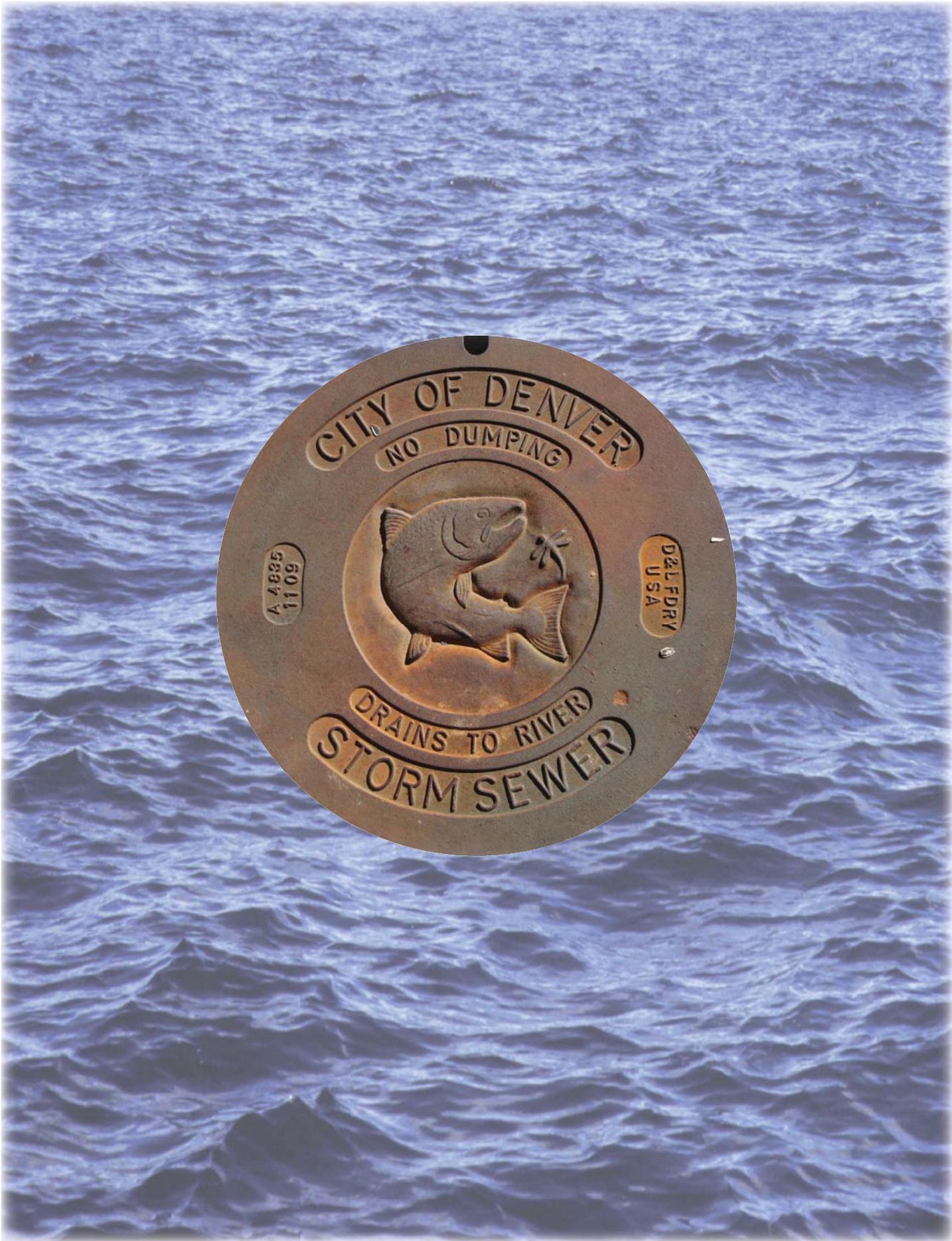


# AESTHETICALLY ENHANCED DETENTION AND WATER QUALITY PONDS



**DENVER**<sup>®</sup>  
THE MILE HIGH CITY

*September 2010*



# Table of Contents

Introduction.....	5
Detention Pond Zones .....	9
Tools for Success	
1. Siting and Functionality .....	11
2. Physical Character and Architectural Elements.....	15
3. Landscape Design .....	19
Guidelines for Site Enhancement Table.....	22
Acronyms.....	23

