

**Appendix B:**  
Landscape Design Standards and  
Guidelines for Stormwater and  
Detention Facilities

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**City of Fort Collins**  
**Landscape Design Standards and Guidelines**  
**for**  
**Stormwater and Detention Facilities**  
**November 5, 2009**

**PREPARED BY BHA DESIGN INC.**

WITH CITY OF FORT COLLINS UTILITY SERVICES

## **ACKNOWLEDGEMENTS:**

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CIPO: Multi-Use Basin - Detention, Water Quality, Passive Recreation, Habitat Restoration



CIPO: Integrated Outfall Structure



CIPO - Habitat, Bio-Mimicry



## INTRODUCTION

The following standards and guidelines have been developed to inform the design and maintenance of landscaping within storm drainage and detention facilities in Fort Collins. Currently the City of Fort Collins follows written standards for the technical design of drainage and detention facilities. These facilities represent a significant portion of open space within both public and private developments in the city. As a result, these standards and guidelines will improve the overall character of our community, storm drainage function, reduce irrigation demand, improve wildlife habitat, and promote maintenance of these open areas.

### VISION AND GOALS

These standards and guidelines are part of a larger vision of both the City of Fort Collins City-Wide Sustainability Initiative and the 21st Century Utilities Initiative. This vision is:

*“To inspire community leadership by reducing environmental impacts while benefiting customers, the economy and society”*

In order to help achieve this vision, these standards and guidelines for landscaping have been developed with the following goals:

- Promote water infiltration and water quality
- Habitat value and plant conservation
- Improve aesthetic quality

### STRUCTURE

This document includes background information and describes concepts and objectives for design of stormwater facilities to meet the goals of the 21st Century Utilities Initiative. It includes both **guidelines** (suggested recommendations for design improvements) and **standards** (mandatory requirements for design or documentation). The standards or requirements are outlined at the end of each section.

This document is intended to supplement, not supersede, current regulatory documents which may include:

- Fort Collins Land Use Code
- Fort Collins Stormwater Design Criteria Manual

- Larimer County Urban Area Street Standards
- Army Corps of Engineers
- Neighborhood Home Owner’s Association Requirements
- Neighborhood Design Review Committee Requirements

### VARIANCE PROCEDURES

These standards and guidelines illustrate and regulate the implementation of the concepts and objectives of the 21st Century Utilities Initiative. Their purpose is to convey these fundamental concepts, but also to foster design innovation and collaboration between city staff, developers, and design professionals. Proposed designs that illustrate the spirit and accomplish the goals, but do not conform to these standards must be approved by the City of Fort Collins Utilities Executive Director or the Director’s designee. A variance request shall be submitted in writing prior to or as part of an application for development review. The variance request (s) shall include:

- **Identifying Issue:** Identification of the standard to be waived or varied and why the standard is unfeasible.
- **Alternate Design:** Identification of the proposed alternative design or construction criteria.
- **Comparison to Standards:** A thorough description of the variance request and how the new design compares to the standard.
- **Justification:** Indication of how the proposed plan (as varied) advances the purpose of the standard sought to be varied equally well or better than would compliance with such standard.

Based upon review of the plans and additional information submitted, the Director may approve or deny the variance request. If the Director of Utilities approves the variance request, the plans will continue to be reviewed and approved within the typical review process. If the Director denies the variance request, the applicant shall subsequently submit revised plans in compliance with these Standards. The Director shall provide a written response outlining the basis for all approvals or denials of variance requests.

# BACKGROUND

## CONCEPTS

The basic concepts of stormwater management are not complicated. The goal is to restore the hydrological cycle to the extent possible and to utilize the available precipitation to promote a naturalized environment in developed areas. This requires understanding the pre-development conditions so they can be an integrated system in the development.

Site stormwater design should not simply focus on basin sizing and outfall rates, but should address site drainage as an integrated multi-use hydrologic system. This system may include detention, water quality treatments, stream bank erosion control, habitat creation, infiltration, energy dissipation, and/or recreational use. The concepts here illustrate specific measures which affect landscape treatments within this overall, integrated stormwater design approach.

## INFILTRATION VS. RUNOFF

Infiltration is a natural process by which precipitation is absorbed into the soil. Depending on the local soil type, some of the water remains in the top layers of soil and is used by vegetation. The rest of the water percolates

through the soil and bedrock, recharging the groundwater system.

Runoff occurs when the soil is saturated, has become impermeable or when structures and impermeable materials are placed on the site. Runoff tends to contain silt and pollutants that require mitigation. Excessive runoff also contributes to adverse hydraulic downstream conditions causing unnatural stream bank erosion and limited groundwater recharge.

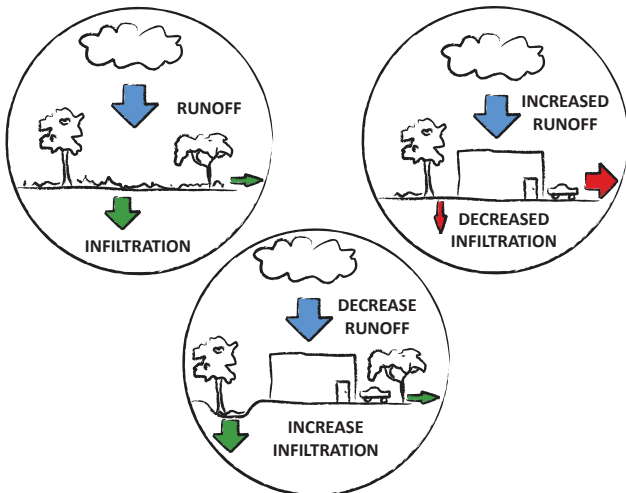
Appropriate site design promotes natural infiltration resulting in fewer downstream impacts including excessive stream flow, exaggerated geomorphology, and reduced stormwater capacity of natural systems.

