistant; Abundant fragrant flowers	
Miss Kim Lilac	<i>Syringa pubescens</i> subsp. <i>patula</i> 'Miss Kim'	☀			💧	👉	4-10 ft	5-10 ft	Abundant fragrant flowers; Crimson fall color	
Yew	<i>Taxus x media</i>	☀	🌑	●	💧	👉	2-20 ft	2-12 ft	Tolerates a wide range of conditions; Preferred Cultivar: 'Taunton'	
Northsky Blueberry	<i>Vaccinium</i> 'Northsky'	☀	🌑		💧	👉	1-2 ft	2-3 ft	Fruiting shrub preferring acidic soil; Pair with 'Northcounty' for pollination	
Viburnum	① <i>Viburnum dentatum</i>	☀	🌑		💧	👉	3-5 ft	3-5 ft	Best Cultivar: 'Christom' Blue Muffin	
Arrowwood Viburnum 'Morton'	<i>Viburnum dentatum</i> 'Morton'	☀	🌑		💧	👉	10-12 ft	8-10 ft	Provides shelter and forage for birds	
Wayfaring Bush Viburnum	<i>Viburnum lantana</i>	☀	🌑		💧	👉	7-10 ft	7-10 ft	Preferred Cultivar: 'Mohican'	
Blackhaw Viburnum	<i>Viburnum prunifolium</i>	☀	🌑		💧	👉	12-14 ft	8-12 ft	Berries attract birds and mammals	
American Highbush Cranberry	① <i>Viburnum trilobum</i>	☀	🌑		💧	👉	8-10 ft	8-10 ft	Preferred Cultivar: 'Wentworth'; Winter interest	

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

① Minnesota native plant species



Plant List

These perennial forbs, grasses, sedges, and shrubs are appropriate for planting in rain gardens and other temporarily inundated stormwater management features. Refer to *Plants for Stormwater Design: Species Selection for the Upper Midwest* by Daniel Shaw and Rusty Schmidt (2003) for more a more thorough guide to plant selection based on hydrology and stormwater function.

Rain Garden Plants:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Perennial Forbs										
Sweet Flag	Ⓝ Acorus calamus	☀			💧			1-2 ft	1-2 ft	Good for pond edges and wetland margins
Marsh Milkweed	Ⓝ Asclepias incarnata	☀	☉		💧	💧		4 ft	1.5-3	Seeds freely; Monarch host plant
Turtlehead	Ⓝ Chelone glabra	☀	☉		💧	💧		2-3.5 ft	1.5-3	Good for wet, shady sites
Boneset	Ⓝ Eupatorium perfoliatum	☀	☉		💧	💧		4-6 ft	3-4 ft	Great pollinator species
Joe-Pye Weed	Ⓝ Eutrochium maculatum	☀	☉		💧	💧		4-6 ft	3-4 ft	Many nice cultivars; Good for shadier sites
Bottle Gentian	Ⓝ Gentiana andrewsii	☀	☉		💧	💧		1-2 ft	1-2 ft	Colorful late-season bloomer
Sneezeweed	Ⓝ Helenium autumnale	☀	☉		💧	💧		4 ft	1.5	Late summer/fall bloomer
Blue Flag Iris	Ⓝ Iris versicolor	☀	☉		💧	💧		2-3 ft	2 ft	Must have evenly moist soil
Prairie Blazing Star	Ⓝ Liatris pycnostachya	☀			💧	💧		2-5 ft	1.5-2 ft	Great monarch food plant
Cardinal Flower	Ⓝ Lobelia cardinalis	☀	☉		💧	💧		3-4 ft	1 ft	Swallowtail butterfly and hummingbird nectar source; Good for shade
Great blue Lobelia	Ⓝ Lobelia siphilitica	☀	☉		💧	💧		2-3 ft	1-1.5 ft	Great for bees
Obedient Plant	Ⓝ Physostegia virginiana	☀	☉		💧	💧		2-3 ft	1-1.5 ft	Can spread aggressively
New England Aster	Ⓝ Symphiotrichum novae-angliae	☀			💧	💧		3-5.5 ft	2-3 ft	Seeds freely; Plant in contained sites only
Blue Vervain	Ⓝ Verbena hastata	☀			💧	💧		3-6 ft	1-2 ft	Seeds freely; Colonizes wet areas
Ironweed	Ⓝ Vernonia fasciculata	☀	☉		💧	💧		5-6 ft	2-3 ft	Pollinator species
Culver's Root	Ⓝ Veronicastrum virginicum	☀	☉		💧	💧		4-5 ft	2-3 ft	Pollinator species
Golden Alexander	Ⓝ Zizia aurea	☀	☉		💧	💧	💧	2-3 ft	2 ft	Seeds aggressively; Plant in contained sites only