## Acknowledgements

This document is the result of extensive work and collaboration among staff from several City and County of Denver sections who care deeply about the aesthetic appearance of stormwater facilities, including:

Mark Mancini, Development Services, Site Engineering  
Olga Mikhailova, Development Services, Project Coordination  
Walt Hime, Development Services, Site Engineering  
Alan Sorrel, Development Services, Site Engineering  
Jill Wuertz, Parks and Recreation, Water Conservation

## Comments

To ensure that this pamphlet achieves its objectives, it will be revised periodically. Comments and suggestions are welcome and should be made to:

*Development Services  
City and County of Denver  
201 West Colfax Avenue, Dept 203  
Denver, CO 80202  
Phone: 720-865-2982  
e-mail: [Developmentservices@Denvergov.org](mailto:Developmentservices@Denvergov.org)  
[www.denvergov.org/developmentservices](http://www.denvergov.org/developmentservices)*



*24 St & Glenarm Pl*



*E Evans Ave & S High St*



*Denver, Colorado*



*W Colfax Ave & Elati St*



*W 38th Ave & Tennyson St*

Managing urban stormwater runoff, providing stormwater detention and water quality are regulatory requirements. There are many strategies that may be used to address these requirements. The most common conventional method is to use various best management practices (BMPs). BMPs are either nonstructural, such as reduced road widths and elimination of sidewalks, or structural, such as swales, above-ground and underground detention facilities, sand filters, etc.

The City and County of Denver also actively supports and encourages Low Impact Development (LID) and other sustainable stormwater management approaches, such as installing ecoroofs, porous pavement, etc. Should you be interested to implement any of these approaches, please contact Development Services.

The information contained in this pamphlet is to be used as a guide to help the design professional when an above-ground stormwater detention and water quality facility is chosen as a method to control stormwater runoff.

The City and County of Denver Storm Drainage Design and Technical Criteria Manual, the Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3, and the City and County of Denver Zoning Code generally address the aesthetic component of above-ground detention and water quality facilities. Together, these documents require that stormwater detention and water quality facilities be safe, maintainable, and are aesthetically pleasing. Our goal is to have these elements viewed as community assets rather than liabilities.

Incorporation of detention and water quality facilities into a proposed development site is traditionally performed early in the design process. However, attention to the aesthetic elements of these facilities is not always a primary consideration during this initial design stage. It is the goal of the City and County of Denver to have the aesthetic elements incorporated into the project at the earliest stages of design. This document will help the design professional in meeting this objective.

The diagram illustrates the water cycle in an urban environment. It shows a city block with buildings and houses. A blue arrow indicates 30% evapotranspiration from the buildings. Another blue arrow shows 55% runoff from the buildings. A blue arrow shows 10% shallow infiltration into the ground. A blue arrow shows 5% deep infiltration into the ground. The ground is labeled as 75%-100% Impervious Cover.

The collage includes the following documents and diagrams:

- URBAN STORM DRAINAGE CRITERIA MANUAL** volume 3 - best management practices. Urban Drainage and Flood Control District, Denver, Colorado, September, 1999. Latest Revision: April 2008.
- 2010 DENVER Zoning Code**. City and County of Denver logo.
- STORM DRAINAGE DESIGN & TECHNICAL CRITERIA**. CITY AND COUNTY OF DENVER. DEPARTMENT OF PUBLIC WORKS, WASTEWATER MANAGEMENT DIVISION, ENGINEERING DIVISION.

## INTRODUCTION (cont.)

### *Why are Aesthetic Stormwater Detention and Water Quality Facilities **IMPORTANT** to Developers?*

Aesthetically enhanced storm drainage facilities add to property value and their positive visual appearance improves the quality of life in our community.

As a developer, you do not want to miss a significant marketing opportunity. People are drawn to water and the natural environment. Instead of focusing on the minimum technical design criteria for meeting these requirements, we encourage developers to seize the opportunity to create water quality and detention ponds that will help create more livable, sustainable, and valuable developments. These enhanced facilities will offer residents opportunities to observe nature, engage in recreation, or simply enjoy the view.

