

**City of Brookfield
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**STORMWATER DETENTION/RETENTION BASIN
LANDSCAPE GUIDELINES**

**Landscape Requirements & Maintenance Standards
for Stormwater Detention/Retention Basins
February, 1996**

Prepared in collaboration with
City of Brookfield Planning Department

&

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Introduction

The rapid growth in the city and consequent development and construction of buildings, paved surfaces, roads and other improvements, has altered the natural flow of surface waters. The construction of culverts, drains and channels for the carrying off of surface waters has both increased the quantity of storm and surface drainage and amplified in quantity and intensity the extent of runoff and surface flow, thus leading to present and potential flooding of property and homes, soil erosion, danger to health, injury and destruction of property.

In addition, natural drainage waterways have long been corridors of natural beauty and has greatly contributed to the attractiveness of the community, the economic value of the land, and to the health and welfare of its citizens. The aforementioned rapid growth and development has not only contributed to the potential for drainage and flooding difficulties, but has also resulted in the unnecessary destruction of the natural and traditional character of the community. It is therefore necessary for the City of Brookfield to control and guide the landscape design and development of stormwater detention/retention basins as a means to protect the public safety, health and general welfare, while at the same time maintaining a more natural landscape character, consistent with sound zero runoff drainage practices.

It is the intention of the City of Brookfield to protect the citizens, prevent the dangers arising from improper drainage, improper drainage facilities, inadequate construction of drainage facilities, and to aesthetically plan for the present and future use of waterways through the establishment of standards governing the design & development of stormwater detention/retention basins within the City of Brookfield.

Purpose

Proper landscaping of drainage swales, waterways, and basins offers many benefits such as seasonal color, texture, improved water quality, and environmental and energy concerns. Certain plants are ideal for slope stabilization, water quality, screening incompatible adjacent uses, wildlife habitat, buffering objectionable views, sound reduction and air quality. Proper landscape development of stormwater basins unifies and organizes disparate site elements, creates visual continuity and enhances a site's potential recreational use.

These guidelines encourage developers/owners to provide proper landscape developments based on ecological and aesthetic design principles and requires minimum plant quantities and selections which allow for maximum design flexibility while addressing the specific role plant materials play in the safety, aesthetics, and maintenance of stormwater basins.

To insure that the intent of the guidelines are accomplished, an applicant is required to submit for approval a stormwater basin landscape plan developed by a licensed landscape architect, engineer or certified wetland consultant, and following installation, provide a written certification that all the required landscape materials have been installed in substantial conformance with the plans as approved by the Plan Commission.

Purpose of these standards is as follows:

1. To aid in stabilizing the environment's ecological balance by contributing to the processes of air purification, oxygen regeneration, ground water recharge, water quality and storm water runoff retardation.
2. To provide a natural appearance to detention/retention basins and enhance the beautification of the city.
3. To safeguard and enhance property values and to protect public and private investment.
4. To preserve and protect the unique character and environment of the City of Brookfield and preserve the economic base attracted to the City of Brookfield by such factors.
5. To conserve energy, water, and natural resources through the use of applicable landscape materials and maintenance procedures and strategies.
6. To protect the public health, safety and general welfare.

Approval Process

PLAN REQUIREMENTS

1. Before starting any of the work regulated by this provision, an applicant shall comply with the requirements set forth in this provision with respect to submission and approval of preliminary and final subdivision plats, plan and method of operation, Development Agreements, building and zoning permits, inspections, and similar matters along with those set forth in this provision, and as regulated by the Brookfield Municipal Code.
2. The provisions and regulations contained in this provision shall be used as guidelines and be applicable to the development, and improvement of all lots, blocks, tracts and parcels of land over which the City has jurisdiction to regulate matters not specifically regulated or controlled by the provisions contained in the Zoning Codes, Erosion Control Ordinance, Subdivision Codes and Building Codes.
3. A licensed/registered landscape architect, engineer or certified wetland specialist knowledgeable in stormwater basin planting design and local vegetation, and with a minimum of three years experience, must certify/seal the plan as complete and accurate and in compliance with the requirements of this provision. The requirement that such plans and specifications be certified by an experienced professional may be waived for the minor alterations and improvements which, in the sole discretion of the Department of City Planning, does not require the services of such a professional.

PROCEDURES

1. When a site plan review is required, the plan shall contain landscaping information in accordance with this provision and the city's minimum requirements for site plan information. All stormwater basin landscape plans must include the following information:
 - a. The location and dimensions of all existing and proposed structures, parking lots, drives, roadways and right-of-way, sidewalks, bicycle paths, ground signs, refuse disposal areas, bicycle parking areas,

architectural features, utility equipment, utility easements and lines (above & below ground), conservation easements and lighting.

- b. A plant schedule including the location, quantity, size at time of planting, root condition, spacing of perennials, grasses, and shrubs and the scientific and common names of all proposed landscape materials, including the seeding mixtures and rates, types of sod, method of seedbed preparation, expected seeding dates, type and rate of lime and fertilizer application and kind and quantity of mulching.
 - c. Topographical plans of the property to be developed indicating, at one (1) foot intervals, the location of all proposed berming and percent of slope, ground elevation contours, stormwater basin cross sections, wells and private sewerage disposal facilities.
 - d. The designation, location, quantity and names (both scientific and common) of all existing vegetation that is to remain.
 - e. A general description of the predominate soil types within the stormwater basin areas to a depth of intended excavation, their location, and their limitations for the proposed use.
 - f. All plans must also include the following information:
 1. North Arrow
 2. Scale
 3. Name of Owner
 4. Project Location
 5. Name of Project
2. Landscape plans approved by the Plan Commission as part of a development site plan shall not require further approval by other city agencies if the approved landscape plan meets all the requirements of this provision.
 3. The City of Brookfield Inspection Department shall inspect each site to insure compliance with this provision. Prior to final landscape inspection, a sealed letter of concurrence shall be provided to the Inspection Department from a registered engineer, architect or landscape architect representing the development, which letter shall verify that the project has been implemented in accordance with the city approved plans and is in full compliance with this provision.
 4. Prior to issuance of an occupancy permit for non-residential developments, all dry bottom storm water storage areas (detention basins), wet bottom storm water storage areas (retention basins), and swales must be functional and completely landscaped as per the approved plans for such improvements. In the case of residential development, said work must be completed within twelve (12) months of the signing of the subdivider's or development agreement.