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

Ⓝ Minnesota native plant species



Plant List

Rain Garden Plants:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Grasses and Sedges										
Fringed Brome	Ⓝ Bromus ciliatus	☀	☾	●	☾	☾		2-4 ft	1-2 ft	Great cool season grass for rain gardens
Blue Joint Grass	Ⓝ Calamagrostis canadensis	☀	☾		☾	☾		3-4 ft	2-3 ft	Spreads aggressively by rhizomes
Palm Sedge	Ⓝ Carex muskingumensis	☀	☾		☾	☾		1-2 ft	1-2 ft	Preferred Cultivar: 'Oehme'; Excellent rain garden species
Long-Beaked Sedge	Ⓝ Carex sprengeii		☾	●	☾	☾		2 ft	1 ft	Prefers moist soil; Grows well in shade
Fox Sedge	Ⓝ Carex vulpinoidea	☀	☾		☾	☾		3 ft	1-2 ft	Prefers moist soil; Adaptable and easy to grow
Canada Wildrye	Ⓝ Elymus canadensis	☀	☾		☾	☾	☾	4-5 ft	2-3 ft	Seed heads can be sharp; Use caution in a garden setting
Common Rush	Ⓝ Juncus effusus	☀			☾			2-4 ft	2-4 ft	Best for wet areas
Wool Grass	Ⓝ Scirpus cyperinus	☀			☾			4-5 ft	1-2 ft	Clumps form from rhizomes and can be divided to start new plants
Indian Grass	Ⓝ Sorghastrum nutans	☀	☾		☾	☾	☾	5-6 ft	2-3 ft	Spreads aggressively; Use only in contained sites or managed areas
Cordgrass	Ⓝ Spartina pectinata	☀	☾		☾	☾		6-8 ft	2-3 ft	Aggressive; Best in larger landscapes; Use to combat Reed Canary Grass
Shrubs										
Saskatoon	Amelanchier alnifolia	☀	☾	●	☾	☾	☾	4-15 ft	6-8 ft	Blue-purple berries provide food for wildlife; Fragrant white flowers
False Indigo	Ⓝ Amorpha fruticosa	☀	☾		☾	☾	☾	6-12 ft	4-6 ft	Great pollinator plant; Spreads by self-seeding suckers
Glossy Black Chokeberry	Ⓝ Aronia melanocarpa	☀	☾		☾	☾		4-6 ft	4-6 ft	Best Cultivars: 'Autumn Magic', 'Morton', and 'Viking'
Buttonbush	Ⓝ Cephalanthus occidentalis	☀	☾		☾	☾		4-12 ft	4-8 ft	Flowers attract many pollinator species; Prefers moist sites
Grey Dogwood	Ⓝ Cornus racemosa	☀	☾		☾	☾	☾	10-15 ft	10-15 ft	Adapts to a wide range of conditions; Spreads by rhizome
Redtwig Dogwood	Ⓝ Cornus sericea	☀	☾		☾	☾		6-10 ft	6-10 ft	Excellent for massing; Best if cut back to 6" every 5 years
Dwarf Bush Honeysuckle	Ⓝ Diervilla lonicera	☀	☾	●	☾	☾	☾	2-3 ft	2-4 ft	Short stature shrub; Excellent for massing
Meadow Sweet	Ⓝ Spiraea alba	☀	☾		☾	☾		3-4 ft	3-4 ft	Requires consistent moisture
Winterberry 'Red Sprite'	Ilex verticillata 'Red Sprite'	☀	☾	●	☾	☾		5-7 ft	5-7 ft	Must plant with male 'Jim Dandy' for flowering

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

Ⓝ Minnesota native plant species

Plant List

Deciduous Trees:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Red Maple	Ⓝ Acer rubrum	☀	☀	☐	☀	☀	☐	40-80 ft	30-50 ft	Best Cultivars: Northwood®, Red Sunset®, Red Rocket®
Sugar Maple	Ⓝ Acer saccharum	☀	☀	●	☀	☀	☐	40-60 ft	30-60 ft	Native tree with exceptional fall color
Freeman Maple	Acer x freemanii	☀	☀	☐	☀	☀	☐	40-50 ft	30-40 ft	Best Cultivars: Autumn Blaze®, Celebration®, Sienna Glen®
Ohio Buckeye 'Autumn Splendor'	Aesculus glabra 'Autumn Splendor'	☀	☀	☐	☐	☀	☐	20-40 ft	20-40 ft	Nut producing; Beautiful fall color
Downy Serviceberry	Ⓝ Amelanchier arborea	☀	☀	●	☀	☀	☐	15-25 ft	15-25 ft	Understory tree
Autumn Brilliance Serviceberry	Amelanchier x grandiflora 'Autumn Brilliance'	☀	☀	☐	☐	☀	☐	15-25 ft	15-25 ft	Salt tolerant; Attractive to pollinators
River Birch	Ⓝ Betula nigra	☀	☀	☐	☀	☀	☐	40-70 ft	20-50 ft	Attractive white bark; Drops leaves and twigs late summer
Paper Birch	Ⓝ Betula papyrifera	☀	☀	☐	☀	☀	☐	50-70 ft	30-50 ft	Best Cultivars: Renaissance Oasis®, Prairie Dream®
Whitespire Birch	Betula populifolia	☀	☀	☐	☀	☀	☐	20-40 ft	15-20 ft	Disease resistant; Smooth Bark
Blue Beech	Ⓝ Carpinus caroliniana	☀	☀	●	☀	☀	☐	20-30 ft	20-30 ft	Tolerant of urban conditions
Bitternut Hickory	Ⓝ Carya cordiformis	☀	☀	☐	☐	☀	☐	50-80 ft	30-50 ft	Nut producing
Shagbark Hickory	Ⓝ Carya ovata var. ovata	☀	☀	☐	☐	☀	☐	50-60 ft	40-50 ft	Interesting bark
Northern Catalpa	Ⓝ Catalpa speciosa	☀	☀	☐	☐	☀	☐	40-70 ft	20-50 ft	Drops seed and flowers
Common Hackberry	Ⓝ Celtis occidentalis	☀	☀	☐	☀	☀	☐	40-60 ft	40-60 ft	Deep root system provides drought tolerance
Thornless Cockspur Hawthorn	Crataegus crus-galli var. inermis	☀	☀	☐	☐	☀	☐	20-25 ft	20-25 ft	Very drought tolerant
Honeylocust	Ⓝ Gleditsia triacanthos	☀	☐	☐	☐	☀	☐	35-50 ft	25-35 ft	Best Cultivars: Skyline®, Imperial®, Northern Acclaim®
Kentucky Coffeetree	Gymnocladus dioicus	☀	☐	☐	☐	☀	☐	60-80 ft	30-50 ft	Best Cultivars: 'Stately Manor' and 'Espresso'
Black Walnut	Ⓝ Juglans nigra	☀	☐	☐	☐	☀	☐	60-80 ft	60-80 ft	Plant only in wild areas; Inhibits plant growth beneath canopy
Royal Raindrops Crabapple	Malus 'JFS-KW5'	☀	☐	☐	☐	☀	☐	15-20 ft	15-20 ft	Purple foliage with magenta flowers
Prairie Fire Crabapple	Malus 'Prairifire'	☀	☐	☐	☐	☀	☐	15-20 ft	15-20 ft	Disease resistant; Fruit persists throughout winter; Eaten by birds
Red Jewel Crabapple	Malus 'Red Jewel'	☀	☐	☐	☐	☀	☐	15-20 ft	15-20 ft	Disease resistant; White flowers

