West Shoreline Erosion Control Management Plan

Cherry Creek State Park

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Management & Planning

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Colorado State Parks

Cherry Creek State Park

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EXECUTIVE SUMMARY

Since its opening in 1959 Cherry Creek State Park, in Southeast Denver, Colorado, has grown to host more than 1.5 million visitors per year who enjoy a wide range of recreation opportunities. The west shoreline of Cherry Creek Reservoir has been managed to support the park's multiple-use policy – in addition to the shoreline fishing and recreation the area provides, various improvements such as a beach, restrooms, accessible fishing areas, picnic shelters, concrete paths, shoreline access, and a parking area have been added.

With the growing number of park visitors, the park staff has noticed a developing erosion problem along the west shoreline that is attributable to the cumulative effects of high foot traffic and concentrated storm runoff. In most areas these effects have resulted in a severe loss of groundcover, tree root exposure, soil rutting, foundation erosion, and compromised visitor safety.

There are a variety of options available that the park could employ to restore the site and mitigate future erosion in the area. First, a project design that utilizes the input of park staff, a landscape architect, an engineer, and a qualified contractor should be organized. The design should include aspects such as soil replacement and stabilization, pedestrian control, safety improvements, and the use of native grasses, trees, and shrubs to reestablish groundcover and prevent future erosion problems in the area. Following the implementation of the design, future management would include monitoring the site and updating the erosion control management plan and practices accordingly.

INTRODUCTION

Cherry Creek State Park opened for public recreation on June 17, 1959. At that time, the park was outside the Denver Metropolitan area and the average park visitor fished for several hours, picnicked, and sometimes used the campground for a night.

Today, the park is surrounded by commercial and residential development creating a demand for diverse recreation opportunities. Consequently, the park hosts more than 1.5 million visitors annually who enjoy a wide range of activities including, among other activities, swimming, boating, fishing, hiking, bicycling, horseback riding, and camping. To support the growing number of park users and their diverse interests, the park utilizes approximately 3,900 acres of land that is comprised mostly of shortgrass prairie and riparian environments, and the 880-acre Cherry Creek Reservoir, the cornerstone of the park (See Appendix A).

For the purpose of this management plan, the west shoreline includes the area south of the west boat ramp and north of Mountain Loop (See Appendix B). When first constructed, the west shoreline consisted of unimproved reservoir shoreline. Since that time, many improvements have been added to the site to provide a variety of recreation opportunities in keeping with the Park's multiple use management policy. The most significant improvement was the addition of a beach just south of the boat ramp. This area includes mature stands of trees and grassy areas in addition to the sandy beach along the shore and shaped the future development in the area (See Figure 1).

Figure 1: Beach and shoreline looking south.

Figure 2: Bathrooms, picnic shelter, and concrete path.

West Lake View Road and a large parking area were later built to provide visitor access to the reservoir and restroom facilities were recently added between the beach and parking lot. The West Shade Shelters were constructed along the beach and shoreline. These 10 facilities are very popular during the summer months for use as picnic areas and as staging areas for other activities such as fishing and beach access. Finally, multiple concrete paths have been built that are part of the park's trail system and provide access to the shore, restrooms, shade shelters, and handicapped-accessible fishing areas (See Figure 2).

Recently the park staff has noticed a developing erosion problem in the west shoreline area. On the beach and along the shoreline south of the beach, multiple areas of erosion have developed that are attributable to the cumulative effects of pedestrian traffic and concentrated storm runoff. Erosion has also been noted along the edges of the picnic shelters, near the restroom facilities, and beneath some of the concrete access paths that can also be traced to the combination of pedestrian traffic and storm runoff. The Park is concerned that

the erosion around these facilities has developed or may develop to a point that will be detrimental to visitor safety.

GOAL AND PURPOSE

The goal of Cherry Creek State Park, as stated in its general management plan, is to "maximize outdoor recreational opportunities while preserving the natural quality and resources of (the park) for future generations." The goal of this management plan is to support the Park's goal by maintaining the natural quality of the west shoreline and the variety of recreation opportunities it provides.

The purpose of this management plan is to provide a summary of the west shoreline erosion conditions, present alternatives and a recommended plan for erosion mitigation and prevention, and to provide guidelines for the future management of the Cherry Creek Reservoir west shoreline.

BACKGROUND

For the purpose of this management plan, the west shoreline will be divided into three focus areas – the beach, the shoreline, and the permanent structures and improvements (See Appendix C). Although some erosion aspects are common to all three focus areas, each contains its own unique combination of problems and potential solutions that will be analyzed individually.

Beach

The beach area is characterized by three main features –

1. The sandy beach area
2. An area of grass approximately 70 feet from shore
3. A stand of trees that coincides with the grassy area.

The beach area is primarily used by boaters and personal watercraft users for shore access. During the summer, it is not uncommon for the beach to be crowded with boats and watercraft that are run up onto the beach or anchored near the shore. From here, users spend time on the beach or access the various nearby amenities. The beach is also used by visitors who access the beach from the parking area the pedestrian path, or the picnic shelters west of the beach.

Access to and from the beach is not controlled by a designated access route. Instead, foot traffic is generally widespread along the southern half of the beach near the restrooms and parking area access. This part of the beach remains in good condition primarily because the beach slopes are typically mild and not vulnerable to major erosion.