## HABITAT VALUE

Historically the area that is now Fort Collins was a short grass prairie with a large variety of plant and animal species. Many of these species have been displaced by the onset of development. Natural waterways and drainage patterns are altered by development. This decreases the functionality of existing hydrologic systems. It is necessary to reasonably accommodate and/or reestablish the hydrologic systems that existed prior to development through the site and landscape design process.

**PRE-DEVELOPMENT**

**POST-DEVELOPMENT  
(TYPICAL)**



**GOAL: POST-DEVELOPMENT  
DESIGNED FOR INFILTRATION**





# City of Fort Collins Stormwater Standards and Guidelines

## **STORMWATER IS AN AMENITY**

Stormwater facilities have a reputation for being functional site features without natural qualities. The basic design parameters for a detention pond design is capacity or volume and rate of discharge. These parameters combined with economic factors typically result in designs that maximize the amount of stormwater detention within the smallest possible area.

These parameters are typically accomplished by the creation of geometric basins with calculated volume and outflow rates, connected to site and local utilities through standard gray concrete and steel structures. The typical detention basin is functional as a facility, yet, provides little or no aesthetic or habitat benefits. In many cases detention basins of this kind detract from the overall project image or appeal and adversely affect surrounding properties.

Detention ponds and waterways can instead be designed to both meet the engineering requirements and provide an attractive diverse space. A detention pond can serve as a multi-use area, wildlife habitat, picturesque scene, entry experience or educational opportunity while maintaining the necessary functions of stormwater detention and water quality improvement. Stormwater facilities should be considered an opportunity for aesthetic interest and natural integration rather than solely necessary features of a development.



**"Front Door" Curb Appeal - Improved Aesthetics**

## OBJECTIVES

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In order to achieve the overall goals, the following objectives must be met:

### 1. INFILTRATION AND WATER QUALITY

Reduce excess runoff and downstream pollution by increasing on-site infiltration and water quality. Maintain the primary functions of detention ponds and stream drainages to attenuate flows and improve water quality while creating and improving wildlife habitat.

- Increase pervious surface area and surface conveyance.
- Decrease flow concentration.
- Take advantage of natural processes through bio-filtration and bio-retention.
- Manage vegetation to insure proper drainage functions are maintained while allowing habitat values to be expressed to the extent possible.

### 2. HABITAT VALUE AND PLANT CONSERVATION

Create and protect habitat for a diverse array of plants and animals; birds, mammals, insects, amphibians, and wetland plants.

- Increase plant species diversity including the number and variety of butterfly host plant grasses, forbs, and shrubs as well as the number of nectar plants and shelter plants.
- Increase the number and variety of native shrubs and trees that provide valuable cover, berries, insects, nest sites and other resources for migratory, nesting, and wintering birds.
- Increase the number and variety of wetland species that provide optimal conditions for amphibian and reptile breeding to occur.

### 3. AESTHETIC APPEAL

Create a beautiful landscape that people will enjoy and appreciate without sacrificing function and value for wildlife and plant habitat.

- Increase the amount of shade and resting areas along trails and open spaces while providing habitat for wildlife and viewing opportunities for visitors.
- Use plant species that maintain their beauty in a variety of seasons, such as a species with colorful

and showy flowers, fall leaf color, winter texture, and grasses that persist through the winter while they provide good wildlife habitat.

- Use vegetation to frame viewsheds and enhance the natural aesthetic qualities of the site.

## DESIGN GUIDELINES

### GENERAL CONSIDERATIONS

A significant portion of a developed site often must be used for drainage conveyance and site detention. In planning your site, consider how the storm drainage facilities can contribute to the overall character of the project.

Developers and designers should consider:

- How will the stormwater facilities be designed to achieve the goals of this document and the needs of the project?
- How will the stormwater facilities be designed as an amenity rather than a necessary nuisance for this project?

### PLANNING/SITE CONTEXT

Obtain and understand information about **site conditions** and **site context** before designing the detention facilities, including:

- Adjacent and regional drainage, recreational, and open space patterns
- On-site topography and drainage conditions
- Soil conditions
- Unique natural features, amenities or views
- Aesthetic expectations

Consider how the design of drainage facilities and detention areas can contribute to the overall plan and adjacent developments. **Collaborate** with adjacent property developers to formulate a more effective neighborhood or regional storm drainage plan. Look for opportunities to integrate storm drainage conveyance and water quality systems into the planned development. Using bioswales, linear conveyance with check dams, and inverted landscape islands throughout the project will increase **distributed infiltration** and can result in reduced land dedication requirements for larger detention ponds.

Different development types will have differing needs that can be enhanced by thoughtful design of stormwater systems that can serve **multiple functions**. Some concepts to consider for detention areas based on development types include:

- **Residential Development** – neighborhood greenbelts, multi-purpose recreational fields\*, pedestrian trails, entry features, water features, wildlife habitat, wetland/riparian amenities, community gardens\*, orchards, natural playgrounds, off-leash dog play areas\*.



- **Business / Retail Development** – Water features, entry features, loop trails, picnic shelters\*, visual buffer to screen service areas from public spaces, bioswale/ landscape islands, etc.



- **Industrial Development** – Visual buffer to screen service and loading areas, trail connections, recreation areas, etc.



\* Structures and fences should be designed for flooding conditions.



## LANDFORM AND SLOPES

Detention ponds engineered solely to meet the minimum holding capacity of the required storm flows generally result in ponds with uniform side slopes with little natural character, or with vertical side walls that may create unsafe conditions. Design pond slopes in a way that they may also contribute to other goals.