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

Ⓝ Minnesota native plant species

Plant List

Deciduous Trees:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Spring Snow Crabapple	Malus 'Spring Snow'	☀			💧			20-30 ft	15-25 ft	Not fruit producing
Sugar Tyme® Crabapple	Malus 'Sutyzam'	☀			💧	💧		15-20 ft	15-20 ft	Scab resistant; Profusion of white blooms that emerge pink
Ironwood	Ⓝ Ostrya virginiana	☀	☉		💧	💧		25-40 ft	25-40 ft	Good urban tree; Preforms well in narrow boulevards
Bigtooth Aspen	Ⓝ Populus grandidentata	☀			💧			70-95 ft	30-60 ft	Fast growing; Plant in natural areas
Quaking Aspen	Ⓝ Populus tremuloides	☀			💧			20-50 ft	20-30 ft	Fast growing; Plant in natural areas
American Plum	Ⓝ Prunus americana	☀	☉		💧	💧		15-25 ft	15-25 ft	Spreads by rhizomes; Plant in natural areas
Pin Cherry	Ⓝ Prunus pensylvanica	☀	☉		💧	💧		20-40 ft	10-20 ft	Plant in natural areas
Black Cherry	Ⓝ Prunus serotina	☀	☉		💧	💧		50-60 ft	20-30 ft	Plant in natural areas
Chokecherry	Ⓝ Prunus virginiana	☀	☉		💧	💧		20-40 ft	15-20 ft	Spreads by rhizomes; Plant in natural areas
White Oak	Ⓝ Quercus alba	☀			💧	💧		50-80 ft	50-80 ft	Long lived; Wildlife supporting
Crimson Spire Oak	Quercus alba x Quercus robur	☀			💧	💧		50-80 ft	50-80 ft	Columnar form; Fast growing; Drought tolerant
Swamp White Oak	Ⓝ Quercus bicolor	☀			💧	💧	💧	50-60 ft	50-60 ft	Tolerant of salt, heat and drought
Northern Pin Oak	Ⓝ Quercus ellipsoidalis	☀			💧	💧	💧	50-80 ft	40-60 ft	Preferred Cultivar: Majestic Skies®; Stunning fall color; Drought tolerant
Bur Oak	Ⓝ Quercus macrocarpa	☀			💧	💧	💧	50-80 ft	50-80 ft	Spreading form; Wildlife and insect supporting
Pin Oak	Ⓝ Quercus palustris	☀			💧	💧	💧	50-80 ft	50-80 ft	Beautiful form
Northern Red Oak	Ⓝ Quercus rubra	☀			💧	💧	💧	60-80 ft	40-60 ft	Tolerant of urban conditions; Wildlife supporting
Japanese Tree Lilac	Syringa reticulata 'Ivory Silk'	☀	☉		💧			20-30 ft	20-30 ft	Small street tree with profuse blooms
American Linden	Ⓝ Tilia americana	☀	☉		💧	💧		50-80 ft	50-80 ft	Good Cultivars: 'Redmond', 'Boulevard'
Littleleaf Linden	Tilia cordata	☀	☉		💧			50-70 ft	40-60 ft	Disease resistant; Pollinator species
Elm Tree	Ulmus sp.	☀			💧	💧	💧	40-60 ft	30-40 ft	Choose Dutch Elm Disease resistant cultivars only

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

Ⓝ Minnesota native plant species

Plant List

Coniferous Trees:

Common Name	Scientific Name	Sun Exposure			Soil Moisture			Height (ft)	Spread (ft)	Notes & Recommended Cultivars
		Full Sun	Part Sun	Shade	Wet	Medium	Dry			
Eastern Red Cedar	Ⓝ Juniperus virginiana	☀			☔	☔		40-50 ft	10-15 ft	Tolerates hot and dry sites; Can be a host for Cedar Apple Rust
American Larch	Ⓝ Larix laricina	☀			☔	☔		40-80 ft	20-40 ft	Tolerates wet sites; Deciduous conifer that loses needles in winter
White Spruce	Ⓝ Picea glauca	☀			☔	☔		40-60 ft	10-20 ft	Native to Blufflands and Anoka Sand Plain; Avoid hot, dry sites
Black Hills Spruce	Picea glauca var. densata	☀			☔	☔		30-60 ft	15-25 ft	Better heat and drought tolerance than some other spruces
Black Spruce	Ⓝ Picea mariana	☀	☾		☔			70-75 ft	20-30 ft	Native to all of Southeast Minnesota
Jack Pine	Ⓝ Pinus banksiana	☀					☔	30-60 ft	15-25 ft	Does not tolerate heat and humidity well
Red Pine (aka Norway Pine)	Ⓝ Pinus resinosa	☀					☔	60-80 ft	25-40 ft	The Minnesota state tree
White Pine	Ⓝ Pinus strobus	☀			☔	☔	☔	60-80 ft	25-40 ft	Tall, straight native pine tree
White Cedar (aka Arborvitae)	Ⓝ Thuja occidentalis	☀	☾		☔	☔		25-50 ft	10-15 ft	Preferred cultivars: 'Techny' and 'Brandon'