The grassy areas of the beach are adjacent to the sand and extend approximately 70 feet to the pedestrian path and are subject to significant erosion. Due to the steeper slopes that characterize the area, these areas are typically not used for recreation, but instead provide access between the beach and the permanent facilities to the west. While the steeper slopes do discourage recreational use, the slopes are generally not steep enough to inhibit pedestrian traffic. Additionally, most paths that have developed in the area are

perpendicular to the ground slope, further increasing the potential for erosion (See Figures 3 and 4).

Figure 3: Beach access erosion.

Figure 4: Severe erosion leading to beach.

The soil in this area of the beach is generally sandy and rocky. This soil type, combined with the high amount of pedestrian traffic, has inhibited the growth of grasses in the area. Without grass to protect against erosion, the steeper slopes in the area have been left vulnerable to erosion by storm runoff. As the runoff erodes the slopes, the resulting gullies attract more pedestrian traffic, again increasing the amount of erosion. It is the cumulative effects of runoff and pedestrian traffic that has led to the severe erosion problems in the area.

The third feature of the beach is a stand of trees that grows within the grassy area. The majority of the trees are cottonwood trees, which are commonly found along waterways and adjacent to lakes in the Colorado Front Range. The trees appear to be of similar size and age and have all developed erosion problems. In general, the erosion due to pedestrian and runoff traffic has begun to expose tree roots, threatening the health of the trees and the stability of

the slope. In areas of more severe slopes, the tree roots have been used as natural staircases for pedestrians to access the shore. Further erosion in these areas could eventually threaten the stability of the tree and pose a danger to park visitors (See Figure 5).

Figure 5: Root exposure due to pedestrian traffic.

Shoreline

The shoreline extends from the beach south toward Mountain Loop. The area is primarily used by fishermen who gain access to the shore via one of three routes – a concrete ramp, a concrete staircase, or by unimproved paths that have been developed by pedestrian traffic.

The shoreline is generally in good condition. The original reservoir design included riprap along the water edge that ranges from 6 to 18 inches in size. While the riprap has provided effective erosion protection along the shoreline, the

Park is concerned that the size of riprap is difficult to traverse and inhibits access to a significant portion of the shoreline (See Figures 6 and 7).

Figure 6: West shoreline looking south.

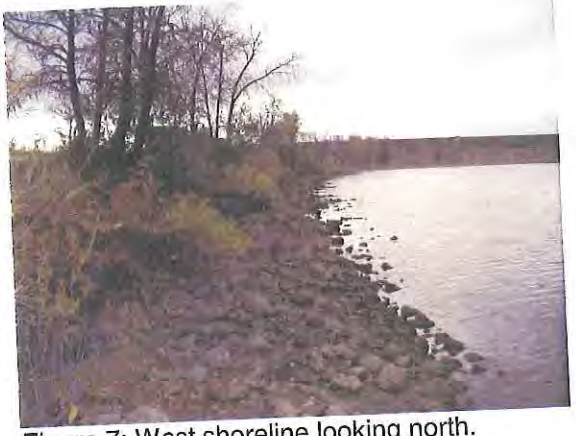


Figure 7: West shoreline looking north.

Adjacent to the riprap, the shoreline is relatively steep as compared to the beach area. Trees and bushes have been established on the slope as another source of erosion protection and several access routes have been constructed. Two wheelchair accessible concrete ramps provide access to platforms that can be used for fishing or relaxing near the reservoir. Both concrete paths have been severely eroded by runoff and wave action, in some areas causing the path to buckle and creating an unsafe condition (See Figure 8). Two concrete staircases are also in place to provide shoreline access from the parking lot and picnic shelters. The stairways are typically in good condition with minor erosion from runoff and pedestrian traffic along the edges (See Figure 9).

Figure 8: Concrete access ramp damage.

Figure 9: Shoreline access stairway.

Lastly multiple footpaths have developed between the picnic shelters above the shore and the water's edge. The general pattern of pedestrian traffic and storm runoff applies in these areas as well. However, the steep banks have resulted in the use riprap and tree roots as stairs and in the erosion of the soil in the area (See Figure 10). The major concern to the Park is the potentially unsafe condition of loose rock, unstable trees, and the dangerous paths to shore.

Figure 10: Shoreline access erosion.

Structures and Improvements

The west shoreline has been developed with a variety of features that offer recreation opportunities and conveniences to visitors. Picnic shelters and a bathroom facility have been constructed along the parking lot west of the

shoreline and a network of concrete paths has been constructed to provide access to these facilities as well as the beach and shoreline areas.

The ten picnic shelters that line the west shoreline each contain two picnic tables and access to a charcoal grill. The shelters have proven to be a successful addition to the park with half of the shelters providing access to the beach and half providing shoreline access.

The concrete construction of the shelters has withstood the effects of weathering and use without much wear. The curved roof of each structure was an innovative and attractive design that was modeled to represent a bird's wings and directs rainfall to a downspout in the center of the shelter where it is released toward the shoreline (See Figure 11). The configuration requires minimal maintenance and could have an indefinite lifespan with proper care.