The location of the detention pond on the site (Siting), its Physical Characteristics, Architectural Elements and Landscaping are critical elements for the pond to meet the aesthetic objective. Since pictures are much better than words to convey a message or provide information, we have chosen to include many photos within this pamphlet. The photos in this document provide the designer with examples of how to successfully incorporate ponds into different sites, and how to address the physical character, architectural and landscape elements. The photos also demonstrate ecologically and friendly approaches to site development and



*Creative landscape design above underground detention vault with porous landscape detention in the background.*



*This pond shows an example of a passive dual-use design that enhances to the community.*





*Although functional, these ponds do not incorporate any aesthetic elements. Utilitarian design should be limited to areas of low visibility and public activity.*



*This pond is located near a major arterial and does not add to the streetscape. Aesthetic enhancements of this pond would help to create a positive public experience.*

stormwater management that aim to integrate site design with natural systems and hydrologic functions.



This symbol illustrates a successful example or certain desirable pond characteristics.



This symbol illustrates designs or design elements that should be avoided.

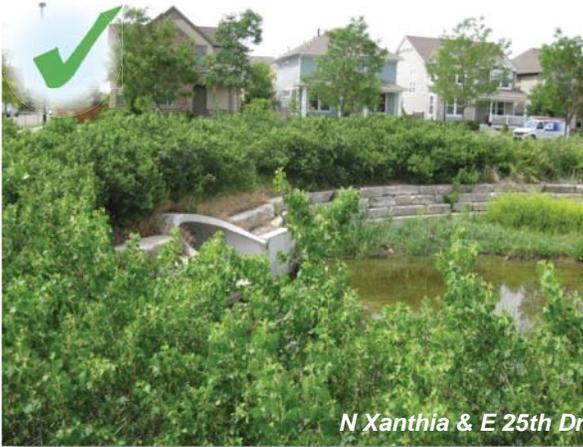
Green infrastructure has documented benefits such as reduced and delayed stormwater runoff volumes, stormwater pollutant reductions, increased carbon sequestration, urban heat island mitigation, reduced energy demands, improved air quality, additional wildlife habitat and recreational space, and increased land values. Many of these benefits are enhanced when additional time and effort is placed into improving the aesthetic quality of these features. Of particular note, Trust for Public Land (TPL) has quantified improved economic benefits of park or park-like settings based on two primary factors: distance from the open space and the quality of the open space. In their study, TPL ascertained that excellent quality open space can add up to 15 percent to the value of a proximate dwelling and that problematic open space can actually reduce home value by up to 5 percent (2009 TPL Report “Measuring the Economic Value of a City Park System”).

Coupled with water savings that can be achieved through the use of native plant palettes, prudent investment in detention and water quality ponds has both an environmental and economic benefit for developers and the communities that surround these spaces.