5. If any portion of a proposed development is included within a floodplain, floodway or wetland delineation accepted or recognized by the City, such delineation shall be clearly shown on all preliminary plans, subdivision construction plans, final plats or certified survey maps submitted for approval.

EXEMPTIONS

1. Except as otherwise provided below, this provision shall apply to all land located in the City's zoning jurisdiction.
2. A common development which includes more than one lot shall be treated as one lot for the purposes of this provision. Split ownership, planning in phases, construction in stages, or multiple building permits for a project shall not prevent it from being such a common development. Each phase of a phased project shall comply with this provision.
3. This provision shall not apply to the following:
 - a. Single-family residences where only one structure is constructed on a previously platted lot.
 - b. Substantial restoration which occurs within a 12 month period of a building which has been damaged by fire, explosion, flood, tornado, riot, act of the public enemy, or accident of any kind.
 - c. Restoration of buildings with a historic designation.
 - d. Interior or facade remodeling as long as the front and side exterior walls of the building remain in the same location.
4. Developed property or platted lots of record which are impacted by a subsequent right-of-way condemnation may be developed without strict compliance with the requirements in this provision, under the following provisions:
 - a. Improvements (structures and related facilities) which are shown on the remainder of the platted lot after condemnation has occurred may be constructed subsequent to the approval by the Plan Commission of a modified landscape plan reflecting the impact of the right-of-way condemnation.
 - b. Improvements on developed property which is lost through the right-of-way condemnation may be replaced elsewhere on the remaining lot and only the area contained within the new limits of construction for the

recaptured improvements shall be required to comply with the requirements of this provision.

ALTERNATIVE COMPLIANCE

1. Notwithstanding the foregoing requirements of this provision and in unusual situations where a hardship would be created, a landscape plan which proposes an alternative to strict compliance with the various landscape requirements in this provision may be approved by the Plan Commission if the Plan Commission finds that such a plan adequately achieves, or is an improvement on the intent of the landscaping requirements in this provision.
2. Preferential consideration should be given to the preservation of large existing native trees and vegetation not necessarily in the required landscape areas.

EXISTING TREE PRESERVATION

Many trees that are growing in Brookfield have been here for many generations. These trees should be preserved to the maximum extent feasible for the education, and enjoyment of future generations. Designating trees for preservation and ensuring that they survive grading and construction procedures require special attention. Those trees designated to be preserved shall be clearly shown on the plans and special attention should be given to them at the time of construction. These areas must be unmistakably identified in the field as an area of “no disturbance”, so that it is obvious to all equipment operators and other construction personnel that care should be taken to avoid damage. Harmful practices such as grading or trenching within the area, placing backfill near trees, driving or parking equipment in preservation areas and dumping trash, oil, or paint within the vicinity is prohibited and enforceable by Inspection Services.

FISCAL SECURITY

At the time of site plan approval the City staff can recommend to the Plan Commission that the owner make a fiscal arrangement either by bond, certificate-of-deposit or letter-of-credit with the City, to ensure that the owner is in full compliance with landscape installation and maintenance requirements.

To assure compliance with the landscape installation requirements, a fiscal security may be required at the time of execution of an approved plan in an amount calculated in accordance with the rate set forth in this provision. The fiscal arrangements shall reflect the cost of required landscaping, including plant installation and planting bed preparation. Additionally, a maintenance bond may be required to assure that the landscape installation is maintained during its

critical establishment period (three years) following installation. The amount of the maintenance bond is calculated in accordance with the rate set forth in this provision.

Any owner must also grant a temporary access easement and license to the City or its licensed contracted agent to enter upon the land for the purposes of installing the required landscaping for the length specified for the maintenance compliance, typically three years, in the event that such landscaping is not in place by the date specified in the agreement. Such fiscal arrangements shall be released when landscape improvement verification is received. Should the City have to provide for full compliance, the applicant will then forfeit the fiscal security deposit.

1. Installation Compliance Security - A fiscal arrangement in the amount of **\$85.00/1000 sq. ft.** (where square feet is the total area of influence) may be included, as a segregated line item, as part of the letter-of-credit required by the City for all residential and non-residential developments.
2. Maintenance Compliance Security - A fiscal arrangement in the amount of **\$12.00 /1000 sq. ft.** (where square feet is the total area of influence) may be included, as a segregated line item, as part of the letter-of-credit required by the City for all residential and non-residential developments.

Landscape Requirements

Stormwater basins, whether they function as retention or detention basins, all have a zone of influence, i.e. a series of concentric bands or planting zones, where various physical and environmental components such as soil type, water depth, water fluctuations, velocity, and slope, collectively and/or individually influence the kinds of plants which will tolerate such conditions and thrive.

The intent of landscape requirements is to assure that appropriate plant species are incorporated into the stormwater basin landscape design. Each planting zone or band requires its own plant type to properly perform its mutually critical role. Requirements are based on:

1. The plant's specific niche in the stormwater runoff system.
2. The minimum percentages of plant types required to provide a diverse plant community.
3. Creating a naturally appearing basin in the urban landscape.

4. Developing an asset in the landscape which enhances safety, prevents nuisances such as geese, and improves water quality.

Planting Zones

The landscaping and engineering of stormwater basins can range from the very simplistic “hole in the ground with ‘volunteer’ vegetation”, to a sophisticated natural system utilizing forebays, weirs, peat berms, etc. It is emphasized here, that each basin be designed site specific, following consideration of an accurate analysis of the soils, water quality, velocity, microclimate, etc., prior to its final design.