While the picnic shelters themselves do not exhibit signs of deterioration, the soil at the base of each shelter does. Around each shelter most vegetation has been worn away and the remaining soil has been eroded by foot traffic and storm runoff (See Figure 12). In most cases, the soil around the concrete pad for each shelter has been eroded to a depth up to one foot below the top of the concrete pad. Further erosion may expose the soil beneath the shelters, compromising the foundation and putting the future of the shelters at risk. In some cases the process has already begun, as evidenced at one shelter by the concrete rainspout having broken away from the concrete pad.

Figure 11: Typical picnic shelter.

Figure 12: Typical erosion at base of picnic shelter.

The bathroom facility was recently constructed above the beach area adjacent to the parking lot and includes a concrete path along the easterly side of the shelter. To date, the structure itself is showing no signs of erosion and the concrete paths adjacent to the building are showing only slight amounts of erosion (See Figure 13). However, the areas of soil adjacent to the structure and path have not developed significant amounts of vegetative growth. This fact, coupled with the high level of pedestrian activity in the area and the steeper ground slope to the east suggest that an erosion problem could develop if not properly managed.

Figure 13: Bathrooms, concrete path erosion, and lack of vegetative cover looking north.

The remainder of the concrete paths form a network between the parking area and the picnic shelters. The paths were recently constructed and replaced older asphalt paths that had been in use. As was evident around the restroom facility, groundcover vegetation has been slow to establish and has been subject to high foot traffic. Future erosion is likely without slope protection from runoff and excessive foot traffic.

MANAGEMENT OPTIONS

The management options are discussed below according to the three focus areas previously detailed. As discussed previously, the main two causes of erosion in all areas of the west shoreline area are pedestrian traffic and storm runoff. In general, this plan focuses on the use of best management practices (BMPs) in the rehabilitation of these areas and the future protection of the west shoreline area (See Appendix D).

Beach

The erosion problem at the beach is concentrated in the area of grass and trees that is between the concrete path and sandy beach area. The steeper slopes, lack of vegetative cover, and widespread foot traffic are all contributing factors to the problem and offer a variety of options for management.

The slopes in the area present the smallest degree of flexibility for mitigation. The main challenge is that the site is constrained by the beach to the east and the concrete path and parking area to the west. In order to reduce the effects that a steep slope has on erosion, the gradient of the land must be

reduced. Because the slope remains relatively constant from the beach to the path, simply grading the area is not a viable solution to the problem.

Therefore two options for slope reduction remain – raising the ground near the beach or lowering the ground near the path. The most viable option is that of lowering the ground near the concrete path and could be accomplished through the use of a retaining wall. In addition to reducing the ground slope in the area, this option would have the added benefit of controlling beach access and pedestrian traffic. Also, the additional area could be used as an extension of the beach or could be planted with grasses and trees to provide a shady area for visitor use (See Figure 14).

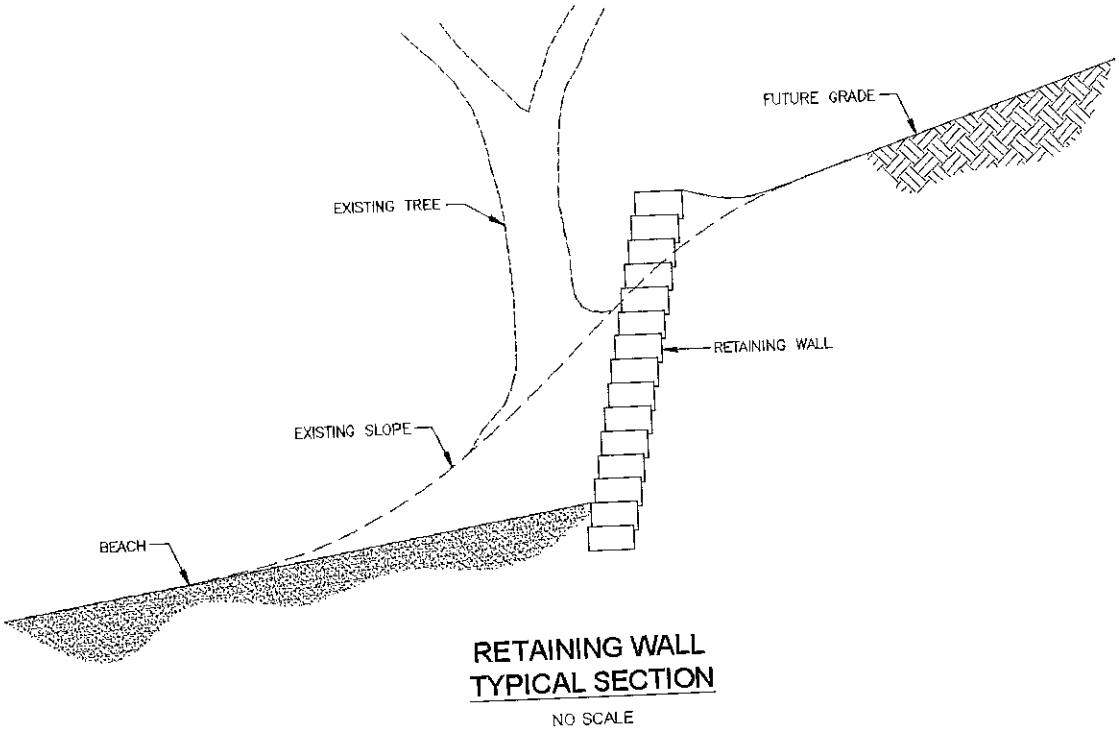


Figure 14: Retaining wall detail.