W 13th Ave & Broadway



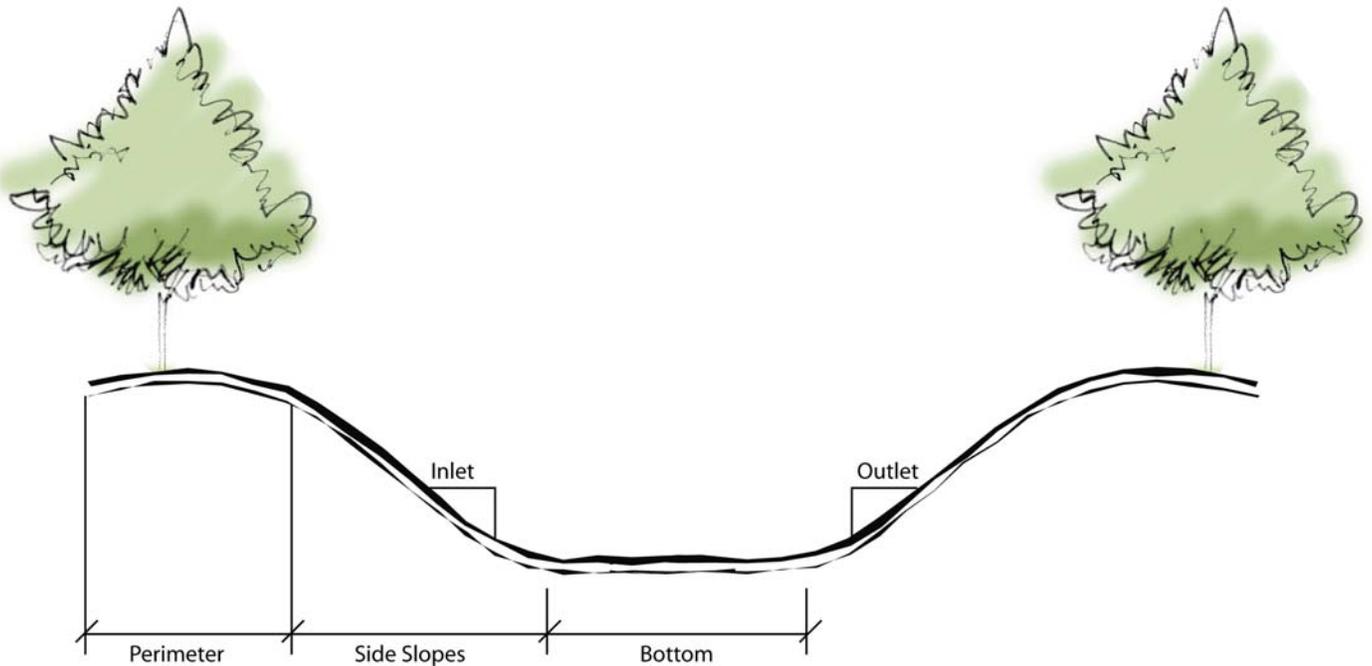
N Xanthia & E 25th Dr



E Belleview Ave & S Monaco St



W 3rd Ave & Kalamath St



There are many ways to approach the topic of aesthetics. For ease of discussion, we have chosen the approach of segregating a stormwater detention and water quality pond into zones.

The facility typically has three different zones: perimeter, side slopes, and bottom. Each zone is unique and each must be addressed to design a pond that is fully incorporated into the site in an aesthetic manner.

## Perimeter

The zone surrounding the facility, most likely on the pedestrian grade, provides the greatest opportunity for improving visual impacts with landscaping, benches, walkways, and site furnishings. The shape of the basin should be as natural looking as practical. Avoid “boxy” and geometric features. To the extent possible, maximize the distance between the inlet and the outlet structures.

## Side Slopes

This is the zone where the greatest grade changes occur. Basin side slopes should be stable and gentle to facilitate maintenance and access.

Consider creating topographic changes that mimic natural conditions by including a variety of slope changes. The tops and the toes of slopes should vary, and there should be an undulation in the shape and grading of the sides of the detention area. Side slopes generally should be no steeper than 4:1.

## Bottom

This is the lowest portion of the facility, and it will likely see the largest fluctuations in water supply. For extended detention basins, trickle or low flows need to be conveyed through this zone which is designed to have minimum slope. If you prefer to eliminate the forebay, trickle channel, and micropool, provide the Water Quality Capture Volume (WQCV) in a bioretention (porous landscape detention basin) or a sand filter basin. For bioretention and sand filter basins, the bottom surface, also referred to as the filter area, should be flat. Treating the WQCV within a bioretention area will reduce the frequency of inundation of the flood control storage area and provide an area better suited for multipurpose uses.





W 12th Ave & Acoma St



E 19th Ave & Franklin St



E Hampden Ave & S Tamarac Dr



E Hampden Ave & S Yosemite St



## 1. Siting and Functionality

**Goal:**

*Stormwater detention and water quality facilities should appear as an extension of the surrounding landscape. They can be designed with attractive, natural-looking features so they become site amenities rather than eyesores.*



N Speer Blvd & Lawrence St



E Maplewood Ave & S Syracuse Way

### **General**

One of the first issues to be addressed when designing detention and water quality ponds is where the pond will be situated on the site.

### **Perimeter**

- Naturally, the pond should be placed near the low point of the final graded site. However, it is preferred that the designer ensures that the perimeter of the pond is integrated into adjacent open space and neighboring properties,



# TOOLS FOR SUCCESS

## Siting and Functionality(cont.)

complements the character of the general neighborhood, and blends with the individual site the pond is serving.

- Incorporating other uses into the pond is strongly encouraged, (e.g., strategically placing a bench to provide a quiet place for reading a book or enjoying the surrounding wildlife, creating an area for a neighborhood picnic or volleyball game, etc.).

### Side Slopes

- Ponds located near high pedestrian activity areas should address safety concerns. Gentle slopes are preferred versus steeper slopes or walls with protective fencing.
- When a pond is adjacent to a street right-of-way or located in a highly visible area, special attention should be given to incorporating aesthetic elements into the pond design.

### Bottom

- Stormwater facilities not only need to meet technical standards, but also serve as an amenity. To the maximum extent feasible, the stormwater facility should be located, designed and managed for use as year-round open space and recreational area.