For the purposes of determining landscape strategies for Brookfield’s stormwater basins, these standards utilize an abbreviated concept of concentric bands, or rings, which together make up a basin’s “zone of greatest influence”. Each zone has its own requirements. These zones are:

1. **Low Flow Channel**
2. **Bottom Zone**
3. **Fringe Zone**
4. **Shoreline Zone**
5. **Upland Buffer Zone**

Because of their function to permanently retain pools of water, retention basins are the more dynamic of the two basin types. Their Emergent and Shoreline zones are vulnerable to water/wind fluctuations requiring a diverse mix of tenacious plant types. Detention basins on the other hand are designed to occasionally store water, generally remaining dry for long periods. As different as they are, they do share common plant species.

Retention Basin Landscape Requirements:

The following are the planting requirements for the zones comprising retention basins. *See attached Retention Basin illustration at back of guidelines.*

The planting zones are:

Bottom Zone
Emergent Zone
Shoreline Zone
Upland Buffer Zone

Bottom Zone Requirements: This zone of a retention basin is generally the 1'-6' deep permanent water holding area. Vegetative cover is unnecessary. However, volunteer plants will tend to establish themselves through natural succession.

Emergent Zone Requirements:

Sometimes referred to as the safety shelf, it is under water and located along the perimeter of the pool, 10' inside the normal water level. Generally it does not exceed 3% slope. Aquatic plantings are required, no woody shrubs shall be planted within this zone. The Emergent Zone must meet the following requirements:

1. Stone rip rap (washed stone 3''-6''), is allowed yet shall not exceed 30% of the total Emergent Zone area.
2. The required aquatic vegetation (minimum 70% of the area) shall be specified as a combination seed mix and plantings, at the following, rate:
 - a. Wetland seed mix shall be applied at 80lbs/acre over 100% of the vegetative area.
 - b. Plantings in the form of plugs, in addition to seeding, shall be incorporated to cover 20% of the vegetated Emergent Zone area at a ratio of one plant per square foot.

Shoreline Zone Requirements:

The Shoreline Zone, generally flat or gently sloping, is measured from the normal water level out five feet. The Shoreline Zone must meet the following requirements:

1. A minimum 40% of the Shoreline Zone area shall be planted in a native seed mix at a rate of 80lbs/acre. Acceptable seed mixes include meadow and/or prairie grasses and forbs. Individual plants may be used at a rate of one per sq. foot.
2. Maintained turf areas (such as Kentucky Blue Grass) shall not exceed 60% of the total Shoreline Zone area. Seed shall be applied at 4lbs/1000 sq. ft.

Upland Buffer Zone Requirements:

Located 25' outside the Shoreline Zone, where environmental conditions are more stable, trees and shrubs are introduced as a buffer and transition to the surrounding landscape. Generally it is planted in turf, however, within this zone the following is required:

1. Deciduous trees: At least one deciduous tree no less than 2'' caliper shall be incorporated into the design and included as part of the installation per the following ratio:

One 2'' cal. tree per 6000/sq. ft. of total Upland Buffer Zone area.

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2. Evergreen trees: The location of the tree (s) shall be anywhere within the Upland Buffer Zone. At least one 6' high evergreen tree shall be incorporated into the design and included as part of the installation per the following ratio:

One 6' evergreen tree per 8000 sq. ft of total Upland Buffer Zone area.

3. Shrubs: A combination of deciduous and evergreen shrubs must comprise a minimum 10% coverage area of the total Upland Buffer Zone. Evergreen trees do not contribute to the 10% coverage area.
4. Ground cover: Historically, maintained turf has been the choice for ground cover vegetation. However, a natural prairie, meadow or wildflower seed mix is the preferred choice when developing a more natural appearance to the basin. Seed at the following rates:
 - a. Natural seed mix: 80lbs/acre
 - b. Maintained turf: 4lbs/1000 sq. ft.

Detention Basin Landscape Requirements:

The following are the planting requirements for the zones comprising detention basins. *See attached Retention Basin illustration at back of guidelines.*

The planting zones are:

Low Flow Channel
Bottom Zone
Fringe Zone
Upland Buffer Zone

Low Flow Channel Requirements:

Water tolerant plants should be installed within the Low Flow Channel which typically runs from the inlet to the discharge drain, or lowest point of the basin. This area is most apt to hold water the longest following a heavy storm. Perennials and/or tall grasses, shall be planted within this channel, including the areas surrounding both inlet and discharge drains. No woody plant material or stone rip rap is permitted, except as a force dissipating feature at the inlet pipe or structure. The Low Flow Channel shall be a minimum 3' wide and meet the following requirements:

1. **Ground Cover:** Water tolerant tall grasses and/or perennials shall be specified. Erosion control matting shall be installed as a temporary erosion control measure to assist in the establishment of the plant material. Seed at 80lbs/acre.
2. **Inlet & Discharge Drains:** Perennials and/or tall grasses shall be specified around the drains to a minimum distance of six (6) feet.

Bottom Zone Requirements:

Surrounding the Low Flow Channel, is the Bottom Zone which is generally flat, and occasionally inundated. Grass seed mixes comprised primarily of Kentucky Bluegrass is not permitted. Water tolerant seed mixes (Prairie, meadow, fescues, etc.) or plantings shall cover 100% of the zone. Seed shall be sown at 80lbs/acre. Trees shall be incorporated to begin to break up the engineered contours of the basin.

Trees: A minimum 2” caliper deciduous tree is required for every 6000 sq. ft. of total Bottom Zone area. For Bottom Zones less than 6000 sq. ft. in total area at least one tree is required.

Fringe Zone Requirements:

The Fringe Zone is measured 10 feet from the outside edge of the Bottom Zone. This zone generally includes the side slopes of the basin and is subject to periodic inundation. The Fringe Zone must meet the following requirements:

1. Trees:
A minimum 2” cal deciduous tree or six (6) foot high evergreen tree is required for every 6000 sq. ft. of total Fringe Zone area. For Fringe Zones that are less than 6000 square feet, a minimum one tree shall be planted.
2. Shrubs:
Deciduous or evergreen shrubs, minimum 24” high, must cover 5% of the total Fringe Zone area.
3. Ground Cover:
 - a. A minimum 30% of the Fringe Zone area shall be planted in a native seed mix sown at 80lbs/acre. Acceptable seed mixes include meadow and/or prairie grasses and forbs.

- b. Maintained turf areas shall not exceed 70% of the total Fringe Zone area. Seed shall be applied at 4lbs/1000 sq. ft.