The main drawback of this option is the disturbance that would be caused in the area. The stand of cottonwood trees, which are the only established vegetation in the area, would be have to be removed. And while the area could be landscaped with new plants and trees, it would take a number of years for the landscape to return to the level of maturity that it is currently at. Also, while the area does contain multiple improvements and facilities, the addition of a permanent structure such as a retaining wall would greatly change the appearance of the landscape – a change that may or may not be popular to park visitors.

In general, the use of ground cover will stabilize the soil and protect it from the effects of running water. There are two primary options for the protecting slope against storm runoff – plants and landscaping materials.

As used in this management plan, landscaping materials include inert materials ranging from riprap to gravel to mulch. Smaller materials, such as gravel or mulch, would be an effective solution in flat or gently sloped areas and along the edges of paths. However, on steeper slopes, materials such as gravel and mulch tend to settle to the bottom of the slope, creating a maintenance problem and re-exposing the soils to erosion. In these areas larger materials, such as riprap, would be a more effective solution.

The use of these various landscape materials presents a variety of benefits. First, they are very effective erosion control methods that have proven reliable in other areas of the park. Second, by using properly sized rock, the

riprap could be used to control access to the beach and reduce the effects of foot traffic in the area. Finally, these materials are a relatively low-cost and low-maintenance solution, saving the park time and money that could be put to other uses.

Although gravel, mulch, or riprap would be an easy and effective solution to provide ground cover in the area, there are negative aspects to its use as well. First, placing riprap in such a high-traffic area could pose a hazard to park visitors who attempt to traverse the area. Also, the use of gravel and mulch in the large areas of exposed ground would prevent park visitors from using these areas, contradicting the park's multiple-use policy. Finally, the use of these materials would be a significant change to the landscape and, similar to the construction of a retaining wall in the area, may not be popular with park visitors.

The alternative to using inert landscaping material as ground cover is the use of vegetative cover. As detailed previously, the growth of cottonwood trees constitutes the majority of plant life in the area with the most significant erosion problem. However, to the north, where slopes are generally milder, plant life includes a variety of grasses, trees, and shrubs. The incorporation of a variety of plants, similar to those north of the beach, could serve multiple purposes.

First, grasses could provide the groundcover that is needed to protect the soils from erosion. Second, the proper placement of new trees and shrubs, while not preventing pedestrian access, could serve to guide park users to the intended access points between the beach and the improvements to the west,

limiting the effects of foot traffic. Lastly, the addition of plants and trees in the area would significantly improve the landscape in the area and would likely be widely popular with park visitors.

The primary disadvantage to using grasses and trees for erosion control is the high initial cost. Additionally, following the initial landscaping of the area, a high level of maintenance would be required until the plants are established, and maintenance would be required in the future to guarantee the continued benefits that the grasses and plant life provide. Lastly, protecting the vegetation until it is well established would create a significant inconvenience to park users.

One factor that will never change is that the beach will always sustain a high level of pedestrian traffic. Because of this, the primary goal of the Park should be to control the traffic patterns and minimize its effects on the land.

The most important factor in controlling pedestrians is to establish a path system between the parking area and the beach. The number and location of the paths should serve to encourage pedestrian use and minimize erosion in the area. Additionally, the path or paths should be designed for proper slope to ensure visitor safety and maximize the erosion control benefits.

The type of path constructed can offer added benefits to the area. Ideally, the construction material chosen should be low-maintenance, such as concrete, gravel, or composite decking. Also, the construction of a footpath typically channels surface runoff and concentrates flows, often increasing the erosive effects of the runoff. The incorporation of a trench drain along the edge of the

path or a subdrain system beneath the path would serve to collect the storm runoff and prevent additional erosion. Finally, the type of path chosen should be consistent with the landscaping options employed in the other areas of the beach.

Even with the addition of an effective path system, many park users would forego the path and take the most direct route to their destination. As detailed previously, the use of landscaping materials or vegetation as pedestrian barriers could guide park visitors to the proper access points. Another option for pedestrian control is the use of fences – either permanent or temporary. The use of these methods would not be intended to completely block visitor access in these areas, rather it would simply be used to discourage foot traffic, thus avoiding the establishment of well-worn footpaths.

Shoreline

As detailed previously, the main concern of the Park is the effect of erosion on visitor safety. The footpaths that have developed over time and the erosion of the concrete paths and stairways both present potentially dangerous conditions to park users.

The concrete paths and stairways would require the greatest amount of repair. Because the access ramps have been eroded to the point of buckling and failure, the first step is to remove the damaged sections of concrete and replace them. When the paths are reconstructed, the foundation should be properly prepared to prevent future damage. In the areas where erosion is evident but the

paths or stairways have not been compromised, restoration is required. Soil should be placed beneath and along the sides of the concrete path and should be stabilized through the use of riprap or shrubs and/or trees.

Typically, footpaths have been worn into the slope above the shoreline where no permanent path or access has been built. In these cases, the Park could best serve its visitors by replacing the paths that have developed with permanent paths. However, to retain the character of the shoreline and to maintain the quality of the visitor experience, the use of rock or wood to construct the paths would be the best solution (See Figure 15). Treated wood steps have been used in another area of the shoreline and appear to be a successful alternative to concrete. Alternatively, the use of rock might give visitors a more satisfying outdoor experience that could come with using a path that does not appear manmade.