*The utilitarian design of this pond is well screened from those passing by in vehicles.*



*However, the view for pedestrians walking on the sidewalk along the building has not been addressed.*





*Functional, aesthetically pleasing design from all points of view.*

- Wherever possible, stormwater detention facilities should be located in pervious landscaped areas. Detention ponds located in parking lots are discouraged given the potential for inconvenience, hazards, and damages resulting from ponding and possible ice buildup.
- The design of these facilities must consider maintenance issues such as weed control measures, maximum heights of grasses/turf, mowing, and water retention/release rates that can result in soggy ground at the bottom of the ponds.

Another way to minimize the impact of a water quality and/or detention facility within the site is to reduce the water quality and detention volume required.



*Hidden in the back, this type of detention pond can become a trash collector. These pond types do not add any aesthetic value to the property, nor enhance the site.*

- Site designs that minimize directly connected impervious areas, utilize low impact development practices, and incorporate other best management practices are eligible for volume reduction.
- Minimizing directly connected impervious areas means that runoff from impervious surfaces such as parking lots, drives, walks and roofs is designed to drain over grass buffer strips or other pervious surfaces before reaching a stormwater conveyance system to enhance infiltration and filtering of the stormwater. Please refer to Urban Drainage and Flood Control District (UDFCD) Criteria Manual Volume 3 for guidance on how to calculate effective imperviousness and adjusted volumes.





*E Orchard Rd & S Quebec St*



*E Evans Ave & S High St*



*24 St & Glenarm Pl*

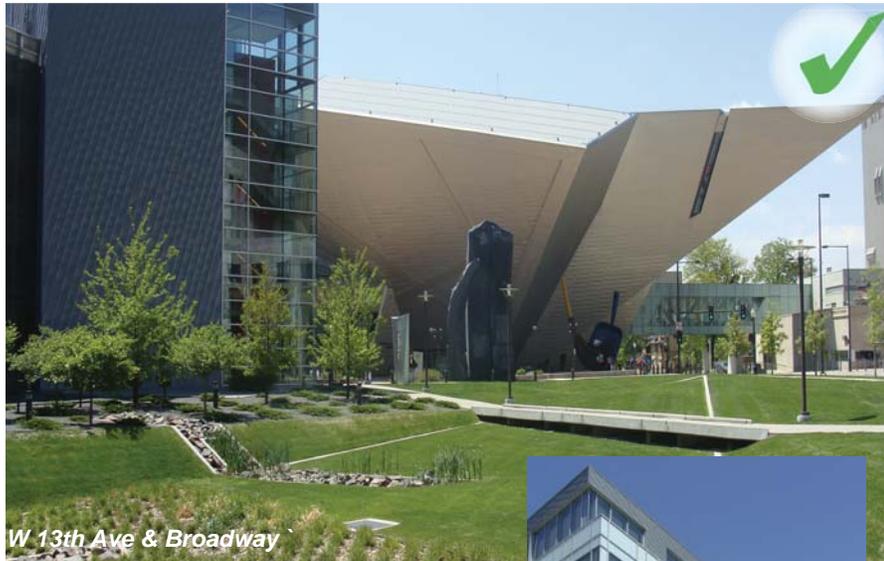


*Belleview Ave & S Monaco St*

## 2. Physical Character and Architectural Elements

**Goal:**

*Integrate building architecture and site elements into the pond design and drainage components to create an aesthetically pleasing community asset.*



W 13th Ave & Broadway

*The design of this pond reflects the surrounding architectural forms.*



**General**

- Instead of being seen as unattractive left-over space, detention ponds can be designed as attractive features of the site and overall surrounding environment. Stormwater facilities can be designed to appear as an extension of the surrounding landscape.
- Often, a visually appealing pond will require more land than the most efficient engineering design. However, it is believed that the financial cost of this additional land can be more than offset by the increased project value with an integrated, accessible, and usable recreational or open space.
- Consider curvilinear (non-rectangular) design.
- If topography of the site dictates that the pond be located near an entrance and/or in a highly visible area, the pond should be integrated into the environment as a visually attractive feature. Perhaps the pond may even create a focal point for the site (e.g. water features, a sign in a retaining wall, etc).
- The use of concrete and other impervious materials should be limited to areas necessary to prevent erosion that cannot be accomplished using other stormwater design or landscape techniques. Such erosion devices should either be buried below live plant materials or designed in a naturalized manner (i.e., textured and appropriately colored).