Upland Buffer Zone Requirements:

Located 15' outside the Fringe Zone, trees and shrubs are more prevalent. The Upland Buffer Zone serves as a transition into the development's overall landscape theme, and as a buffer to adjacent land uses. Within this zone the following is required:

1. Deciduous trees:

Upland Buffer Zone. At least one deciduous tree no less than 2" caliper shall be incorporated into the design and included as part of the installation per the following ratio:

One 2" cal. tree per 6000/sq. ft. of total Upland Buffer Zone area.

2. Evergreen trees:

The location of the tree (s) shall be anywhere within the Upland Buffer Zone. At least one 6' high evergreen tree shall be incorporated into the design and included as part of the installation per the following ratio:

One 6' high evergreen tree per 8000 sq. ft of total Upland Buffer Zone area.

3. Shrubs:

A combination of deciduous and evergreen shrubs, no less than 24" high (at time of planting) must comprise a minimum 10% coverage area of the total Upland Buffer Zone. Evergreen trees do not contribute to the 10% coverage area.

4. Ground cover:

A natural seed mix is the preferred choice of ground cover. However, maintained turf may be used. Sow seed at 80lbs/acre for native seed mixes, and 4lbs/1000 sq. ft for maintained turf.

Exemptions:

Where slopes are in excess of 3:1, maintained turf is not permitted.

Maintenance Requirements

The goal of the maintenance requirements is to provide a well maintained landscape emphasizing minimum environmental impact with reduced chemical use.

The following maintenance requirements identify general procedures applicable to landscape developments and specific terms for each stormwater basin type.

General Maintenance

1. The property owner shall be responsible for the regular maintenance of all required landscape areas and plant materials in a vigorous and healthy condition free from diseases, pest, weeds, and litter. This maintenance shall include weeding, watering, fertilizing, pruning, mowing, mulching or other needed maintenance in accordance with generally accepted horticultural practices.
2. Failure to regularly maintain as described in these maintenance requirements shall constitute a violation of this provision and may be enforced in accordance with City of Brookfield Building Inspection policy. Notice of noncompliance may be issued to the owner requiring the immediate attention to conforming to these maintenance requirements. The city may, correct, repair or replace landscape materials as required by this provision. Costs for such repair, or replacement will be covered by the owner's Maintenance Security Deposit, if filed.
3. Required plant materials, if dead, diseased, or severely damaged, shall be removed by the owner as soon as possible, but no later than 60 days after notification. All such plants shall be replaced within six months of notification or by the next planting season, whichever comes first.
4. Replacement plants must be of the same size and species as shown on the approved landscape plan or must be equivalent in terms of quality and size. Such replacement will not be considered an amendment to the approved plan.
5. All work shall be performed by trained, properly supervised personnel in accordance with accepted horticultural practices. Chemicals will be applied by licensed personnel.

6. All fertilizers and pesticides shall be applied in accordance with manufacturer's directions. Where alternate products are available the environmental impact of the products shall govern which is used.
7. All water necessary during the initial installation period of three years, shall be provided by the Owner with adequate hose bibs and/or hydrants. Owner shall water with a tanker truck as required.
8. Planting Beds:
 - a. Collect all debris .
 - b. Remove all leaf accumulations from bed areas.
 - c. Prune woody plant materials showing damage or deadwood.
 - e. Hand spade all shovel cut bed edges.

Tree Care

1. Watering:

All trees shall be watered as necessary to maintain vigor. On average, trees require one inch of rainfall a week. Supplemental watering is necessary if this rainfall does not occur. Water availability is particularly critical during the tree's transition periods: when the tree is putting on new leaves and again at leaf drop. Plants should not be watered until a moisture check has been made of representative plants in the landscape. Check the soil to a depth of four (4) inches. If it is still moist, don't water. Over watering will suffocate the roots and kill the tree. This is particularly true in heavy, clay soils. Maintain a large enough dike around the perimeter of the root zone to fill with water. When hand watering, use a water wand to break the water force. In rainy seasons, open basins to allow surface drainage away from the root crown where excess water may accumulate.
2. Mulching: All trees in lawns shall have a large mulch ring (4-5' Dia.) maintained around the base of the trunk at a depth of 3-4" for a minimum of three (3) years following planting. This will reduce damage to tree trunks and roots by machinery, keep roots cool, and avoid lawn/root competition. Use hand weeding whenever possible to control growth in these areas. Do not use weed whips around trees to do trimming or weeding. Avoid frequent soil cultivation that destroys shallow roots and breaks the seal of any pre-emergent herbicides if present. Do not allow the mulch to build up against the trunk of the tree.

3. Fertilizing: Once, in early Spring before bud break/leaf expansion, fertilize at the root ball and base of the main stem; rather than spread evenly under the plant to drip line.

4. Pruning: All trees shall be pruned once each year following leaf drop in late fall for the first five years following installation. Once “scaffolding” or structural branches have been established, the trees should be put on a 5-7 year pruning cycle.

Pruning Tips:

- Damaged trees or those that constitute health or safety hazards shall be pruned at any time of the year as required.
- Maintain a natural appearance.
- Remove dead, diseased or damaged branches that are smaller in diameter than the trunk or branch to which they are attached which have a vertical spacing of from 18-48” and radial orientation so as not to overlay one another.
- Eliminate double leader when necessary to prevent wind and storm damage.
- Remove branches with clean cuts close to the main branch without leaving “stubs”.

5. Insect Control: Carefully monitor trees and shrubs for insect populations, particularly as they build up in early spring. Spot control with insecticides if manageable. If necessary , apply a broad spectrum contact insecticide between May 15 to June 15 to affected trees for controlling aphids, inchworms, leafhoppers, sawflies, and tent caterpillar and other chewing and sucking insects active at that time.
6. Disease Control: Carefully monitor trees for the presence of diseases. Treatments are based on extent of the damage and the environmental impact of the product chosen. It’s best to consult with the County Extension Agent.
7. Special Needs: Some trees have a tendency to become chlorotic due to a mineral or nutrient deficiency. Symptoms generally show up as yellow or pale green leaf color with darker green veins. For iron chlorosis in trees up to 3” caliper, broadcast one (1) pound of granular sulfur from inside the drip line to the trunk in a 10’ x10’ area. Larger trees (4-8” cal.) will require four (4) pounds broadcast around the tree in a 20’ x20’ area. This treatment should be done in early spring before the bud break/leaf expansion.