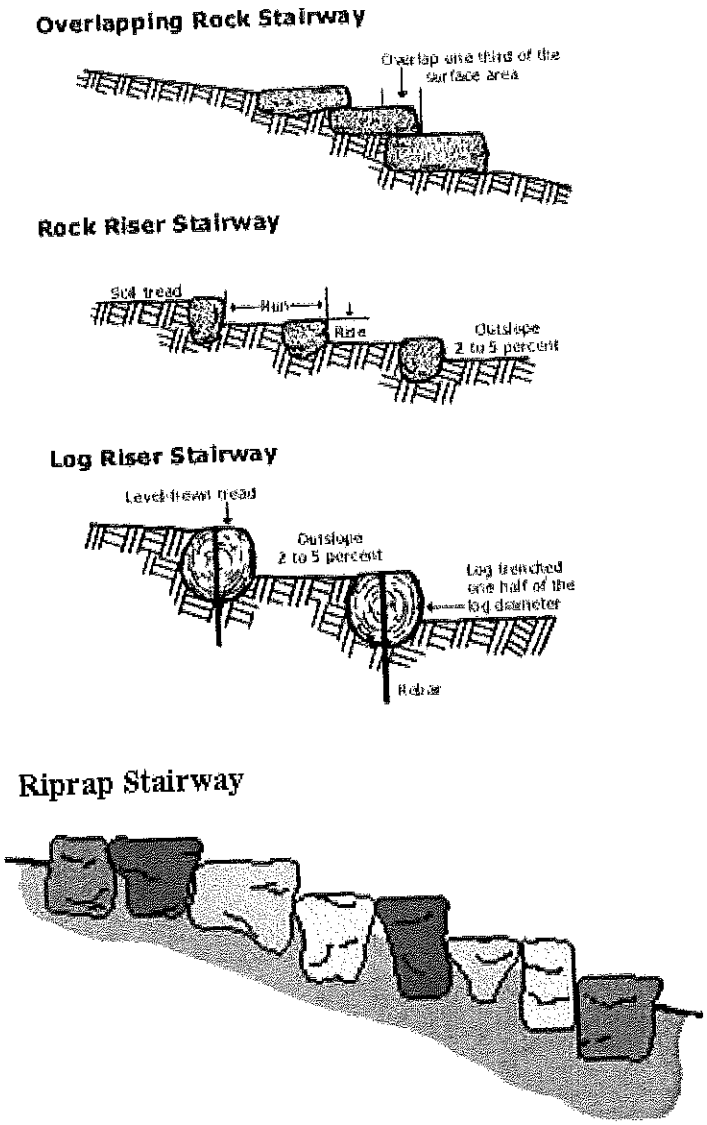


Figure 15: Natural material stairway examples.

Finally, the improvement of shoreline accessibility would consist of two steps. First, the vegetative overgrowth that prevents even the most rugged visitor from walking along shore would need to be cut back or removed. Second, the riprap that currently inhibits walking along the shore would require maintenance. Options include removing and resetting the riprap, larger riprap could be used to replace the existing riprap, or gabions could be used to build a

wider, more accessible shoreline access route. Any of these options would provide a more even walking surface for visitors while maintaining the character of the shoreline.

Structures and Improvements

The erosion along the concrete paths and at the bases of the concrete picnic shelters has grown to be a significant problem. However, with proper remediation and diligent maintenance, these areas can be restored and will continue to serve park visitors into the future.

As described earlier in the plan, the erosion of soil along the base of each picnic shelter is primarily due to excessive foot traffic. Therefore, after soil is added along the base of each shelter, pedestrian control measures would be required to maintain the integrity of the shelters.

First, new paths must be used to connect each shelter with its corresponding grill area and shoreline or beach access point. Second, the area immediately adjacent to the shelter base should be landscaped in a way that discourages visitors from gathering near the shelter base and causing the majority of erosion in the area. The use of materials such as shrubs or rock would serve the dual purpose of protecting the ground from erosion as well as encouraging visitors to use the paths.

Lastly, the large areas of exposed soil that lie beyond the immediate edge of the shelter should be planted with groundcover, grasses, and other vegetation to restore the site to its prior condition and to match the surrounding areas of

prairie environment. Other methods of ground protection, such as mulch or rock, could also be used in place of vegetative cover to provide similar protection for a lower price. However, as detailed previously, the use of such materials would have a negative impact on the park visitor experience.

The erosion along path edges is not as severe as the erosion near the picnic shelters, although the remediation methods would likely be similar. The first step is to replace the soil that has eroded away. To protect this soil, the ground should be planted with grasses or other groundcover vegetation common to the surrounding areas. Using shrubs or other landscaping along the edges of the path would provide additional pedestrian control, however, in most instances, once the groundcover along the concrete paths is established and the path system is developed to provide access to the beach, the area should not be subject to large amounts of pedestrian traffic and the additional measures should not be necessary.

MANAGEMENT RECOMMENDATIONS

The key to successfully repairing the erosion and preventing its development in the future is the assembly of a qualified project team. First, the management recommendations presented in this plan should be reviewed by a licensed engineer and landscape architect. These individuals should be tasked with developing the final west shoreline design that would be most effective in erosion restoration and prevention. The final key member of the project team is an experienced contractor or contractors that have performed erosion

remediation work in the past. Often a skilled contractor can suggest valuable modifications to a design and guarantee the success of a project.