*Ideal exposure: **Full Sun** = >6 hours of daily sunlight, **Partial Sun** = 3 - 6 hours of daily sunlight, **Shade** = <3 hours of daily sunlight

** Soil moisture: **Wet** = Excessively wet in spring and after rain events, **Medium** = average garden soil, **Dry** = excessively well drained

Ⓝ Minnesota native plant species



Plants to Avoid *These species should not be planted on Hennepin County properties. They are either on the Minnesota Invasive Species List or on the Species of Concern List. They reproduce aggressively threatening wildlife habitat and resulting in the need for added maintenance.*

Perennial Flowers:

Common Name	Scientific Name
Flowering Rush	Butomus umbellatus
European Bellflower	Campanula rapunculoides
Oxeye Daisy	Chrysanthemum leucanthemum
Crown Vetch	Coronilla varia
Queen Ann's Lace	Daucus carota
Grecian Foxglove	Digitalis lanata
Cut-leaved Teasel	Dipsacus laciniatus
Giant Hogweed	Heracleum mantegazzianum
Dame's Rocket	Hesperis matronalis
Yellow Iris	Iris pseudacorus
Dalmatian Toadflax	Linaria dalmatica
Birdsfoot Trefoil	Lotus corniculatus
Large-Leaved Lupine	Lupinus polyphyllus
Moneywort	Lysimachia nummularia
Japanese Knotweed	Polygonum cuspidatum
Giant Knotweed	Polygonum sachalinense
Common Tansy	Tanacetum vulgare
Cow Vetch	Vicia cracca
Hairy Vetch	Vicia villosa

Trees:

Amur Maple	Acer ginnala
Norway Maple	Acer platanoides
Tree of Heaven	Ailanthus altissima
Russian Olive	Elaeagnus angustifolia
Autumn Olive	Elaeagnus umbellata
Callery Pear	Pyrus calleryana
Glossy Buckthorn	Rhamnus frangula
Black Locust	Robinia pseudoacacia
Siberian Elm	Ulmus pumila

Grasses:

Common Name	Scientific Name
Smooth Brome	Bromus inermis
Japanese Stilt Grass	Microstegium vimineum
Amur Silver Grass	Miscanthus sacchariflorus
Chinese Silver Grass	Miscanthus sinensis
Phragmites	Phragmites australis

Shrubs:

Korean Barberry	Berberis koreana
Japanese Barberry	Berberis thunbergii
Siberian Peashrub	Caragana arborescens
Russian Peashrub	Caragana frutex
Winged Euonymus & Cultivars	Euonymus alatus
Cheyenne Privet	Ligustrum vulgare
Golden Vicary Privet	Ligustrum x vicaryi
Asian Honeysuckles	Lonicera tatarica, L. morrowii, L. x bella, L. maackii
Multiflora Rose	Rosa multiflora
False Spirea	Sorbaria sorbifolia
Summer Glow Tamarisk	Tamarix ramosissima
Guelder-rose	Viburnum opulus var. opulus

Vines:

Oriental Bittersweet	Celastrus orbiculatus
Japanese Hops	Humulus japonicus

APPENDIX C

LANDSCAPE MAINTENANCE CHECKLISTS



General Landscape Maintenance Tasks

Maintenance tasks required for the care and upkeep of trees, shrubs, and perennials.

Late Winter (February 1 – March 31)

- Prune woody shrubs and trees.
 - Remove tree suckers, prune tree branches for form & structure.
 - Prune woody shrubs- remove odd or damaged branches only.

Spring (April 1 – May 15)

- Provide early weeding to remove early germinating annual weeds.
- Cut perennials back to 4-6", cut grasses back to top of clump mass.
- Remove leaf litter in planting beds in early May.
- Cut back previous season seedheads & grass stems in early May.
- Refresh mulch (provide continuous 3" layer of finely shredded hardwood mulch). Do not provide more mulch than is needed. Do not pile mulch against tree trunks or on the stems and branches of shrubs and perennials.
- Prune ground cover shrubs back to sidewalk or curb edges where necessary for accessibility.

Early Summer (May 15 – June 30)

- Weeding: hand pull weeds from landscape beds.
- Divide and transplant perennials as needed.
- Fill water bags on new trees weekly.

Late Summer (July 15 – August 31)

- Weeding: hand pull weeds from landscape beds.
- Pruning: trim back foliage drooping on sidewalk for accessibility.
- Do not prune or deadhead perennials after blooming. Leave spent flowers and seedheads intact for habitat & seasonal interest.
- Fill water bags on new trees weekly.

Fall (September 1 – October 31)

- Weeding: hand pull weeds from landscape beds.
- Transplant/divide perennials if desired to maintain single species masses.
- Leave grasses & seedheads through season for winter interest.
- Prune flopping/ drooping material only for aesthetics, as desired.
- Do not remove leaf litter in beds.
- Fill water bags on new trees weekly.

Early Winter (November 15 – December 31)

- Protect tree and shrub trunks as needed from rodent damage.
- Snow removal review with maintenance staff:
 - Mark snow-storage areas: do not pile snow on planting beds.
 - Review salt-use policies. Minimize salt-use.