If a detention pond is designed to also serve as a neighborhood recreation or athletic field, use **gentle side slopes** to allow for easy access to the play fields. Steeper side slopes can be designed with terraced flat areas to serve as spectator seating. Other greenbelt amenities such as picnic areas and pedestrian trails can be developed adjacent to these spaces to create a neighborhood park amenity that also serves as stormwater detention. While gentler slopes for detention may require more land for the pond, by combining the required pond area with required community uses, less land may be used for these open areas overall.



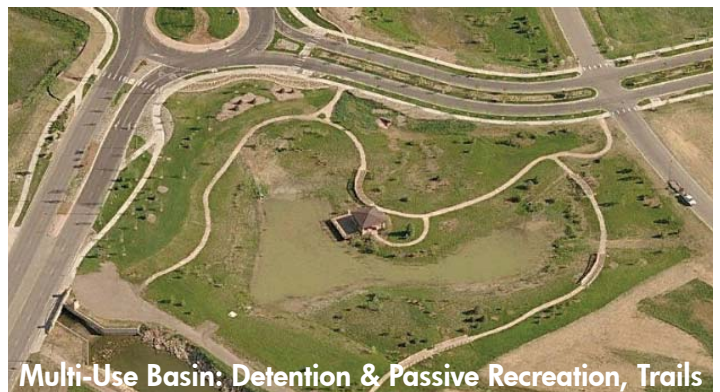
Multi-Use Basin: Detention & Passive Recreation



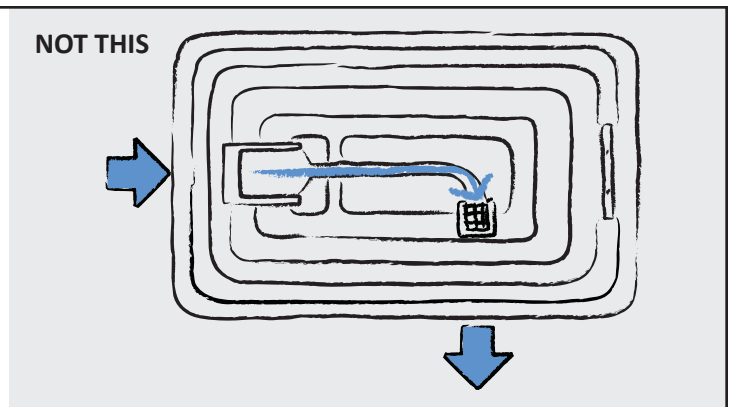
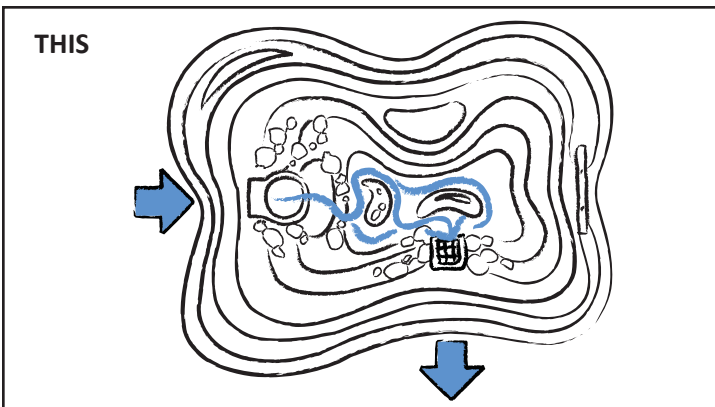
Multi-Use Basin: Detention & Sports Field



Multi-Use Basin: Detention & Passive Recreation, Trails



Multi-Use Basin: Detention & Passive Recreation, Trails



# City of Fort Collins Stormwater Standards and Guidelines

Detention ponds designed to be naturalized open space should include **varied side slopes and an undulating bottom**. Varied slope conditions will promote opportunities for plant diversity and wildlife habitat by creating subtle changes in elevation above the average water level. Combine these techniques to create a wide array of diverse soil conditions and exposures for plants and animals to inhabit and “naturalize”.

Design detention ponds with positive slopes (2% minimum) near the outlet to avoid standing water and limit mosquito habitat. Manicured turf areas that require regular mowing should also be sloped to drain appropriately (4:1 Max). However, flatter areas are encouraged to increase infiltration, but must be landscaped appropriately with wetland plants, forbs and shrubs that do not require regular mowing and will tolerate wet and dry conditions.

Avoid the use of concrete trickle pans in areas with well-draining soils as they reduce infiltration and promote evaporation and increased runoff. Where necessary, trickle pans shall be designed as an integrated part of the landscape. Horizontal alignment shall complement topographic character and be non linear. Embedded cobbles and/or boulders are encouraged. Color shall be a subtle earth tone.

General access is a primary **safety consideration**. Ramped access and gentle side slopes allow people and animals to evacuate the basin in the event of high water.

**Access for maintenance** equipment and personnel is necessary for proper care and management of stormwater facilities. Design slopes to provide appropriate access for wheeled service vehicles, utility vehicles, lawn mowers

and/or brush hogs. Consider that trash and debris must be regularly removed by maintenance personnel. Periodic cleanup operations may also require the use of heavy equipment. If walls are used, they shall be limited to the minimum required height and length needed. Ideally no more than 50% of a basin perimeter should be bound by walls. All walls shall be built of suitable materials matching adjacent architecture or designed into the landscape scheme with natural stone or integral color concrete with form liner.