Beach

First, the eroded soil in the area should be replaced and the eroded banks should be reconstructed paying particular attention to the exposed tree roots and ruts. To further stabilize the soil, a geotextile grid should be placed in areas of steep slopes. The use of a retaining wall is not recommended for slope reduction due to the severe impact and high cost such a structure would have.

The second step is to construct a system of paths and natural pedestrian barriers such as large rocks, trees, and shrubs to control access between the beach and the parking area and paths to the west. The path design should take into account visitor use and accessibility and should provide the most effective traffic control possible to prevent future erosion. Also, the design of a storm runoff collection system should be incorporated into the path design. When properly sized, either a perforated pipe underdrain or trench drain system would both be an effective system.

Following the construction of the footpaths, the area would require new landscaping. In all areas requiring ground cover, the recommended solution is to use a variety of grasses, trees, and shrubs that are native to Colorado shortgrass prairie and riparian environments. The use of native species will minimize the future maintenance required along the west shoreline and will be consistent with remainder of the park. Additionally, planting new trees would create a more

diverse stand of trees and would ensure the continued protection of the slope as the trees age.

Four key steps should be followed to enhance the viability of the new landscape.

1. The sandy, rocky soil that is present throughout the site should be replaced with topsoil prior to seeding.
2. Following seeding/planting operations, the area should be protected from use through the use of temporary fences and signs informing visitors that the area is under repair.
3. The area should be given sufficient water and care through the first year to ensure establishment of the vegetation.
4. The landscape should be repaired in phases in order to minimize its effect on visitors and encourage their cooperation in reestablishing the area plantlife.

Shoreline

Due to its immediate effect on visitor safety, the priority for shoreline restoration is the reconstruction of the damaged concrete paths. The panels that are replaced should be constructed on new foundations that are erosion resistant. The design should be approved by a licensed engineer prior to construction.

The next area of improvement should be to replace soils that have been eroded from the remainder of the concrete paths, along the concrete stairways,

and where tree roots have been exposed. Whenever possible, these areas should be reseeded or replanted with native riparian vegetation. The use of native vegetation will minimize the level of maintenance required while restoring the reservoir shoreline habitat.

Next, new pathways between each concrete picnic shelter and the shoreline should be constructed to provide a safe access route for visitors. Either rock or wood stairs would be acceptable alternatives that could withstand years of use.

Finally, shoreline access should be improved near each of the picnic shelter access points. Clearing the vegetation from the entire shoreline would likely have adverse effects on the shoreline and would be detrimental to the quality of the visitor experience. Instead, by improving only a portion of the shoreline near each access point, the Park would be able to provide a significant amount of quality shoreline access and improve visitor safety without compromising the visitor experience. To improve visitor access along the shoreline, the recommended solution is the incorporation of larger riprap in each of these areas to provide an even walking surface. A more cost-effective alternative would be to rearrange the existing riprap to create a flat surface for visitors. However, this method would be more labor intensive and time consuming, therefore the Park should weigh the benefits of each alternative prior to finalizing the plan.

Structures and Improvements

The restoration around the structures and paths along the west shoreline is similar to that of the beach area. First, the eroded soil in the area should be replaced and each site graded to ensure proper drainage.

The second step is to construct path to provide access between each picnic shelter, shoreline access, and the corresponding grill area. The paths should be designed to match the other paths used on the site and should provide the most effective pedestrian control possible.

Following the construction of the footpaths, the area would require new landscaping. In all areas requiring ground cover, the recommended solution is to use a variety of grasses that are native to Colorado shortgrass prairie environments. The use of native species will minimize the future maintenance required in the area and will be consistent with remainder of the park. Along the edge of each picnic area approximately 3 feet of additional landscaping should also be incorporated into the design to discourage visitors from straying from the proper paths.

Again, the following four key steps should be followed to enhance the viability of the new landscape.

1. The sandy, rocky soil that is present throughout the site should be replaced with topsoil prior to seeding.

2. Following seeding/planting operations, the area should be protected from use through the use of temporary fences and signs informing visitors that the area is under repair.
3. The area should be given sufficient water and care through the first year to ensure establishment of the vegetation.
4. The landscape should be repaired in phases in order to minimize its effect on visitors and encourage their cooperation in reestablishing the area plantlife.

Future Management

The first year following construction will be the most labor intensive and the most critical to the success of the erosion remediation. Throughout the first year, all rehabilitated areas should be checked on a weekly basis during the summer when the park is busiest and hottest. Any damage to the landscape should be recorded and repaired as soon as it is found. Additional inspections should be made after storms of a significant amount of precipitation.