TREES	Description of Work Completed	By Name / Date	Owner's Rep Name / Date
Late Winter (February 1 – March 31)			
Prune trees & remove suckers, prune tree branches for form & structure (Oaks: November-March only)			
Maintain tree wrap			
Spring (April 1 – May 15)			
Remove tree wrap			
Adjust treestakes as needed			
Spray with insecticide to keep pest free as needed (required documentation)			
Fertilize deciduous trees if needed per soil testing			
Add new mulch every three years, or as needed			
Water bags – Fill (weekly)			
Early Summer (May 15 – June 30)			
Water bags – Fill (weekly)			
Late Summer (July 15- August 31)			
Water bags – Fill (weekly)			
Fall (September 1 – October 31)			
Water bags – Fill (weekly)			
Replace dead trees			
Protect from grazing damage by wrapping trees			
Early Winter (November 15 – December 31)			
Maintain tree wrap			

SHRUBS	Description of Work Completed	By Name / Date	Owner's Rep Name / Date
Late Winter (February 1 – March 31)			
Prune & trim back foliage, remove odd or damaged branches only			
Spring (April 1 – May 15)			
Remove excess leaf litter in beds			
Fertilize shrub beds (yearly) if needed per soil testing (provide testing report)			
Hand pull weeds in shrub beds – monthly through growing season			
Topdress mulch as needed, 3" max. in beds			
Early Summer (May 15 – June 30)			
Replace shrubs as needed			
Hand pull weeds in shrub beds – monthly through growing season			
Late Summer (July 15- August 31)			
Prune overgrown foliage for aesthetics or that may be blocking walks			
Hand pull weeds in shrub beds – monthly through growing season			

PERENNIALS	Description of Work Completed	By Name / Date	Owner's Rep Name / Date
Spring (April 1 – May 15)			
Remove excess leaf litter in beds (after May 1)			
Prune & trim back previous season foliage			
Fertilize perennial beds as needed per soil testing (provide testing report)			
Hand pull weeds in perennial beds – monthly through growing season			
Topdress mulch as needed, 3" max. in beds			
Early Summer (May 15 – June 30)			
Replace/ transplant/divide perennials as needed			
Hand pull weeds in perennial beds – monthly through growing season			
Late Summer (July 15- August 31)			
Prune overgrown foliage for aesthetics or that may be blocking walks			
Hand pull weeds in perennial beds – monthly through growing season			
Fall (September 1 – October 31)			
Leave perennials & grasses undisturbed until Spring for habitat and winter interest			
Leave leaf litter on beds for protective mulch over winter			

LOW GROW FESCUE SEEDING AREAS	Description of Work Completed	By Name / Date	Owner's Rep Name / Date
Spring (April 1 – May 15)			
Weed (monthly) via spot spraying			
Early Summer (May 15 – June 30)			
Hand pull weeds: No spot spray weeding to avoid damage to fescue			
Initial mowing: 3" height or greater (late May/early June)			
Late Summer (July 15- August 31)			
Hand pull weeds: No spot spray weeding to avoid damage to fescue			
No mowing to avoid possible damage to fescue			
Fall (September 1 – October 31)			
Weed (monthly) via spot spraying			
Maintenance mowing: 4" height or greater			
Aerate (yearly)			
Fertilize (yearly) if needed per soil testing; provide soil test report			
Overseed bare areas by hand as needed			

LOW MAINTENANCE TURF SEEDING AREAS	Description of Work Completed	By Name / Date	Owner's Rep Name / Date
Spring (April 1 – May 15)			
Dethatch (yearly) if signs of excess thatch present			
Weed (monthly) via spot spraying			
Initial mowing: 3" height or greater			
Early Summer (May 15 – June 30)			
Maintenance mowing (as needed): 3" height or greater			
Late Summer (July 15- August 31)			
Maintenance mowing (as needed): 3" height or greater			
Fall (September 1 – October 31)			
Weed (monthly) via spot spraying			
Maintenance mowing (as needed): 3" height or greater			
Aerate (yearly)			
Fertilize (yearly) if needed per soil testing; provide soil test report			
Overseed bare areas by hand as needed			



Native Seed Establishment Period Tasks

Maintenance tasks required to establish native vegetation via seed during growing seasons 1-5 after planting.

Growing Season 1

Spring (April 1 – May 15)

- When vegetation reaches a height of 10 to 12" cut down with a flail mower to a height of 6-8". This is to prevent smothering from cut materials.

Summer (May 15 – August 31)

- When vegetation reaches a height of 10 to 12" cut down with a flail mower to a height of 6-8". This is to prevent smothering from cut materials.

Fall (September 1 – October 31)

- When vegetation reaches a height of 10 to 12" cut down with a flail mower to a height of 6-8". This is to prevent smothering from cut materials.

Growing Season 2

Spring (April 1 – May 15)

- When vegetation reaches a height of 10 to 12" cut down with a flail mower to a height of 6-8". This is to prevent smothering from cut materials.

Summer (May 15 – August 31)

- Monitor the site monthly to detect areas of weed colonization.
- Mow/cut any seed heads of noxious weeds. Pull noxious weeds if occurring as individuals (not in clumps). Contact County Agricultural Inspector for IPM techniques for noxious weeds.

Fall (September 1 – October 31)

- Monitor the site monthly to detect areas of weed colonization.
- Mow/cut any seed heads of noxious weeds. Pull noxious weeds if occurring as individuals (not in clumps). Contact County Agricultural Inspector for IPM techniques for noxious weeds.

Growing Season 3

Early Summer (May 1 – June 1)

- Monitor the site to detect areas of weed colonization.

Summer (June 1 – July 20)

- Monitor the site to detect areas of weed colonization.
- Pull noxious weeds if the infestation is limited to a few individual plants. Cut or treat noxious weeds if the infestation is in larger patches. In this case either mow/cut off the flower heads or apply a target specific herbicide. Contact the County Agriculture Inspector for further guidance on treating and removing noxious weeds.