## LANDFORM AND SLOPES

### Required Design Standards:

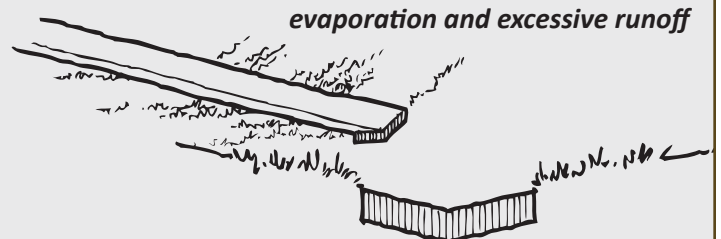
In all cases the following standards apply:

- No concrete trickle channels shall be used where free draining soils are present (Soil Group A, B). Limit their use to areas with clayey soils (Soil Group C, D) if necessary.
- Side slopes should vary and range from 4:1 to 20:1
- No vegetated slope should exceed 3:1
- Landscaped areas should slope to drain (2% minimum) or be planted appropriately so regular mowing is not required (see PLANTING DESIGN section).
- Basin area cannot be 100% bound by walls. All walls proposed for the pond perimeter are required to have a high quality visual character (such as natural stone or integral color concrete with form liner). Walls should not exceed 30” in height. Fences may be required for safety.
- Provide a minimum of one entry point for regular access by maintenance vehicles and mowers, and for occasional access by heavy equipment if necessary. Provide adequate egress to allow users to safely evacuate the area in the event of high water.

**THIS** *Naturalized drainage channel slows drainage, promotes infiltration, allows for habitat establishment*



**NOT THIS** *Concrete trickle channel eliminates infiltration and promotes evaporation and excessive runoff*





## PLANTING DESIGN

There is no universal approach to landscape design for detention areas. Planting design must respond to site-specific stormwater functions, soil types and hydrology, slopes, solar aspect, availability and type of irrigation, habitat creation, planned uses and planned maintenance. A Landscape Architect can assist with a comprehensive plan for the landscape design for your project's open space and detention areas. The following guidelines outline important criteria for the development of landscape plans for these areas.

Before finalizing planting plans and seed mixes, obtain **horticultural testing** of the on-site soils where planting will occur. Testing can be completed by the Colorado State University Soil and Crop Sciences Department for a nominal fee. Contact the Soil-Water-Plant Testing Lab at <http://www.extsoilcrop.colostate.edu/SoilLab/soillab.html> for more information. Often planting plans must be completed before construction activities take place, so final soil conditions for areas to be planted are not available at the time of design. If overlot grading is planned to occur after the planting plans are complete, require the contractor to incorporate 6" of topsoil from on-site or imported source into final grading operations, and indicate that the final seed mixes will be modified after final grading is complete and subsequent horticultural tests are evaluated.

Use native and adapted plants. Proper landscape design with native plants based on a site's unique conditions can:

- Reduce or eliminate need for supplemental irrigation
- Reduce fertilizer and chemical pest control needs
- Enhance wildlife habitat
- Reduce maintenance needs

Plants should be screened for invasiveness by using the Nature Conservancy's Nature Serve Explorer website at <http://www.natureserve.org/explorer/servlet/NatureServe?init=Species>

## PLANT SPECIES SELECTION

Delineate **planting zones** with similar characteristics and proposed function. Characteristics should include slope, aspect, soil type, and moisture levels. Functions may include wildlife habitat, recreational use, or visual amenity or visual screening.

Develop a plant list for each zone type. See TABLE 1 for a sample listing of appropriate plant types.

# City of Fort Collins Stormwater Standards and Guidelines

**TABLE 1: RECOMMENDED PLANT LIST**

## TREES AND SHRUBS

### Upland Species – North and East Facing

Fourwing Saltbush (*Atriplex canescens*)  
 Rubber Rabbitbrush (*Chrysothamnus nauseosus*)  
 Three-leaf Sumac (*Rhus trilobata*)  
 Native Smooth Sumac (*Rhus glabra*)  
 Wood’s Rose (*Rosa woodsii*)  
 White Snowberry (*Symphoricarpos alba*)  
 Western Snowberry (*Symphoricarpos occidentalis*)  
 Netleaf Hackberry (*Celtis reticulata*)

### Upland Species – South and West Facing

Fourwing Saltbush (*Atriplex canescens*)  
 Rubber Rabbitbrush (*Chrysothamnus nauseosus*)  
 Three-leaf Sumac (*Rhus trilobata*)  
 Desert False Indigo (*Amorpha canescens*)  
 Winterfat (*Krascheninnikovia lanata*)  
 Yucca (*Yucca glauca*)

### Species for Moist, Well-drained Areas

#### (2.5-6 feet above high water line or one-year storm)

Saskatoon Serviceberry (*Amelanchier alnifolia*)  
 Shiny-leaved Hawthorn (*Crataegus erythropoda*)  
 Wild Plum (*Prunus Americana*)  
 Western Chokecherry (*Padus virginiana var. melanocarpa*)  
 Western Sand Cherry (*Prunus bessyi*)  
 Cottonwood Tree (*Populus spp.*)  
 Netleaf Hackberry (*Celtis reticulata*)

### Species for Subirrigated Areas

#### (1-3 feet above high water line)

Leadplant (*Amorpha fruticosa*)  
 Redosier Dogwood (*Cornus sericea*)  
 Golden Currant (*Ribes aureum*)  
 American Black Currant (*Ribes americanum*)  
 Peachleaf Willow (*Salix amygdaloides*)

## GRASSES

### Species for Upland Slopes

Little Bluestem (*Schizachyrium scoparium*)  
 Side Oats Grama (*Bouteloua curtipendula*)  
 Blue Grama (*Bouteloua gracilis*)  
 Western Wheatgrass (*Pascopyrum smithii*)  
 Green Needlegrass (*Nassella viridula*)  
 Slender Wheatgrass (*Elymus trachycaulus*)  
 Buffalograss (*Buchloe dactyloides*)  
 Bottlebrush Squirreltail (*Elymus elymoides*)  
 Sand Dropseed (*Sporobolus cryptandrus*)  
 Alkali Bluegrass (*Poa juncifolia*)  
 Sun Sedge (*Carex inops ssp. heliophila*)