Shrub Care

1. **Watering**: All shrubs shall be watered as necessary to maintain the health and vigor of the plant. Do not over water. Plants should be not be watered until a moisture check has been made of representative plants in the landscape. Use a probe or other tool to check the moisture in the root zone.
2. **Mulching**: Maintain bark mulch 2-3” deep on all shrub beds to reduce evaporation and weeds. All mulched beds shall be maintained as weed free through hand weeding, spot treating or applying a pre-emergent herbicide to the shrub bed areas. Keep mulch back from the stems of the plants.
3. **Fertilization**: Once, in spring apply an organic fertilizer. Re-fertilize in early to mid-summer. Fertilize in fall to promote root growth.
4. **Pruning**: The objectives of shrub pruning are to maintain the natural form of the plant as it occurs in nature and to allow plants to grow together as a mass to maximize the plant’s natural beauty and develop a dense screen.

Pruning Tips:

- When maintaining shrubs as a clipped hedge, pruning should be done twice a season.
 - Evergreen shrubs should be pruned once a season in early summer but before the end of August.
5. **Insect Control**: Carefully monitor shrubs in Spring for the infestation of insect populations. Spot control with insecticides or soaps if the infestation is minor. Apply a broad spectrum contact insecticide between May 15 and June 15 to control aphids, inchworms, leafhoppers, sawflies, and tent caterpillars and other chewing and sucking insects active at that time of the year. Consult with your County Extension agent for insect problem identification. Consult with the County Extension Agent if insect identification is uncertain.
 6. **Disease Control**: Carefully monitor shrubs for the presence of disease. Environmental impact shall govern the product chosen for control and how frequently and extensively it is used.

Perennial /Ground Cover Care

1. **Watering**: Water enough so that moisture penetrates throughout the root zone and as frequently as necessary to maintain healthy vigor and growth.
2. **Mulching and Cultivation**: Control weeds, preferably with hand weeding, to keep undesirable plants/grasses from encroaching into the planting bed and to maintain a neat appearance.
3. **Fertilization**: Fertilize in spring with a 10 10 10 balanced fertilizer.
4. **Insect, Disease and Rodent Control**: Monitor plants for the presence of insects, disease or rodent damage. The method of control is based on the proper identification of the cause of the problem. The foliage of affected plants should be removed and disposed of off-site.

Basin Maintenance

With regular maintenance, stormwater basins can be one of the most reliable and attractive ways to control stormwater pollution. Routine basin landscape maintenance should include:

1. Pond maintenance:
 - a. Tree leaves and debris should be skimmed and discarded in fall and spring to avoid large deposits at the bottom of the pond.
 - b. Once a year, the inlet and outlet should be inspected and any necessary repairs made.
 - c. The pond will require dredging, typically once every 15 to 25 years.
2. Mowing:

The native seed mix areas or non-maintained turf areas, must be mowed at least once a year to prevent woody growth. More frequent mowing may be necessary if the basin is to be used for recreational uses. Bottom zones may often be soggy, therefore mowing should occur during the dry periods.

Environmental quality and its protection is a high priority. The landscape investment needs to be protected from pest damage. This fact needs to be balanced with the goal of protecting the neighboring waters, soils, flora and fauna from damaging chemical build-up. Environmental conditions such as temperature, humidity, rainfall and snow cover influence pest populations and can help to predict periods when pests are likely to reach unacceptable levels. These factors can be weighed with field monitoring to determine when pest controls are

necessary and which control method will be most effective. Modification of horticultural practices to respond to changing environmental conditions can minimize pest problems.

Mechanical and biological controls are preferred over pesticide applications. Non-toxic chemicals and biodegradable chemicals are preferred. Applications of pesticides in the environment should be pest specific, time specific, quantity controlled and monitored for effectiveness. Pesticide use should not become routine or institutionalized on a “blind” schedule. As chemical technology changes, it is important to stay current on all Integrated Pest Management techniques.

Definitions

Berm

An earthen mound designed to provide visual interest , screen undesirable views and/or decrease noise.

Buffer

The use of landscaping (other than mowed turf on flat terrain), or the use of landscaping along with berms, walls, or decorative architectural features that at least partially and periodically obstruct the view, in a continuous manner, from the street.

Detention Basin

A facility that is designed to store water only during large storm events; basins with an outlet.

Deciduous

A plant with foliage that is shed annually.

Development

Any man-made change to improved or unimproved real estate, including but not limited to erection or removal of buildings, or other structures, dredging, grading, paving, excavation stripping, clearing or removal operations.

Emergent Plant

An aquatic plant that is rooted in the sediment but whose leaves are at or above the water surface. Such wetland plants provide habitat for the wildlife and waterfowl in addition to removing urban pollutants.

Emergent Zone

A minimum 10 foot wide ledge about 6” to 12” under water along the perimeter of a retention basin. Also referred to as the Safety Shelf.

Erosion

The natural wearing away of the land by the action of running water, and/or wind.

Evergreen

A broadleaf or needle type foliage plant that persists and remains green year-round.

Excess Storm Water

That portion of storm water runoff which exceeds the transportation capacity of storm sewers or natural drainage channels serving a specific watershed.

Flood

A general and temporary condition of inundation of normally dry land areas from the overflow, the unusual and rapid accumulation, or runoff of surface waters from any source.

Flood Plain

Any land area susceptible to inundation by water from any source.

Forebay

A forebay at the inlet of a pond increases its effectiveness and longevity. A forebay is a four foot to six foot deep basin separated from the rest of the pond by a berm, gabions or rip-rap. This small basin is large enough to hold at least 15% of the pond’s volume. It functions as an extra storage area to trap incoming sediments before they accumulate within the basin. A forebay generally is not required for ‘pocket’ basins due to their small size.