Fall (September 1 – October 31)

- Monitor the site to detect pioneering woody species.
- Cut and stump treat any pioneering woody species in the dormant season when leaves are changing colors or when leaves have fallen off the woody species.
- All woody vegetation must be cut no more than 2" from the ground (cut surface should be as flush as possible with the ground surface).
- All woody species to be cut and stump treated immediately with Triclopyr herbicide. The

mixture must contain a dye.

- Remove cut woody debris from site or slash on site if space permits.
- If the amount of woody material to treat is sparse the material can be slashed and spread on site. Materials under 1" caliper can be slashed and scattered evenly over the vegetated area. All slash material to be scattered evenly so that it does not exceed 1.5" in thickness.
- If the amount of woody material to treat is dense, cut materials shall be chipped and hauled off site.

Growing Season 4

Early Summer (May 1 – June 1)

- Monitor the site to detect areas of weed colonization.

Summer (June 1 – July 20)

- Monitor the site to detect areas of weed colonization.
- Pull noxious weeds if the infestation is limited to a few individual plants. Cut or treat noxious weeds if the infestation is in larger patches. In this case either mow/cut off the flower heads or apply a target specific herbicide. Contact the County Agriculture Inspector for further guidance on treating and removing noxious weeds.

Fall (September 1 – October 31)

- Monitor the site to detect pioneering woody species.
- Cut and stump treat any pioneering woody species in the dormant season when leaves are changing colors or when leaves have fallen off the woody species.
- All woody vegetation must be cut no more than 2" from the ground (cut surface should be as flush as possible with the ground surface).
- All woody species to be cut and stump treated immediately with Triclopyr herbicide. The mixture must contain a dye.
- Remove cut woody debris from site or slash on site if space permits.
- If the amount of woody material to treat is sparse the material can be slashed and spread on site. Materials under 1" caliper can be slashed and scattered evenly over the vegetated area. All slash material to be scattered evenly so that it does not exceed 1.5" in thickness.
- If the amount of woody material to treat is dense, cut materials shall be chipped and hauled off site.

Growing Season 5

Early Summer (May 1 – June 1)

- Monitor the site to detect areas of weed colonization.
- Starting in year 5 conduct a prescribed burn in spring or fall. Burning must be carried out by a trained and permitted professional.

Summer (June 1 – July 20)

- Monitor the site to detect areas of weed colonization.
- Pull noxious weeds if the infestation is limited to a few individual plants. Cut or treat noxious weeds if the infestation is in larger patches. In this case either mow/cut off the flower heads or apply a target specific herbicide. Contact the County Agriculture Inspector for further guidance on treating and removing noxious weeds.

Fall (September 1 – October 31)

- Monitor the site to detect pioneering woody species.
- Cut and stump treat any pioneering woody species in the dormant season when leaves are changing colors or when leaves have fallen off the woody species.
- All woody vegetation must be cut no more than 2" from the ground (cut surface should be as flush as possible with the ground surface).
- All woody species to be cut and stump treated immediately with Triclopyr herbicide. The mixture must contain a dye.
- Remove cut woody debris from site or slash on site if space permits.
- If the amount of woody material to treat is sparse the material can be slashed and spread on site. Materials under 1" caliper can be slashed and scattered evenly over the vegetated area. All slash material to be scattered evenly so that it does not exceed 1.5" in thickness.
- If the amount of woody material to treat is dense, cut materials shall be chipped and hauled off site.
- Starting in year 5 conduct a prescribed in spring or fall. Burning must be carried out by a trained and permitted professional.

Growing Season 6 and Beyond

- Monitor the site monthly to detect areas of weed colonization. Cut or treat noxious weeds as needed. Cut and stump treat woody plants as needed. Follow IPM guidance.
- Starting in year 5 conduct a prescribed burn every three years. Burning must be carried out by a trained and permitted professional. Alternate the timing of the burn from spring to fall.

NATIVE SEED ESTABLISHMENT PERIOD	Description of Work Completed / Comments	By Name / Date	Owner's Rep Name / Date
Growing Season 1			
When vegetation reaches a height of 10 to 12" cut down with a flail mower to a height of 6-8". 1 x spring 1 x summer 1 x fall			
Growing Season 2			
When vegetation reaches a height of 10 to 12" cut down with a flail mower to a height of 6-8". 1 x spring 1 x summer 1 x fall			
Mow or cut seed heads of noxious weeds.			
Growing Season 3			
Monitor site between June 1 and July 20 and cut or treat noxious weeds with targeted herbicide. Follow IPM.			
Treat woody species in fall.			

NATIVE SEED ESTABLISHMENT PERIOD	Description of Work Completed / Comments	By Name / Date	Owner's Rep Name / Date
Growing Season 4			
Monitor site between June 1 and July 20 and cut or treat noxious weeds with targeted herbicide. Follow IPM.			
Treat woody species in fall.			
Growing Season 5			
Monitor site between June 1 and July 20 and cut or treat noxious weeds with targeted herbicide. Follow IPM.			
Treat woody species in fall.			
Burn one time in spring or fall.			



Native Vegetated Mat – Establishment Period Tasks

Maintenance tasks required to establish native vegetation via native vegetated mat.

- Wet soil prior to installation of native vegetated mat.
- Immediately following installation of native vegetated mat ensure there are no exposed mat edges and soak entire area with 1” of water.
- Water all native vegetated mat daily for the first 7 days after installation.
- Apply 1” (or more) of water per week to the native vegetated mat during week 2-6 after installation. Allow to dry between waterings.
- After six weeks the mat will require irrigation only in drought conditions. Monitor the site monthly during the first 3 growing seasons for signs of drought and apply water as needed.
- After 3-5 years the native vegetated mat will be fully established and can be maintained using the Native Vegetation Long Term Maintenance schedule.