### Species for Subirrigated Areas

Big Bluestem (*Andropogon gerardii*)  
 Switchgrass (*Panicum virgatum*)  
 Yellow Indiangrass (*Sorghastrum nutans*)  
 Alkali Sacaton (*Sporobolus airoides*)  
 Green Needlegrass (*Nassella viridula*)  
 Western Wheatgrass (*Pascopyrum smithii*)  
 Nuttall Alkaligrass (*Puccinellia airoides*)  
 Canada Wildrye (*Elymus canadensis*)

### Species for Wetland Areas

Prairie Cordgrass (*Spartina pectinata*)  
 Canada Wildrye (*Elymus canadensis*)  
 Switchgrass (*Panicum virgatum*)  
 Inland Saltgrass (*Distichlis spicata*)  
 Fowl Bluegrass (*Poa palustris*)  
 Nebraska Sedge (*Carex nebrascensis*)  
 Woolly Sedge (*Carex lanuginose*)  
 Creeping Spikerush (*Eleocharis palustris*)  
 Torrey’s Rush (*Juncus torreyi*)  
 Baltic Rush (*Juncus balticus*)

## PLANTING TECHNIQUES

### Soil Preparation

Good soil is the foundation of a successful landscape. Planting areas require topsoil with appropriate levels of organic matter. Spread imported or stockpiled **topsoil** to a minimum depth of four inches over areas to be planted. For native seed areas, additional soil amendments are not necessary. Native plants are adapted to the native soils, and the additional organic matter found in soil amendments may instead promote weed growth.

Sub-grade in planting areas should be loosened to a minimum depth of twelve (12) inches overall (8" of existing sub-grade and 4" of new topsoil). Remove stones and clods that could impede planting, seeding, and mowing. Stones protruding from the soil more than 3" should be removed. Collect and legally dispose of sticks, roots, rubbish, and other extraneous matter. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted the soil. **Fine grade** disturbed planting areas to a smooth, uniform surface plane with a loose, uniformly fine texture. Grade to within the acceptable tolerances provided by the certifying civil engineer. Roll and rake, remove ridges, and fill depressions to meet finish grades based on grading plans.

Weeds thrive in soil disturbed by grading operations. Use of **appropriate herbicides** prior to planting can help to reduce the onset of noxious weeds and other aggressive non-desirable plants. Apply non-selective herbicides to weeds after fine grading has occurred and prior to planting. Herbicide shall be 'Round-Up' or similar product that will not persist in the soil and negatively affect planting operations.

### Seed Mixes and Installation Techniques

Seed mixes should be developed based on the on-site soil conditions determined with the soil **horticultural tests**. Since detention and drainage areas have varying moisture conditions and slopes, develop a **diverse seed mix** with a wide ecological amplitude. When multiple seed species are used, they will tolerate a wide array of soil and moisture conditions. See TABLE 1 for a list of appropriate grass types for various planting zones.

Drill seed specified mix in two passes, each at right angles to each other. Drill half of the seed in each pass. If areas are too wet or steep to drill seed, broadcast seed in two opposite directions. Restore fine grade after seeding, and cover seed to depth of 1/4 inch by raking or dragging. Firm seeded areas with a roller weighing maximum of 100 lbs. per foot of width.

Use of **erosion control** blankets may be needed on steeper slopes (greater than 6:1), or non-irrigated south-facing and west-facing slopes to reduce erosion, improve soil moisture and seed germination. Natural fiber blankets are preferred to synthetic blankets which can entangle reptiles and amphibians in pond settings. Install erosion control blankets as per manufacturer's recommendations.

Remaining seeded areas should be mulched to reduce seed loss and improve soil moisture and germination. Large sites without irrigation can be mulched with straw mulch. Straw mulch should be certified weed-free hay or certified weed-free straw with no seed heads, crimped into the seed bed after seeding has occurred. Irrigated sites can be hydromulched after seeding has occurred.

### Wetland Plantings and Subirrigated Plugs

Concentrate **wetland plantings** in areas where erosion is anticipated or where favorable moisture zones are likely to exist. Since planned moisture levels are difficult to predict, plant species in, above, and below their ideal zone to accommodate for both high water and low water seasons. Plants are then likely to establish in their optimal conditions. Since detention areas fluctuate with storm conditions, use species with wider tolerances to moisture conditions.

Wetland plugs may be necessary in areas that cannot be seeded due to constant inundation or saturation. Plant plugs after drill seeding from mid-May through July. Planting small plugs in the fall is less desirable due to loss of plants to Canada Geese. Plug plantings can be completed immediately after seeding. Subsequent plug plantings are recommended after initial seed establishment when weeds are under control (2-5 seasons after initial construction). These later plantings can be concentrated in bare areas and those areas needing erosion control protection.

# City of Fort Collins Stormwater Standards and Guidelines

Wetland plugs may be planted 12" to 24" on center and may need protection with turf reinforcement mats, jute or similar erosion control devices. Plugs can be caged or covered with wire fabric, jute or other products for protection if damage by geese or small mammals is anticipated. In areas of standing water, grids of string slightly above the water elevation can also be installed to reduce waterfowl access to newly planted areas.

## Trees and Shrubs

Concentrate or group shrubs and woody plants into beds or groups to more quickly create habitat for wildlife and to reduce weeding, watering and maintenance requirements. Select species based on the optimal moisture zones. Construct **planting wells** around each tree or group of woody plants to capture natural moisture for the plants. Use organic **mulch** in planting beds or in tree wells to increase moisture retention and to reduce weed and grass encroachment. Avoid using weed barrier around trees and shrubs.