W 13th Ave & Broadway



# TOOLS FOR SUCCESS

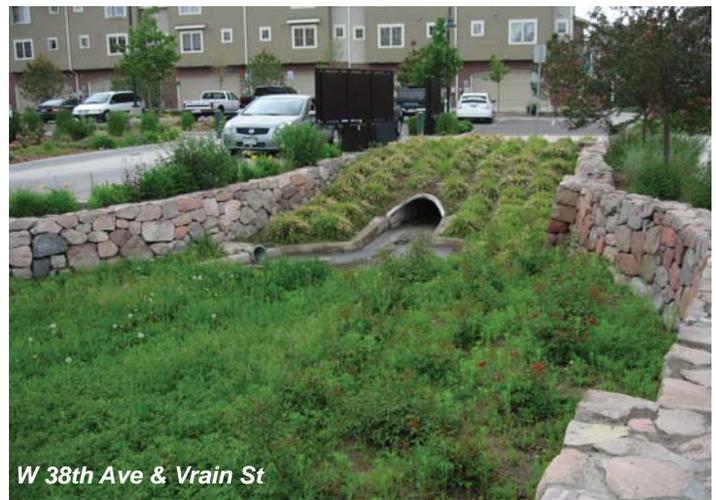
## Physical Character and Architectural Elements (cont.)

### Perimeter

- Existing drainage patterns should be preserved whenever possible.
- Consider maximizing passive and active recreational activities, e.g. incorporating the detention pond perimeter into other on-site features such as strolling and running trails, viewpoints, and picnic and sitting areas.
- Ponds should be designed to avoid the need for fences. When this cannot be accomplished, consider choosing a design that complements the building structure and overall site. Use fences for safety along steep side slopes only, not around the entire pond. When appropriate, consider thorny shrubs in lieu of fences.
- Using excessively high berms to increase pond capacity is discouraged. When necessary, berms can be contoured to take on a naturalized shape. The maximum height of the berm should be 4 feet per Section 10.6.5 of Denver's Zoning Code.



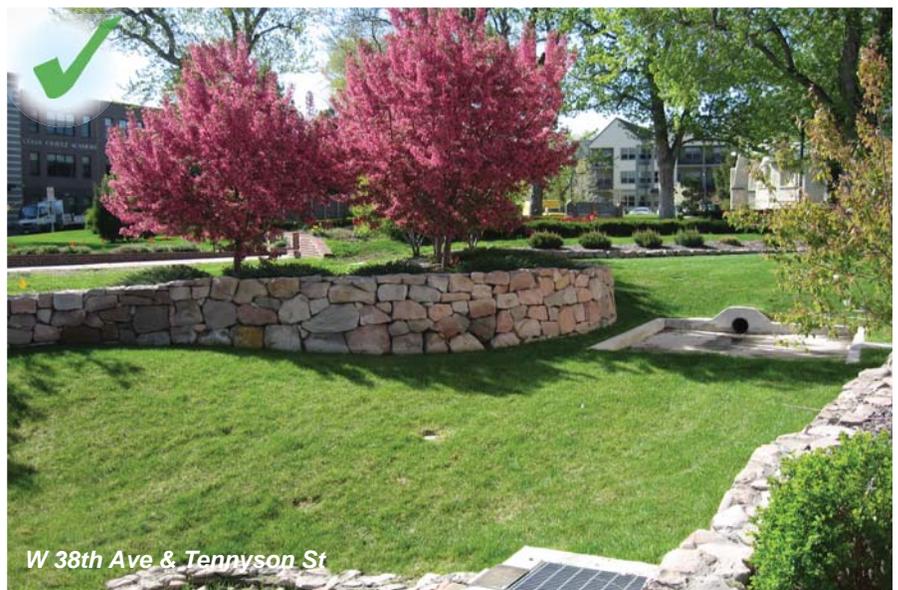
*Although functional, this facility does not incorporate aesthetic elements.*



*Better...*

### Side Slopes

- Engineering structures such as forebays, surface weirs, inlet structures, etc. should be strategically placed to minimize visibility. When possible, they should be embedded into the sloped embankment rather than being exposed.
- Rundowns that convey stormwater runoff from impervious surfaces (such as parking lots) to the pond



*Best.*





*When fences or walls are necessary, consider choosing a design that complements the project. (A water detention pond is located beyond the wall.)*

routes should be provided.