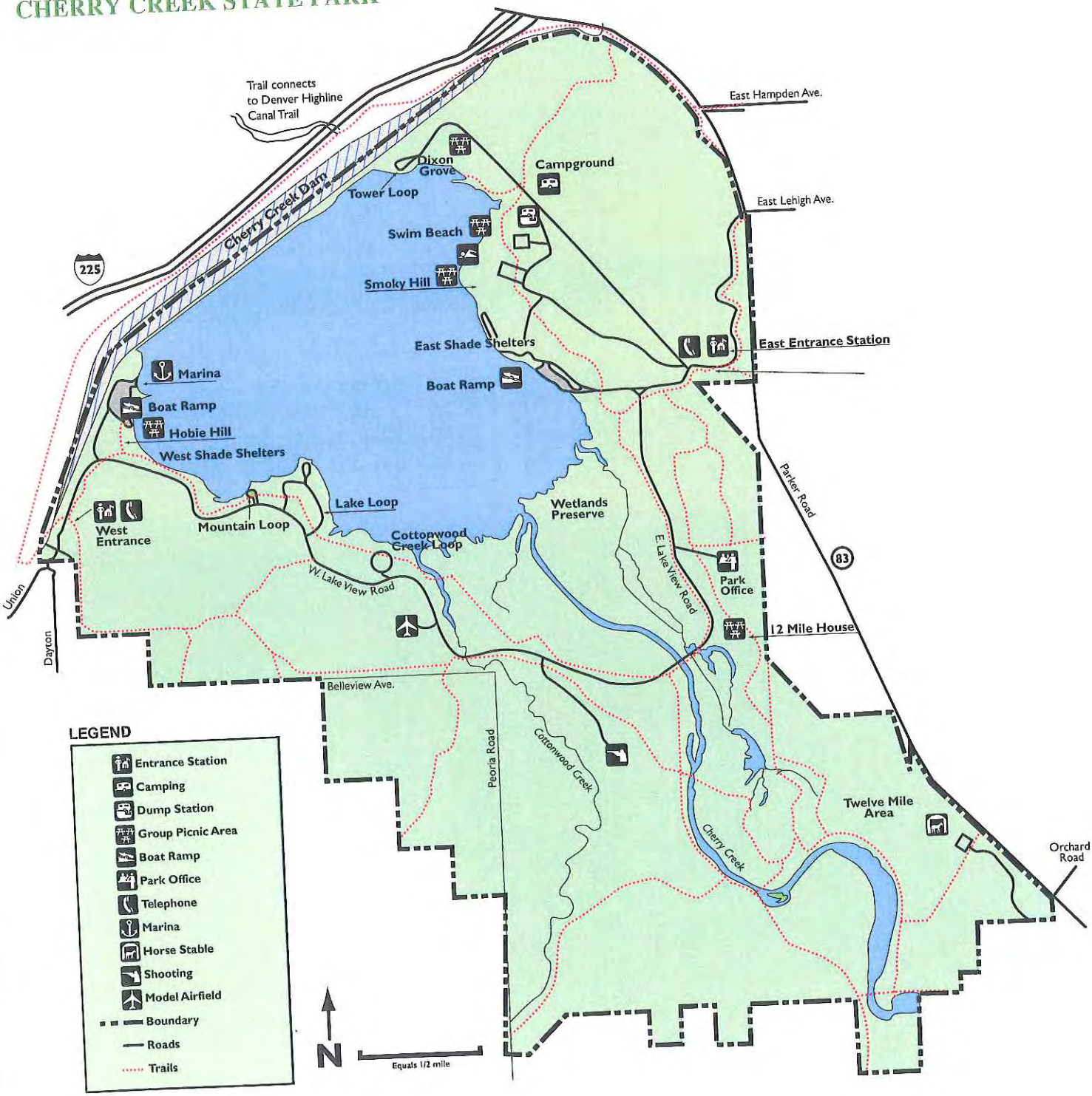
Beyond the first year, inspections can be made during the regular rounds made by park employees. Particular attention should be paid to areas that had been previously eroded, because erosion is most likely to occur in the same areas. If an erosion problem does develop, the problem should be recorded, the cause identified, and a remediation plan developed. Based on these findings, the Park will be able to refine the west shoreline management plan to prevent further erosion.