Use shrubs and wetland plants strategically near inlets to soften the visual impact of these man-made structures without impeding storm drainage function. Avoid the use of exposed rip-rap. Rip-rap if used shall be a subtle earth tone color, not pink, and should be buried and integrated with erosion control matting, and planting to soften the visual impact and provide opportunities for habitat establishment. Other types of less intrusive erosion control materials which incorporate planting materials should be considered. Bio-engineered solutions are preferred in lieu of structural erosion control measures. Brush layering and use of live branch cuttings can restore and protect stream banks and outfall areas while creating

a natural habitat and reduce the cost of structured protection measures. Seeding schedule should be per seed source recommendation. Trees and shrubs should be planted prior to seeding.

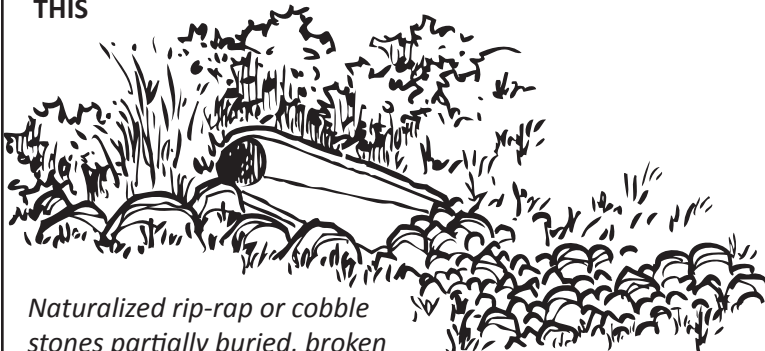
## LANDSCAPE

### Required Design Standards:

In all cases the following standards apply:

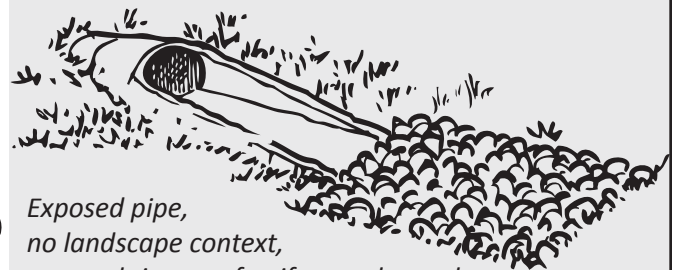
- Enlist the services of a Landscape Architect to prepare the required landscape construction plans for commercial project detention areas.
- Develop plant lists and seed mixes based on horticultural testing of site soil conditions.
- Delineate planting zones based on soil characteristics and function. Develop plant lists appropriate for each planting zone.
- Use native and adapted plants.
- Provide a minimum of one entry point for regular access by maintenance vehicles and mowers, and for occasional access by heavy equipment if necessary. Do not block access with designed landscape features.
- Stockpile and redistribute (or import if necessary) a minimum of four inches of topsoil over areas to be planted.
- Use non-persistent herbicide prior to planting to curtail weed establishment.
- Incorporate erosion control blankets and/or appropriate mulch to reduce erosion and improve soil moisture conditions for new plantings.
- Use wetland species in appropriate areas and pond bottoms likely to be too wet for regular mowing and maintenance.

THIS



*Naturalized rip-rap or cobble stones partially buried, broken edges, streambed appearance*

NOT THIS



*Exposed pipe, no landscape context, exposed rip-rap of uniform color and size, straight edges and square corners*

## **IRRIGATION**

Since storm drainage and detention areas account for the most significant portions of open landscaped space in most projects, their design can greatly impact the amount of irrigation water demand for a project. Irrigation and landscape design should correspond to the types of uses planned for the detention areas. Areas planned for high pedestrian use such as recreational fields will require higher irrigation needs to provide regular, controlled irrigation levels. More natural areas may be able to minimize or eliminate completely the need for supplemental irrigation. Landscape designs are encouraged to respond to each site's unique soil conditions and planned hydrology to minimize or eliminate the need for supplemental irrigation.



## MAINTENANCE

### Weed Control

The primary method of weed control during the initial establishment period (two to three growing seasons) for seeded areas is regular mowing. **Regular mowing** helps prevent weed seeds from being produced. Careful spot spraying is also acceptable, but many herbicides affect seedling grasses and non-target plants. Always read and follow label directions. After the initial establishment period, if chemical weed controls are needed in the pond bottoms of wet detention areas, herbicides should be selected that have an aquatic label. Even herbicides approved for aquatic use should only be used during periods of dry weather and dryer conditions to reduce the amount of herbicide that gets into the water itself. Side slopes generally above the high water line can be sprayed with non-aquatic but non-persistent herbicides as per the manufacturer's recommendations.

**Cattails** will generally establish in created detention areas through natural dispersal. Although they are a native species, they are often so competitive that they become a mono-culture if not managed. Cattails should be suppressed for the first three to five growing seasons to allow less aggressive native species to establish.

### Erosion Control

Areas of erosion should be **monitored and corrected** to prevent damage to the landscape and storm drainage structures.

### Irrigation and Fertilization

Supplemental irrigation will be needed during the initial establishment period. However, once established, naturalized drainage and detention areas using native plants and species appropriate for the specific moisture regimes should not require fertilizers or supplemental irrigation after establishment. Irrigation used during establishment can either be reduced or eliminated altogether. Limit the use of fertilizers in native plant areas.

In detention basins that also serve as recreation fields or active neighborhood spaces, permanent irrigation and more standard fertilization, aeration, and weed control practices are appropriate to keep a more manicured appearance.