- Materials, size, and location of the walls need to be chosen to prevent graffiti. Cast-in-place concrete walls are often the most convenient surfaces for graffiti and, therefore, should be avoided. Using textured materials, reducing wall heights and complementing walls with vines and climbing plants can greatly reduce the potential for graffiti.

### **Bottom**

bottom should be incorporated into the overall design and be designed attractively.

- Maintenance access must be considered for trash and sediment removal. Maintenance equipment must be able to safely reach the bottom of the facility and have adequate space to operate and turn. Consider using gravel or a “grasscrete” like product instead of asphalt or concrete for access roads.

### **Retaining Walls**

One way to reduce the space required for a pond is to increase its depth. Building berms or vertical walls can reduce the pond footprint. However, retaining walls are discouraged because they often become a visual nuisance and liability for the owner. When the installation of retaining walls cannot be avoided, follow these recommendations:

- For commercial projects and projects in densely developed urban areas, use materials and forms that match or complement materials used for the main building.
- For residential projects and projects in suburban settings, use materials such as rocks and stone that compliment the surrounding Rocky Mountain Region natural landscape.
- If several retaining walls are used, a horizontal separation of at least 4 feet shall be provided per Denver’s Stormwater Technical Criteria. Walled-in or steep-sided basins should be located away from major pedestrian routes, and emergency pedestrian egress

- At concentrated points of inflow, energy dissipation needs to be considered to protect against erosion. When using rock for energy dissipation, the rock should graduate away from the area of hard edge into the surrounding landscape. Other non-functional matching rock should be placed elsewhere on the basin to prevent the energy dissipation from appearing out of context.
- Forebay berms, when required, can be made of soil rip-rap and vegetated.
- Trickle channels protect detention and extended detention basin bottoms from becoming boggy, and enable easier maintenance (mowing and cleanup). Although concrete trickle channels are required for detention ponds in accordance with CCD Storm Drainage Design and Technical Criteria, soft bottom trickle channels for extended detention basins can be proposed and accepted on a case by case basis
- Use landscaping to soften engineering stormwater structures as much as possible.





*16th St & Central St*



*W Yale Ave & S Lamar Way*



*E Maplewood Ave & S Syracuse Way*



*Covington Ct & Covington Dr*



*E Bellevue Ave & S Monaco St*

### 3. Landscape Design

**Goal:**

*Choose appropriate plant materials for each zone and maximize the amount of landscape to the greatest extent possible*



*Although this landscape looks nice in the summer (above), thoughtful use of evergreen plant material would enhance the appearance of this conveyance in the winter (below).*



The overall goals for pond aesthetics in relation to planting design include choosing appropriate plant material for each zone and maximizing the amount of landscape to the greatest degree possible. Planting design should reflect the character of the area.

- Where possible, design with a more native palette that is more drought tolerant. Once established, such ponds rarely need mowing or weeding. Use of bluegrass and other species requiring irrigation and high maintenance should be reserved for areas with high public use.
- Soil amendments may be necessary, but a soil test should be conducted first to understand if this is a necessary cost for successfully establishing plants.
- Recommendations on appropriate trees, shrubs and seed mixes can be found in the UDFCD Drainage Criteria Manual, or Denver Parks and Recreation Natural Areas Standards Manual.
- Development of a water budget can help assess potential water savings on a site. For example, an established site that irrigates one acre with native grasses versus bluegrass versus can be an annual savings of approximately \$1500 per year, using 2010 Denver Water rates.



# TOOLS FOR SUCCESS

## Landscaping (cont.)

### Perimeter

- If tied into the larger site design, the landscape should be contiguous to, and consistent with, the rest of the plantings on site. This offers the most rewards to a community.
- When landscaping is needed for screening purposes, tree and shrub massings should be used in clusters. These clusters should be separated by a minimum of approximately 20 feet at maturity to allow some visual access for safety purposes.

### Side Slopes

Within the side slope zone, grasses are often used because they are easy to maintain and do not interfere with the function of the pond.

- Cool season turf grass can be used, however, it should not be planted on slopes greater than 4:1. Also, with its shallow rooting structure, it may not be the best plant material for highly erosive areas.
- Warm season grasses allow for less maintenance and, once established, rarely need to be mowed. Therefore, these grasses could be planted on slopes up to 3:1.
- If cool season turf grass is planted within the perimeter zone, it may be much harder to establish warm season grasses on the side slopes because of the transfer of water and/or fertilizers which could encourage turf to migrate. In these situations, either plant warm season grasses on the perimeter or create a no water/fertilizer buffer.