APPENDICES

APPENDIX A

Cherry Creek State Park Map

CHERRY CREEK STATE PARK



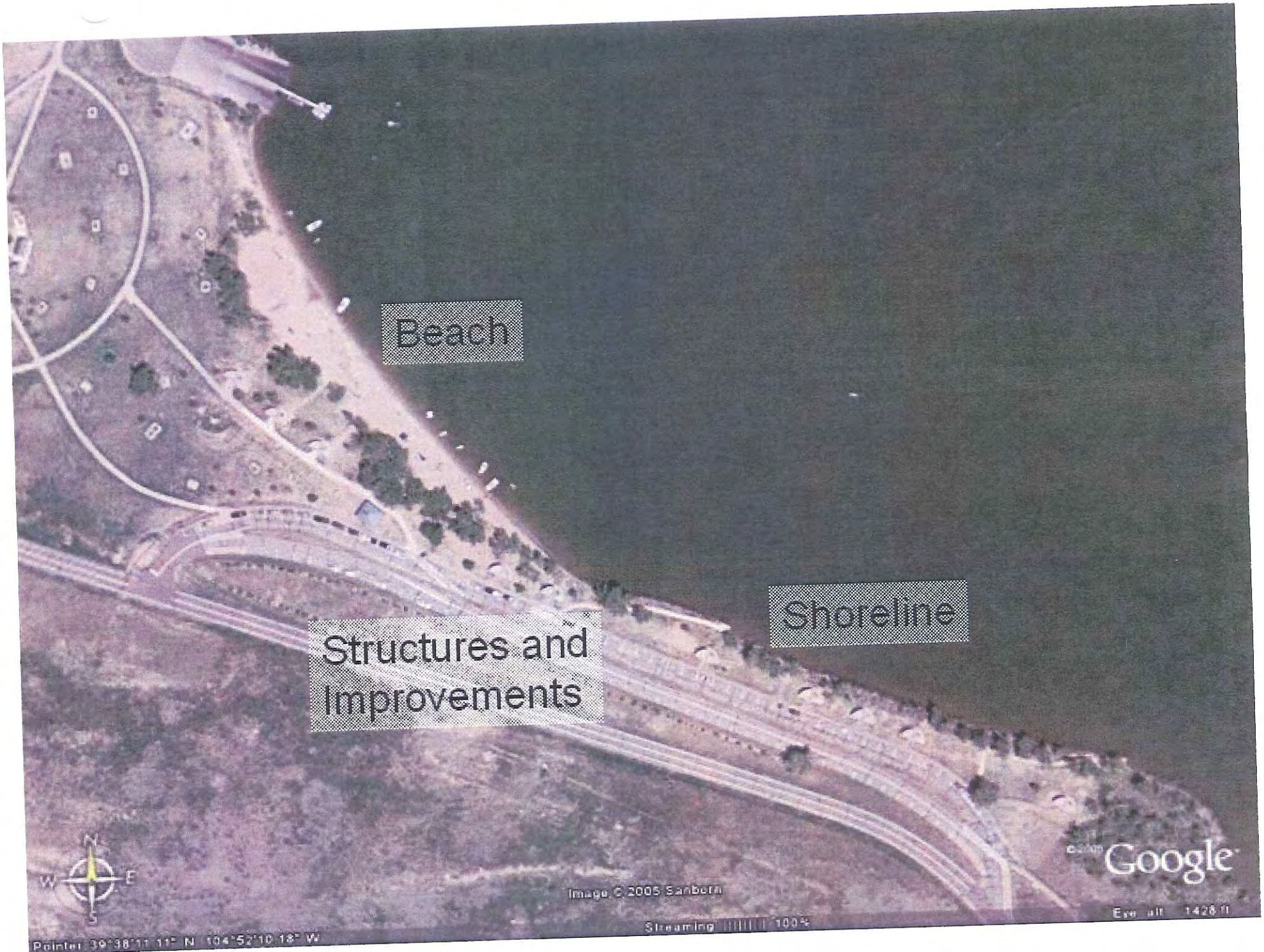
APPENDIX B

West Shoreline Features and Improvements


Beach
Paths
Restrooms
Fishing Access
Parking/Roads
Shelters
Image © 2005 Sanborn
Google
Streaming 100%
Eye alt 1428 ft
Pointer 39°38'11.11" N 104°52'10.18" W

APPENDIX C

West Shoreline Focus Areas


Beach
Shoreline
Structures and Improvements
Image © 2005 Sanborn
Google
Streaming 100%
Eye alt 1428 ft
Pointer 39°38'11.11" N 104°52'10.18" W

APPENDIX D

Cherry Creek Basin Best Management Practice

Facts for *contractors*

Constructing BMPs effectively

BMP
best management practice =
things we can do or build to
maintain or improve water quality

Cherry Creek Basin Water Quality Authority

If you are disturbing land,moving earth,etc.,

+

(photo courtesy of Cherry Creek Corridor Major Drainageway Master Plan project)

Constructing BMPs effectively will

=

Reduce costs from
Work stoppage and fees for non-compliance,
Sediment removal and clean up,
Damage to downstream or offsite areas,
Replacing lost topsoil and regrading erosion areas, and
Repeated seeding and mulching.

=

(photo courtesy of Gary Bernhart)

And improve water quality in Cherry Creek Reservoir

The BMP Series: FS 8

This poster is part of The BMP Series, a program developed by the Authority to provide education on BMP requirements within the Cherry Creek Reservoir Basin.
Authority manager: 303-779-4525

Steps to follow:

DO

Examples of effective BMP construction

Potential mistakes

DON'T

Silt Fence

Silt fence is a temporary sediment barrier constructed of woven fabric stretched across supporting posts. The bottom edge of the fabric is placed in an anchor trench that is backfilled with compacted soil.

Properly installed silt fence cannot easily be pulled out of the ground.

Silt fence is to be securely tied into adjacent BMPs such as the sediment control log shown here, or reinforced rock berms or sediment basin embankments.

A reinforced rock berm may be used downgradient of disturbed areas in lieu of silt fence.

The lower edge of this silt fence is not anchored in a backfilled trench.

Vehicle Tracking Control Pad

A vehicle tracking control pad consists of crushed aggregate paced in a pad at all entrances/exits on a construction site utilized to remove mud/dirt from the tires of vehicles leaving the site.

Properly installed vehicle tracking pad prevents the spread of mud and dirt from the site to other areas.

Failure to utilize a vehicle tracking control pad allowed mud and dirt to be tracked out of this construction site, allowing the material to easily be washed away during a runoff event.

To find out more...

Construction BMP training sessions may be offered by your local land use agency.
Please contact you local land use agency for information on possible training sessions.

Photos and text for BMPs are courtesy of
Douglas County Department of Public Works
Engineering Division