## MAINTENANCE

### Required Design Standards:

In all cases the following standards apply:

- Use regular mowing as a primary weed control method during initial establishment period.
- Limit use of chemical herbicides, and only use those appropriate for conditions. Use non persistent herbicides in upland areas, and aquatic approved herbicides near wet, wetland or water areas.
- Suppress cattails for the first three to five growing seasons to allow less aggressive native species to establish.
- Monitor and correct areas of erosion.
- Limit irrigation and fertilization to that needed for plant establishment and specific designed needs. Naturalized areas with native plants are adapted to Colorado soils so should only require irrigation during the initial establishment period, and should not require fertilization. High-use or active recreation areas will require more regular irrigation and standard fertilization practices.

## APPENDICES

### GLOSSARY OF TERMS & CONCEPTS

**Base Flow** – The portion of stream flow that is not runoff and results from seepage of water from the ground into a channel over time. The primary source of running water in a stream during dry weather.

**Best Management Practice (BMP), nonstructural**– Strategies implemented to control stormwater runoff that focus on pollution prevention, such as alternative site design, education, and good housekeeping measures.

**Best Management Practice (BMP), structural** – Engineered devices implemented to control, treat, or prevent stormwater runoff.

**Bio-filtration** – The use of vegetation such as grasses and wetland plants to filter and treat stormwater runoff as it is conveyed through an open channel or swale, or collects in an infiltration basin (see Bio-retention).

**Biological Diversity** – The concept of multiple species or organisms living together in balance with their environment and each other.

**Bio-retention** – The use of vegetation in retention areas designed to allow infiltration of runoff into the ground. The plants provide additional pollutant removal and filtering functions.

**Detention** - The storage and slow release of stormwater following a precipitation event by means of an excavated pond, enclosed depression, or tank. Detention is used for both pollutant removal, stormwater storage, and peak flow reduction. Both wet and dry detention methods can be applied.

**Evapotranspiration** - The loss of water to the atmosphere through the combined processes of evaporation and transpiration, the process by which plants release water they have absorbed into the atmosphere.

**Filter Strip** - Grassed strips situated along roads or parking areas that remove pollutants from runoff as it passes through, allowing some infiltration, and reductions of velocity.

**Floodplain** - Can be either a natural feature or statistically derived area adjacent to a stream or river where water from the stream or river overflows its banks at some frequency during extreme storm events.

**Green Roof** - A contained space over a building that is covered, partially or entirely, with living plants.

**Groundwater** - Water that flows below the ground surface through saturated soil, glacial deposits, or rock.

**Hydrologic Soil Groups** - Soil groups based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

- *Group A.* Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
- *Group B.* Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
- *Group C.* Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
- *Group D.* Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.
- If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

**Hydrology** - The science addressing the properties, distribution, and circulation of water across the landscape, through the ground, and in the atmosphere.

**Impervious surface** - A surface that cannot be penetrated by water such as pavement, rock, or a rooftop and thereby prevents infiltration and generates runoff.

**Imperviousness** - The percentage of impervious cover within a defined area.

# City of Fort Collins

## Stormwater Standards and Guidelines

**Infiltration** - The process or rate at which water percolates from the land surface into the ground. Infiltration is also a general category of BMP designed to collect runoff and allow it to flow through the ground for treatment.

**Metered Detention and Discharge** - A system where stormwater is collected in a cistern pond and then slowly released into the landscape beds or the storm drain in the following hours at the rate that allows for better filtration and is less taxing to the overall community storm drain.

**National Pollutant Discharge Elimination System (NPDES)** - A provision of the Clean Water Act that prohibits discharge of pollutants into waters of the United States unless a special permit is issued by the EPA, a state, or (where delegated) a tribal government or and Indian reservation.

**Outfall** - The point of discharge from a river, pipe, drain, etc. to a receiving body of water.

**Peak discharge** - The greatest volume of stream flow occurring during a storm event.

**Pervious** - Admitting of passage or entrance. Material that permits elements such as water and oxygen to enter and or pass through.

**Polluted runoff** - Rainwater or snow melt that picks up pollutants and sediments as it runs off roads, highways, parking lots, lawns, agricultural lands, logging areas, mining sites, septic systems, and other land-use activities that can generate pollutants.

**Porous pavement and pavers** - Alternatives to conventional asphalt that utilize a variety of porous media, often supported by a structural matrix, concrete grid, or modular pavement, which allow water to percolate through to a sub-base for gradual infiltration.

**Retrofit** - The creation or modification of a stormwater management practice, usually in a developed area, that improves or combines treatment with existing stormwater infrastructure.

**Runoff** - Water from rainfall, snow melt, or otherwise discharged that flows across the ground surface instead of infiltrating the ground.

**Sanitary sewer system** - Underground pipes that carry only domestic or industrial wastewater to a sewage treatment plant or receiving water.

**Sedimentation** - A solid-liquid separation process utilizing

gravitational settling to remove soil or rock particles from the water column.

**Siltation** - A solid-liquid separation process utilizing gravitational settling to remove fine-grained soil or rock particles from the water column.

**Storm sewer system** - A system of pipes and channels that carry stormwater runoff from the surfaces of building, paved surfaces, and the land to discharge areas.

**Stormwater** - Water derived from a storm event or conveyed through a storm sewer system.

**Surface water** - Water that flows across the land surface, in channels, or is contained in depressions on the land surface (e.g. Runoff, Ponds, Lakes, Rivers, and Streams).

**Swale** - A natural or human-made open depression or wide, shallow ditch that intermittently contains or conveys runoff. Swales can be equipped with an underdrain or other man-made drainage device. and can be used as a BMP to detain and filter runoff.

**Urban runoff** - Runoff derived from urban or suburban land-uses that is distinguished from agricultural or industrial runoff sources.

**Water (hydrologic) cycle** - The flow and distribution of water from the sky, to the Earth's surface, through various routes on or in the Earth, and back to the atmosphere. The main components are precipitation, infiltration, surface runoff, evapotranspiration, channel and depression storage, and groundwater.