W 8th Ave & Delaware St

*A mix of plant material (trees, shrubs, turf, groundcover) provides interest.*



Buchtel Blvd & S High St

*Vegetated screening is used to hide a detention pond.*





*Delineations between pond zones can be made with a variety of vegetation types.*

- Steep slopes should be planted with shrubs and/or groundcovers that don't require mowing.
- Trees are not recommended on steep side slopes. Shredded mulch may be used in these areas, but may require more maintenance.
- If mulch is used, shredded mulch is preferred over large chips in order to reduce the potential for migration, which plugs the outlet structures.

### **Bottom**

Within the bottom zone, plant material should be based upon the use of the pond.

- Dry detention ponds may be planted so that sport courts can be used in the bottoms.
- When placing woody vegetation in the bottom, be aware that planting trees and shrubs in certain areas can reduce the hydraulic capacity of the channel, increase maintenance requirements, and cause the plugging of downstream bridges and culverts if uprooted by higher flows. Choose plant material that will survive moist soils and periodic inundation.
- Wetland plantings should not include cattails, which have a tendency to grow without encouragement. Proper selection of plant materials can also improve the infiltration potential of landscape areas since deep-rooted plants help to build soil porosity.



*Pond zones can be blurred through the use of a monoculture.*



# GUIDELINES FOR SITE ENHANCEMENT

	GOALS	Zone 1: Perimeter	Zone 2: Side Slopes	Zone 3: Bottom	Other
<b>Siting &amp; Functionality</b>	<i>Ponds should be designed with attractive natural-looking features so they become site amenities</i>	<ul style="list-style-type: none"> <li>Integrate perimeter with the adjacent open space</li> <li>Incorporate recreational uses.</li> </ul>	<ul style="list-style-type: none"> <li>Use low height retaining walls to achieve natural appearance</li> <li>Provide gentle slopes to pond bottom</li> <li>Incorporate aesthetic elements into high visible areas</li> </ul>	<ul style="list-style-type: none"> <li>Use irregular form for pond bottom geometry</li> <li>Design for year round multi-purpose uses when appropriate</li> </ul>	<ul style="list-style-type: none"> <li>Avoid parking lot detention</li> <li>Design maintenance access for all areas</li> <li>Minimize directly connected impervious areas</li> </ul>
<b>Physical Character &amp; Architectural Elements</b>	<i>Building architecture and site elements should be integrated into the pond design and drainage elements</i>	<ul style="list-style-type: none"> <li>Use gentle berming or transition slopes to encourage benches/site furnishings/walkways</li> <li>Choose site elements that complement buildings</li> </ul>	<ul style="list-style-type: none"> <li>Use retaining wall heights less than 30 inches</li> <li>Separate walls a minimum of 4 feet to allow area for landscaping</li> <li>Design irregular side slopes</li> <li>Construct with natural appearing materials</li> <li>Use graffiti prohibitive materials</li> </ul>	<ul style="list-style-type: none"> <li>Consider outlet structures, trickle channels to prevent soggy areas</li> <li>Provide access ramps for trash removal or mowing</li> <li>Minimize visual impact of drainage structures</li> </ul>	<ul style="list-style-type: none"> <li>Allow visual access</li> </ul>
<b>Landscape Architecture</b>	<i>Plant materials should be appropriately used for each zone to maximize the amount of landscape to greatest degree possible</i>	<ul style="list-style-type: none"> <li>Tie landscape to larger site design</li> <li>Allow visual access for safety purpose when using landscaping for screening</li> </ul>	<ul style="list-style-type: none"> <li>Avoid cool season turf grass on slopes greater than 4:1</li> <li>Consider warm season grasses to minimize mowing and water requirements</li> <li>Plant steep slopes with shrubs and/or groundcovers</li> </ul>	<ul style="list-style-type: none"> <li>Choose plant material based on use of the pond (active vs. passive)</li> <li>Use high water consumption plants (bluegrass) in active public use areas only</li> <li>Provide visual interest through a mix of trees, shrubs, turf, and groundcovers</li> </ul>	



CCD City and County of Denver  
DPR Parks & Recreation  
DPW Public Works  
EPA Environmental Protection Agency  
LEED Leadership in Energy and Environmental Design  
LID Low Impact Development  
UDFCD Urban Drainage and Flood Control District  
WQCV Water Quality Capture Volume