Maintained Turf

Areas of mown, turf type grasses primarily consisting of Kentucky Bluegrass.

Owner

Any person with a freehold interest in land, or a lessee, agent, employee or other person acting on behalf of the owner with the owner’s authorization.

Rip Rap

A combination of large stone, cobbles and boulders used to line channels, stabilize banks, reduce runoff velocities, and/or filter out sediment. Rip rap stone sizes shall be limited to 3-6” in diameter.

Retention Basin

A facility that is designed to hold a permanent pool of water with an elevated outlet.

Safety Shelf

A minimum 10 foot wide ledge about 6” to 12” under water along the perimeter of a retention basin. Also referred to as the Emergent Zone.

Seedbank

Refers to the large number and diversity of dormant seeds of plant species that exist within the soil. The seeds may exist within the soil for years before they germinate under the proper moisture, temperature or light conditions. Within wetland soils, this seedbank helps to maintain above-ground plant diversity and can also be used to rapidly establish wetland plants within a newly constructed stormwater basin.

Stormwater Runoff

Water that results from precipitation which is not absorbed by the soil or plant material.

Stormwater Storage Area

Areas designated to store excess storm water.

Shade Tree

A self-supporting woody plant having at least one well defined stem or trunk and normally attaining mature height and spread of at least 25 feet and having a trunk that may, at maturity, be kept clear of leaves and branches at least six(6) feet above grade. A deciduous tree planted primarily for its high crown of foliage or overhead canopy.

Shrub

A woody plant consisting of several small stems from the ground or small branches near the ground, may be deciduous or evergreen.

Subsoil

The bed or stratum of earth lying below the surface soil, usually the B or C soil horizons.

Wetland Mulch

A technique for establishing emergent plant communities where the top six inches of wetland soil from a donor wetland are spread thinly over the surface of a created wetland site as a mulch. The seedbank and organic matter of the mulch helps to rapidly establish a diverse wetland system.

Zone of Influence

The total area of a stormwater basin as measured from center to the outside edge of the Upland Buffer Zone.

Landscape Design Considerations & Goals

The design of an effective and diverse stormwater basin requires a sophisticated understanding of hydrology and wetland plant ecology. Clearly, stormwater management requires an interdisciplinary approach during both design and construction. It is encouraged and useful to establish a design team early in the planning process that includes an engineer, a wetlands expert, a landscape architect, and the contractor to make sure that the final design is both effective and practical.

Stormwater basins are not holes in the ground, but rather complex and redundant treatment systems. Their design philosophy presents basic design considerations that achieve the major objectives of stormwater basin systems and comply with the aesthetic goals which are in concert with the community's respect for environmental sensitivity. The key design considerations and goals are as follows:

1. Capture and effectively treat over 90% of the stormwater runoff volume produced by the urban development.
2. Pre-treat the stormwater runoff before it reaches downstream wetland areas so as to reduce the water velocity and trap coarse sediments.
3. Create a diversity of depth zones within the basin to meet the unique growing requirements of emergent wetland plants.
4. Establish a diverse and dense plant community in the shortest possible time.

5. Create a functional landscape within the zone of influence of the stormwater basin that augments pollutant removal, creates better wildlife habitat and promotes a more natural appearance.

6. Reduce the future maintenance burden of the stormwater basin through preventive management to protect its long term function.
7. Provide habitat elements that promote greater wildlife and waterfowl use within the basin's zone of influence, but avoid undesirable habitat outcomes.
8. Serve as an attractive yet safe community asset.
9. Maximize use: As a component of the large open space necessary for the development of a stormwater basin it makes sense to maximize the area for recreation potential. Trees, wildflowers, and paths make the area around a stormwater basin an attractive place to walk, bird watch, or picnic.

Retention Basins

Stormwater retention basins (ponds) are one of the most reliable ways to remove pollutants from urban stormwater runoff. They do this by holding stormwater long enough to allow sediments to settle out of the water. Because many pollutants are attached to sediment particles, they settle out with the sediment. Micro-organisms that live in the retention basins may remove additional dissolved pollutants.

Maintenance should be considered at the time of designing a stormwater pond. To make maintenance easier and less expensive, ponds should include the following features:

1. A discharge drain made of concrete or other durable materials rather than corrugated metal riser pipe.
2. A discharge drain located in the embankment with access for repair and cleaning out debris.
3. A disposal site near the pond to spread dredge spoils.
4. Shoreline protection should be provided to prevent erosion from the wave action.
5. Facilities should be available, if possible, to allow the pond level to be lowered by gravity flow for cleaning purposes and shoreline maintenance.
6. Aeration facilities should be provided to prevent pond stagnation.

7. Natural vegetation should be retained and protected wherever possible. Areas immediately adjacent to natural watercourses should be left undisturbed wherever possible.

8. Plant selections should be based on the probable frequency of climatic and other events likely to contribute to erosion, and on evaluation of the risks, costs and benefits involved.
9. Aesthetics, public health and the requirements of continuing maintenance should be considered in the planting design of the stormwater basins.
10. Appropriate notice signs, as approved by the City of Brookfield, are posted.
11. Encourage walk ways, bike path, jogging trails etc. around the basins to maximize the open space uses through the establishment of public use and access easements.

Safety:

Safety is a vital element of stormwater retention basin design. All basins should include:

1. gentle side slopes
2. a safety shelf around the edges of the retention basin
3. emergent plantings on the safety shelf (Emergent Zone)

Landscaping:

Proper landscaping enhances retention basin safety, improves pollutant removal, discourages large flocks of geese, and provides attractive open space. A typical landscape plan should address the distinct concentric rings of vegetation around the basin. Most important is the Emergent Zone where a ring of wetland plants such as bulrushes, wild celery and sago pondweed emerge from the shallow water within the safety shelf.

A ring of sedges and other plants adapted to wet conditions should be planted along the shoreline for a natural appearance. In many situations maintained turf may be used, yet it is encouraged that it be designed as patches of turf rather than continuous. Beyond this ring is upland vegetation including trees, shrubs, wildflowers, grasses and/or turf.