**Water table** - The level underground below which the ground is wholly saturated with water.

**Watershed** - The land area, or catchment, that contributes water to a specific water body. All the rain or snow that falls within this area flows to the water bodies as surface runoff, in tributary streams, or as groundwater.

## STAKEHOLDER & OPEN HOUSE COMMENTS

- A landscape plan for all stormwater facilities must be prepared by a professionally licensed Landscape Architect with experience in stormwater facility design.
- List possible techniques/solutions with examples and case studies to help appease those entering into uncharted territory (both applicants and reviewers)... this will help avoid the “pioneers get the arrows, and the settlers get the land” dilemma.
- Along with various options, include the design criteria to which City Staff will review against. If every applicant and design team needs to justify the proposed solutions on their own, and spend extra time and money getting Staff on board, it will serve as a deterrent to implementing some of these new techniques. Obviously, the guidelines cannot account for every potential option, and they need to remain fluid to allow future solutions and innovations not yet known. However, to get the ball rolling and encourage more imminent alternatives, not asking each project to ‘fight the battle’ so-to-speak would be a great benefit.
- Please put these boards on the website.
- More Wet Ponds, or flat bottom, because it provides additional volume
- How do you handle clay soils?
- Use appropriate landscaping materials
- If using sub drain, provide outlet
- Ponds should have concrete weir – because it provides a reference elevation
- Slow H<sub>2</sub>O down to increase infiltration.
- Remove concrete pans to assist / allow areas to be more natural. Use planting in this area to build upon drainage path.
- Reevaluate stormwater requirements to over store H<sub>2</sub>O.
- Take into account H<sub>2</sub>O uptake of plant material.
- Use of injection / percolation wells to speed absorption.
- Combine system with pervious pavement solutions to maximize usable land.
- Provide incentives for innovation.
- How can green roofs help with the reduction / delay of stormwater discharge?
- Incentive to developer to allow pond areas to be in natural state and not manicured.
- Encourage bioswales, etc. in and around site.
- Incentive to allow water to be treated at source in rain gardens / bioswales / etc.
- Provide support that will lead to decrease in required pond volumes such as narrower streets, pervious pavements, etc. Currently engineering will not allow pervious pavement or bioswales
- No pan requirements in ponds
- Don’t just default to Urban Drainage; allow variation suitable to project type and size. Allow credit for developments that try several LID practices even if it can’t be modeled or formulated in U.D. Let’s see if it works provided downstream not affected.
- How can we quantify infiltration / to allow for smaller ponds?
- What plants can work in flat-bottom swales (no concrete pan)
- City inspectors requiring concrete pans!
- Keep in mind expansive clay soils, cannot hold / direct water across them without issues.
- Different standards (maintenance / design /aesthetics) for different uses / districts = industrial vs. retail
- Civil Engineers tend to “engineer” a solution in the least amount of space
- Integrated Design
- Go from utilitarian to “aesthetic”
- Multi use spaces included in final design
- Need more cooperation between city departments to reduce maintenance requirements (onerous) on HOA’s
- Go for the more natural look.
- Materials:
  - A. No rock?
  - B. No concrete?
  - C. No vertical edges?
  - D. No irrigation? – (native and adaptive)
- Green (grass) vs. Green (money) vs. Green (sustainable)
- Flexible aesthetics per property / project
- Distributed smaller detention
- No regional pond.
- Savings from less storm sewer.
- Raised landscape islands converted to depressed landscape islands
- Incentives for:

# City of Fort Collins

## Stormwater Standards and Guidelines

- A. Dispersed system
    - B. Water quality
  - Slow down the water!
  - Regional / Neighborhood detention facilities vs. each site – with fee similar to street over sizing
    - A. Regional (City)
    - B. Neighborhood
    - C. Private
  - Infill projects
    - A. Smaller facilities
    - B. Swales with infiltration
  - Linear detention keep larger ponds sizes down
  - Inverted landscape islands in parking lots
  - Alternatives for wetland mitigation similar to Corp of Engineers in lieu of fee?
  - May not apply to detention ponds
  - LID – encourage small ponds close to source
  - Concentration of surface area
    - A. Less curb and gutter
    - B. More infiltration
    - C. \*Increased surface area
    - D. Greenbelts conveying and slowing water (check dams) to increase infiltration
  - Native soils = little infiltration but slowing rate through bioswales still help with down stream flows
  - Tucson = standards top in nation as model
  - City needs to be able to accept new ideas
    - A. Rocky mountain innovation
    - B. Infiltration? City requires 2X capacity if case it doesn't work
    - C. Include innovation process in standards
  - Collaboration – encourage collaboration among project team members and between team and city
  - City to take a leadership role in new techniques
  - Help developer to understand benefits. \*Examples of successful projects?
  - Example projects schematics, concepts illustrated
  - Eliminate risk by having guidelines on the books
  - Access for maintenance
  - Mowing (private Maintenance)
  - Backhoes / Dumptrucks for sediment removal (city)
  - Partnership between private and city
  - Gently sloping sod, few trees
  - No walls?
  - Limit walls to allow maintenance
  - Underground detention?
  - How do you deal with long term maintenance?
- Standards vs. Guidelines
  - Prescriptive vs. Proscriptive
  - Requirement for Landscape Architect on design team
  - Combination? If walls then upgrade
  - Engineering staff on team
  - LUCASS staff on team
  - Life cycle vs. Front end cost
  - Continue to promote growth and development
  - Multiple use = multiple approaches
  - Difficult with little used areas
  - No fertilizer unless play fields
  - No irrigation (except during establishment)
  - Required ground cover
  - Context for plant types
    - A. Categories for use, wetland, soil type, landscape, maintenance
    - B. Review Urban Drainage Standards
    - C. New development vs. Infill / redevelopment