NATIVE VEGETATED MAT ESTABLISHMENT	Description of Work Completed/ Comments	By Name / Date	Owner's Rep Name / Date
Immediately After Installation			
Day of installation: Ensure no exposed mat edges, and apply 1" of water to entire area			
Day 2: water thoroughly			
Day 3: water thoroughly			
Day 4: water thoroughly			
Day 5: water thoroughly			
Day 6: water thoroughly			
Day 7: water thoroughly			
Week 2: apply 1" water over entire area			
Week 3: apply 1" water over entire area			
Week 4: apply 1" water over entire area			
Week 5: apply 1" water over entire area			
Week 6: apply 1" water over entire area			
Monitor site monthly for signs of drought and water as needed			
Monitor site monthly for signs of drought and water as needed			
Monitor site monthly for signs of drought and water as needed			
Monitor site monthly for signs of drought and water as needed			



Native Vegetation – Long-Term Maintenance Tasks

Maintenance tasks required to maintain native vegetation areas on a yearly basis, including areas established by seed or via native vegetated mat.

- Monitor the site monthly to detect areas of weed colonization.
- Cut or treat noxious weeds as needed. Follow IPM guidance.
- Cut and stump treat woody plants as needed. Follow IPM guidance.
- Conduct a prescribed burn every three years. Burning must be carried out by a trained and permitted professional. Alternate the timing of the burn from spring to fall.
- Haying may be used in lieu of burning where burning poses too great a risk.

NATIVE VEGETATION YEARLY LONG-TERM MAINTENANCE	Description of Work Completed / Comments	By Name / Date	Owner's Rep Name / Date
Monitor site monthly to detect areas of weed colonization.			
Monitor site monthly to detect areas of weed colonization.			
Monitor site monthly to detect areas of weed colonization.			
Monitor site monthly to detect areas of weed colonization.			
Cut or treat noxious weeds as needed. Follow IPM.			
Cut and stump treat woody plants as needed. Follow IPM.			
Burn site every 3 years (spring or fall)			

EXOTIC AND INVASIVE SPECIES MANAGEMENT

REMOVE THE FOLLOWING EXOTIC AND INVASIVE SPECIES BY PULLING OR HERBICIDE DURING THE GROWING SEASON (PRIOR TO BLOOMING):

- Purple Loosestrife - *Lythrum salicaria*
- Yellow Sweet Clover - *Melilotus officinalis*
- White Sweet Clover - *Melilotus alba*
- Curly Dock - *Rumex crispus*
- Garlic Mustard - *Alliaria petiolate*
- Common Burdock - *Arctium minus*
- Japanese Hedge Parsley - *Torilis japonica*

IF DETECTED REMOVE THE FOLLOWING EXOTIC SPECIES USING HERBICIDE 2 TIMES PER GROWING SEASON:

- Reed Canary grass - *Phalaris arundinacea*
- Smooth Brome - *Bromus inermis*
- Crown Vetch - *Coronilla varia*
- Bird's Foot** trefoil - *Lotus corniculatus*
- Canada Thistle - *Cirsium arvensae*
- Giant Ragweed - *Ambrosia trifida*
- Common Ragweed - *Ambrosia artemisiifolia*
- Foxtail - *Setaria spp.*
- Leafy Spurge - *Euphorbia esula*
- Japanese Knotweed - *Polygonum cuspidatum*
- Thistles - *Cirsium spp.*
- Spotted Knapweed - *Centaurea stoebe*
- Wild Parsnip - *Pastinaca sativa*
- Queen Anne's Lace** - *Daucus carota*
- Buckthorn - *Rhamnus spp.*

RECORD OF CHEMICALS

Complete a Pesticide Application Record (type of form contingent upon plant material being treated) each time a pesticide is applied on site and provide all completed forms to the owner.

Bioretention (Rain Gardens and Bioswales) Maintenance Tasks

Maintenance tasks required to maintain a bioretention facility.

Spring (April 1 – May 15)

- Winter cleanup: check inlets and outlets, remove sedimentation and debris.
- Fix areas of erosion with mulch or rock as appropriate.
- Topdress mulch throughout rain garden as needed. Maintain a 3" (maximum depth) layer of mulch in the facility.
- Cut back and remove dormant plant material from perennials and grasses.

Early Summer (May 15 – June 30)

- Monthly visits:
 - Check inlets and outlets for erosion and sedimentation. Remove sediment with a shovel. Fix erosion by adding mulch or rock as appropriate.
 - Remove trash and debris.
 - Hand pull weeds.

Late Summer (July 15 – August 31)

- Monthly visits:
 - Check inlets and outlets for erosion and sedimentation. Remove sediment with a shovel. Fix erosion by adding mulch or rock as appropriate.
 - Remove trash and debris.
 - Hand pull weeds.

Fall (September 1 – October 31)

- Monthly visits:
 - Check inlets and outlets for erosion and sedimentation. Remove sediment with a shovel. Fix erosion by adding mulch or rock as appropriate.
 - Remove trash and debris.
 - Hand pull weeds.
- Leave spent plant material and seed heads in place for habitat and winter interest.

BIORETENTION MAINTENANCE	Description of Work Completed / Comments	By Name / Date	Owner's Rep Name / Date
Spring (April 1 – May 15)			
Winter Cleanup: check inlets and outlets; remove sedimentation and debris.			
Topdress with mulch (3" max. layer)			
Cut back and remove dormant plant material: check inlets and outlets, remove trash, pull weeds			
Early Summer (May 15 – June 30)			
May Monthly Site Visit: check inlets and outlets, remove trash, pull weeds			
June Monthly Site Visit: check inlets and outlets, remove trash, pull weeds			
Late Summer (July 15- August 31)			
July Monthly Site Visit: check inlets and outlets, remove trash, pull weeds			
August Monthly Site Visit: check inlets and outlets, remove trash, pull weeds			
Fall (September 1 – October 31)			
September Monthly Site Visit: check inlets and outlets, remove trash, pull weeds			
October Monthly Site Visit: check inlets and outlets, remove trash, pull weeds			

Permeable Pavement Maintenance Tasks

Maintenance tasks required to maintain permeable pavement including modular block, permeable asphalt and permeable concrete.