Each ring serves several functions. The wetland plants that grow in the shallow water along the pool's edge are especially valuable because they:

1. Enhance pollutant removal by providing an environment for micro-organisms that remove nutrients from dissolved water.

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2. Improve the basin's appearance by disguising water level changes and floating debris.
3. Provide habitat for insects such as dragonflies that eat mosquitoes.
4. Discourage resident flocks of geese.
5. Make the basin less attractive for swimming and wading.

Detention Basins

Dry bottom storm water storage areas should be designed to serve a secondary purpose for recreation, open space, or other types of uses that will not be adversely affected by occasional or intermittent flooding. A method of aesthetically carrying the low flow (Low Flow Channel) through these areas shall be provided with a positive gravity outlet to a natural channel or storm sewer.

The Low Flow Channel should be designed as a serpentine channel rather than a straight swale configuration. The minimum planting width for the channel should be three feet. It is preferred that the channel vary in its width. These dry-bottom storage areas will be greatly enhanced with the addition of trees. The recommended tree list consists of plants which can tolerate intermittent flooding. These should be planted in natural groves, and at least three different types of trees should be specified.

Outlet control systems should be designed as simply as possible and shall require little or no attention for proper operation. Each storm water storage area shall be provided with a method of emergency overflow in the event that a storm in excess of the 100 year flood frequency storm occurs. This emergency overflow facility should be designed to function as part of the 'natural' or surface channel system.

SELECTED PLANT MATERIALS

Plant materials selected shall be good quality species, capable of withstanding the extremes of the hardiness zone in southeastern Wisconsin and site specific microclimates.

The following list of plant species is intended as a helpful guide for selecting plant materials. Additional plant materials can be used as long as they meet the requirements set forth, are hardy in the area, and are site sensitive. Seed mixes should be comprised of species compatible to the planting situation and soils

present.

Aquatic Plants: Perennials/Grasses

The following list identifies plants appropriate for the Low Flow Channel and the Emergent Zone.

<u>Botanical name</u>	<u>Common Name</u>
<i>Acorus calamus</i> 'Variegatus'	Variegated Sweet Flag
<i>Angelica atropurpurea</i>	Angelica
<i>Iris versicolor</i>	Blue Flag Iris
<i>Juncus effusus</i> var. <i>spiralis</i>	Corkscrew Rush
<i>Juncus torreyi</i>	Torrey's Rush
<i>Pontederia cordata</i>	Pickerel Weed
<i>Scirpus americanus</i>	Chairmaker's Rush

Wetland Plants: Perennials/Grasses

The following list identifies plants and/or seed mixes appropriate for the Low Flow Channel and the Shoreline Zone.

<u>Botanical name</u>	<u>Common Name</u>
<i>Amsonia tabernemontana</i>	Willow Amsonia
<i>Anthemis tinctoria</i> 'Kelwayi'	Golden Marguerite 'Kelway'
<i>Aruncus dioicus</i>	Goat's Beard
<i>Asclepias incarnata</i>	Marsh Milkweed
<i>Aster novae-angliae</i> 'Harrington's Pink'	Harrington's Pink Aster
<i>Athyrium filix-femina</i>	Lady Fern
<i>Caltha palustris</i>	Marsh Marigold
<i>Chelone lyonii</i>	Pink Turtlehead
<i>Equisetum hyemale</i>	Scouring Rush
<i>Eryngium yuccifolium</i>	Rattlesnake Master
<i>Eupatorium maculatum</i>	Joe-Pye Weed
<i>Iris sibirica</i>	Siberian Iris
<i>Liatris pycnostachya</i>	Native Blazingstar
<i>Lobelia cardinalis</i>	Cardinal Flower
<i>Lobelia siphilitica</i>	Great Lobelia
<i>Monarda didyma</i>	Bee Balm
<i>Physotegia virginiana</i>	Obedient Plant
<i>Pontederia cordata</i>	Pickerel Weed
<i>Ranunculus acris</i> 'flore pleno'	Creeping Buttercup
<i>Solidago rigida</i>	Stiff Goldenrod

Trees:

The following are acceptable trees for the Upland Buffer, Fringe and Bottom Zones.

<u>Botanical Name</u>	<u>Common Name</u>
Acer rubrum	Red Maple
Acer saccharinum	Silver Maple
Alnus glutinosa	Alder
Betula nigra	River Birch
Fraxinus pennsylvanica	Green Ash
Larix decidua	Tamarack
Picea glauca ‘Densata’	Black Hills Spruce
Quercus bicolor	Swamp White Oak
Salix alba ‘Tristis’	Weeping Willow

Shrubs:

The following are acceptable woody shrubs for the Upland Buffer Zone and Fringe Zone.

<u>Botanical Name</u>	<u>Common Name</u>
Aronia arbutifolia ‘Brilliantissima’	Black Chokeberry
Cornus sericea	Redtwig dogwood
Cornus sericea ‘Flaviramea’	Yellow Twig Dogwood
Cornus sericea ‘Isanti’	Isanti Dogwood
Sambucus canadensis	Elderberry
Ilex verticillata	Winterberry
Salix atropurpurea ‘Nana’	Dwarf Arctic willow
Viburnum dentatum	Arrowwood Viburnum

Seed Mixes:

The proper seed selections and percentages for Prairie, Meadow, Native Grasses and Wildflower seed mixes must be determined upon analysis of the soils. And their composition is influenced by the intent of the design theme. Therefore, a standard seed mix for each can not be recommended. The specific seed mixes however must be identified on the plan documents.

The following grass seed mixes however, are adaptable to varying soil types and are readily available in the trade. These grass seed mixes are recommended for those areas that are intended for minimal mowing or frequent mowing.

Bottom Zone:

Non-mowed areas: Sow at 4lbs/1000 sq.ft.

<u>Common Name</u>	<u>% by Weight</u>
Creeping Red Fescue	50
Chewing Fescue	20
Visa or Flyer Creeping Red Fescue	10
VNS Perennial Rye	20

Fringe Zone

Maintained turf areas: Sow at 4lbs/1000 sq.ft.

Seed Mix "A"

<u>Common name</u>	<u>% by Weight</u>
Kentucky Bluegrass 85/80	40
Creeping Red Fescue	25
Perennial Rye Grass	20
White Clover	10
Redtop	5

Seed Mix "B"

<u>Common Name</u>	<u>% by Weight</u>
Fine Textured Turf Type Tall Fescue(BTC)*	80
Baron Kentucky Bluegrass	10
Turf Type Fine Textured Rye Grass (BTC)	10

* Note: BTC - Blue Tag Certified

PROHIBITED PLANT MATERIALS

<u>Botanical Name</u>	<u>Common Name</u>
Phragmites australis	Common Reed Grass
Typha latifolia	Common Cattail
Typha angustifolia	Narrow Leaf Cattail

Installation Guidelines

Successfully constructed stormwater basins and accompanying landscapes are a direct result of the quality of the installation. Improper planting techniques will adversely affect the growth of new plant materials. Quality products and installation also reduce the amount of maintenance required. A healthy vigorous plant requires less maintenance than a sick or problematic plant. Therefore, it is essential that all new planting installations be done in a quality manner.

The three basic steps to establish a dense and diverse plant community within a stormwater basin's zone of influence are:

1. Preparation of the planting wetland bed
2. Installation of the plants and/or seed mix
3. Follow up with reinforcement plantings

Preparing the Planting/Wetland Planting Bed:

The most frequently overlooked aspect of wetland planting is the preparation of the wetland bed prior to planting. Good results can be achieved through a six step process:

1. Grade the basin to interim elevations. Once the basic excavation of the stormwater basin has been completed, it is time to create the major topographic features within the basin's zone of influence, such as berms, wedges and deep water channels. A skid loader or other excavator can be used to form the internal complexity within the basin. These features can only be added while working in the "dry". Spot surveys should be made to ensure that the interim elevations are three to six inches below the final elevations.
2. Add the topsoil/wetland mulch amendments. - Since most stormwater basins are excavated to deep sub-soils, they often lack the nutrients and organic matter needed to support vigorous growth of the wetland plants. It is therefore essential to add three to six inches of topsoil or wetland mulch to all depth zones in the basin from one foot below the normal pool to six inches above. Wetland mulch is preferable to topsoil if it is available. The importance of soil amendments in excavated basins cannot be over-stressed. Poor plant survival rates and a lack of coverage are likely if these soils are

not added. Fertilizers and other soil amendments are not needed if topsoil or wetland mulch are used.

3. After the topsoil or wetland mulch has been added to the stormwater basin, it is time to grade the basin to the final elevations. This is normally done by roughing up the interim elevations with a skid loader prior to spreading the topsoil or wetland mulch to the desired depth. All features above the normal pool level should be temporarily stabilized by hydroseeding or seeding over straw.
4. Provide standing time for the basin. Once the final elevations are attained, the basin should be allowed to fill up to normal pool level. In most cases, nothing should be done for six to nine months. This standing time is needed so that the basin can experience storm flows and inundation, and the designer can more precisely predict; a).where the plant community zones are located in and around the basin, and b).whether the final grade and topographic features will persist over time.
5. Measure and stake planting depths. The stormwater basin is surveyed and staked at the onset of the planting season. Depths in the basin's zone of influence should be measured to the nearest inch to confirm the original planting depths. At this time, it may be necessary to modify the planting depths to accommodate the specified plant materials.
6. Dewater the basin prior to planting. - The basin overflow should be fully opened at least three days prior to the planting date. A "dry" wetland is much easier to plant than an inundated one.

Propagating the Stormwater Basin

Four basic techniques are used to propagate the emergent planting zone over the wetland bed:

1. Planting container grown wetland plant stock or dormant rhizomes. The most common and reliable technique for establishing emergent wetland plants in a retention basin is to transplant nursery stock obtained from aquatic plant nurseries. The following guidance is suggested when transplanting is used to establish a stormwater wetland:
 - a. The transplanting window extends from early April to mid-July. Planting after these dates is quite chancy, as emergent wetland plants need a full growing season to build the root reserves needed to get

through the winter. Plants, therefore, should be ordered at least six months in advance to ensure availability.

- b. To add diversity to the wetland, 5 to 7 species of emergent plants should be planted. Of these at least three species should be aggressive colonizers.
- c. No less than 25% of the wetland surface area need be planted.(Seeding will provide 100% coverage) If the appropriate planting depths are achieved, the entire wetland should be colonized within three years. Biomass and spatial coverage of wetland plants increase sharply after the first growing season. The wetland area should be subdivided into separate planting zones of more or less constant depth. One plant species should be planted within the flagged planting zones based on its approximate depth requirements. Individual plants should be planted 12 inches on center within each single species clump.

2. Utilization of wetland mulch.
3. Broadcasting the wetland seed mixture.
4. The use of woven seed impregnated erosion control blankets.

Planting Pits: Trees & Shrubs

1. All pits shall generally be circular in outline, with vertical sides.
2. Pits shall be deep enough to allow the top of the root ball to be flush or slightly higher than the surrounding grade. Plants shall rest on undisturbed soil or well-compacted backfill.
3. Holes for trees and shrubs shall be at least two times the spread diameter of the root ball
4. Dispose of the subsoil removed from the landscape excavations. Do not mix with planting soil or use as backfill.
5. Fill excavations for trees and shrubs with water and allow to percolate out before planting.
6. Place plants in the center of the hole and at the same depth as they were previously grown. Use enough topsoil to bring the surface of the root ball flush or slightly higher than the surrounding grade.
7. Cut ropes or strings from the top of the root ball after the plant has been set. Leave burlap wrapping intact around the base and sides of the root ball. Cut away or turn under and bury portions of burlap exposed at the top of the root ball. If the root ball is wrapped in a non-biodegradable material, remove the wrapping completely from around the root ball.
8. Provide a saucer or dish around each plant to retain water.
9. Saturate the plant pits with water within 24 hours of planting.

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10. For areas designated as shrub beds or hedge trenches, they shall be cultivated to at least 18 inches in depth.
11. For areas designated for perennials, ground covers and vines, the area shall be cultivated a minimum 12 inches.
12. All trenches and shrub beds shall be edged and cultivated to the lines shown on the approved plans.