Spring (April 1 – May 31)

- Perform site inspection 1x per season
 - Check inlets and pre-treatment area for clogging and debris.
 - Check for any areas of standing water.
 - Check adjacent areas for erosion and sedimentation.
 - Check for dislocated or damaged pavers and take corrective action.
 - Check for sediment on the surface or in the joints between the paving.
- Sweep surface of paving area with power broom.

Summer (June 1 – August 31)

- Perform site inspection 1x per season
 - Check inlets and pre-treatment area for clogging and debris.
 - Check for any areas of standing water.
 - Check adjacent areas for erosion and sedimentation.
 - Check for cracks or deterioration in paving material
 - Check for sediment on the surface or in the joints between the paving.

Fall (September 1 – October 31)

- Perform site inspection 1x per season
 - Check inlets and pre-treatment area for clogging and debris.
 - Check for any areas of standing water.
 - Check adjacent areas for erosion and sedimentation.
 - Check for cracks or deterioration in paving material
 - Check for sediment on the surface or in the joints between the paving.

Winter

- Plow paving area with a rubber edged blade.
- Limit the use of salt.

PERMEABLE PAVEMENT

SEASONAL INSPECTION REPORT

FACILITY:

LOCATION/ADDRESS:

INSPECTOR NAME:

DATE:

TIME:

WEATHER:

INSPECTION ITEM

Observations / Work Completed / Comments

Pre-treatment Area:
accumulation of sediment,
trash, or debris

Pavement Surface: Standing
water, signs of clogging,
sediment accumulation

Pavement Joints (for PICP):
sediment in joints,
vegetation growing in joints,
inadequate gravel in joints

Adjacent Areas: erosion or
deterioration of surrounding
materials

Outlets/ Overflow Spillway:
check for trash and debris

Green Roof Maintenance Tasks

Maintenance tasks required to maintain an extensive green roof after the establishment period is complete.

Spring (April 1 – May 31)

- Remove dried vegetation from previous season with scythe, trimmer, or string trimmer prior to spring flush of growth.
- Fertilize green roof plants if indicated by soil test results.
 - Use organic, slow-release fertilizer only.
 - Do not fertilize with phosphorus (unless specifically required based on soil test).
 - Do not use compost derived from animal waste.
- Hand pull weeds before they set seeds. Do not use herbicides or pesticides on the green roof.
- Check outlets and drainage structures. Remove debris and obstructions.

Summer (June 1 – August 31)

- Hand pull weeds before they set seeds. Do not use herbicides or pesticides on the green roof.
- Check outlets and drainage structures. Remove debris and obstructions.

Fall (September 1 – October 31)

- Hand pull weeds before they set seeds. Do not use herbicides or pesticides on the green roof.
- Repopulate sparse areas of the roof with cuttings or transplants from other areas of the roof, as needed.
- Check outlets and drainage structures. Remove debris and obstructions.
- Photograph green roof for the maintenance record. Take one, or more, photo(s) from the same location each year to track changes in green roof vegetation.

Detect and remove these common weed species from the green roof 3 times per year:

- Poplar seedlings, *Populus* species
- Clover species, *Trifolium* species
- Spotted Spurge, *Euphorbia maculata*
- Horseweed, *Conyza Canadensis*
- Dandelion, *Taraxacum officinalis*
- Foxtail, *Setaria* species

GREEN ROOF MAINTENANCE	Description of Work Completed / Comments	By Name / Date	Owner's Rep Name / Date
Spring (April 1 – May 31)			
Remove dried vegetation from previous season			
Fertilize green roof (requires documentation of soil test results)			
Hand pull weeds			
Check drainage structures; remove debris and obstructions.			
Summer (June 1 – August 31)			
Hand pull weeds			
Check drainage structures; remove debris and obstructions.			
Fall (September 1 – October 31)			
Hand pull weeds			
Transplant cuttings as needed to repopulate sparse areas			
Check drainage structures; remove debris and obstructions.			
Photograph roof for maintenance record			



Tree Trench Maintenance Tasks

Maintenance tasks required to maintain a tree trench facility.

Spring (April 1 – May 31)

- Check tree guard and remove if it is rubbing on the trunk or too small.
- Check mulch ring and replenish as needed to a depth of 2-3". Do not pile mulch against the tree trunk.
- Check for stem girdling roots; consult an arborist if detected.
- Check tree trench inlets and outlets; remove debris and obstructions.

Summer (June 1 – August 31)

- Check trees for broken branches and damage after large storms or high winds.
- Check tree trench inlets and outlets; remove debris and obstructions.

Fall (September 1 – October 31)

- Check trees for broken branches and damage after large storms or high winds.
- Check tree bark for rodent damage. Install trunk protection guard prior to winter.
- Check tree trench inlets and outlets; remove debris and obstructions.

Winter

- Prune trees for safety and clearance as needed.

TREE TRENCH		
SEASONAL INSPECTION REPORT		
FACILITY:		
LOCATION/ADDRESS:		
INSPECTOR NAME:		
DATE:	TIME:	WEATHER:
INSPECTION ITEM	Observations / Work Completed / Comments	
Check mulch; replenish as needed.		
Check tree guards to make sure they are not rubbing on bark. Add or remove tree guards as needed.		
Check trees for stem girdling roots. Consult an arborist if detected.		
Check inlets and outlets; remove debris and obstructions.		
Prune trees for safety and clearance, as needed.		
Check for damage and broken branches after storms.		