

MOUNTAIN AND LAKE LOOP SHORELINE STABILIZATION

Mountain - Lake Loop Shoreline Stabilization Project

Cherry Creek Reservoir Shoreline Stabilization

Cherry Creek Basin Water Quality Authority

BACKGROUND AND PURPOSE:

The Cherry Creek Reservoir *Shoreline Stabilization Mountain and Lake Loop Alternative Development and Analysis* (Project) was part of the Authority's *2008 Capital Improvement Program* (2008 CIP) which was developed to identify and to prioritize activities and projects necessary to achieve water quality standards in Cherry Creek Reservoir. The project area is located on the southwest side of the reservoir as shown on Figure 1 - Area Map. The project site covers approximately 6.5 acres including the area between the foot trail and the shoreline and approximately 2,300 feet of shoreline, see Figure 2. The project objectives include construction of shoreline and bank stabilization measures that:

1. Minimize sediment from wind, rain, ice, surface runoff, wave action and park user access reaching the reservoir.
2. Minimize water quality impacts from two parking lots and other impervious surface runoff.
3. Integrate and enhance the proposed uses within Cherry Creek State Park.



Figure 2 - Project Site

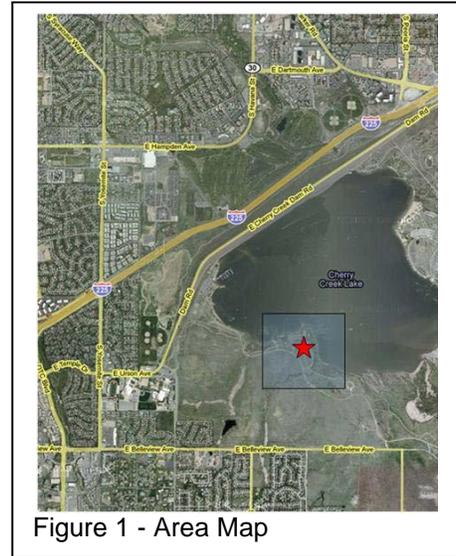


Figure 1 - Area Map

EXISTING CONDITIONS:

Wave action, wind, ice push and shoreline users have each contributed to erosion of the reservoir shoreline and major cut banks. This point along the shoreline is exposed to wind and wave actions during every season of the year. As the ice cover breaks up each spring, the north wind pushes ice to the south shore and in particular this point. Typical pre-project conditions are shown on Photos 1, 2 and 3.



Photo 1 - Existing Condition



Photo 2 - Existing Condition



Photo 3 - Existing Condition

DESIGN APPROACH:

The overall design approach is best described as "stabilization" rather than "reclamation". In 2008 the Authority performed an in depth assessment of the water quality benefits of shoreline stabilization¹. This assessment concluded that phosphorus reduction from shoreline stabilization differs from stream bank stabilization, primarily because shorelines are impacted by additional erosive forces besides storm runoff, including wave and wind forces as well as recreation impacts. The conclusion of this assessment is that, over the long term, shoreline stabilization is expected to reduce phosphorus concentrations into the reservoir from pre-project conditions and likely would reduce phosphorus concentrations to a level consistent with the Authority's goal of 0.20-mg/l.

The assessment also concluded that, based on historical data, for the majority of the time(≈80%) the water surface of the reservoir varied within one foot plus/minus of the normal recreational pool (Elevation 5550). And, the water level remained within two feet of the normal recreational pool over 95 percent of the time. Thus the shoreline stabilization work for this project will be implemented between the elevations of 5548 and 5552.²

The vertical banks were trimmed back to provide manageable vegetated slopes, the shoreline in critical areas was armored with boulders, shoreline point locations were enhanced to protect adjacent shorelines from the prevailing winds, recreation access to beach areas was enhanced, crusher fine trails were created and pedestrian access was directed to the trails using strategically located heavy rail fence; a park standard detail. Runoff from the parking lots was collected and directed into infiltration basis where the storm water is filtered through a select material that allows rapid infiltration.

CONSTRUCTED PROJECT:

Bids for the project were opened on July 24, 2012 and the construction contract was issued to 53-Corporation LLC of Castle Rock on August 16, 2012 in the amount of \$750,436.29. The notice to proceed was issued for September 13, 2013 and the work was substantially complete on June 7, 2013. The final project cost, which included watering of the trees, shrubs and turf totaled \$725,121.97.

Construction of the boulder point with riprap bank protection provides armoring at the Lake Loop point. The boulders were anchored on the reservoir side with Type H riprap sloping at a 3:1 grade into the water. This detail pushes any ice upward and onto the top of the boulders rather than displacing them. A photo of the constructed point is shown as Photo 4 - Constructed Lake Loop Point.

The shape and location of the point (at Lake Loop and at Mountain Loop) protects adjacent shoreline from the direct prevailing winds and wave action.

The beach areas were re-established along the shoreline for recreational uses. The beach areas along the Mountain and Lake Loop project are in continual use by park users for picnics, fishing or a day in the sun as well as providing a convenient location to launch kayaks and long boats.



Photo 4 - Constructed Lake Loop Point

¹ *Water Quality Benefits of Shoreline Stabilization Memorandum, dated October 23, 2008; William P. Ruzzo, P.E., LLC*

² *Recent water rights administration and weather patterns have resulted in more fluctuations in the reservoir pool level. For future projects, the limits of protection are anticipated to be greater.*



Photo 5 - Constructed Mountain Loop Point



Photo 6 - Beach Area

Infiltration basins were incorporated at both the Mountain Loop parking lot and the Lake Loop parking lot. These BMP's are intended to capture minor storm events from the parking lot and provide filtration and infiltration treatment of the runoff. Photo 7 shows an infiltration basin in action at Lake Loop.

September 14, 2013 Storm Event:

On Sunday September 14, 2013 the upper reaches of Cherry Creek received heavy rainfall that at its peak ; the upstream flows were measured at approximately 1,000 cfs. Prior to this event, the water level in Cherry Creek Reservoir was 3.6 feet below normal recreation pool (WSL at 5546.4). On September 16th the reservoir water level was at 5553.2.



Photo 7 - Infiltration Basin @ Parking Lot

An on-site inspection followed on September 18th that found moderate erosion of the trails and graded areas above the upper limit for design (Elevation = 5552) based on the 2008 reservoir water level assessment findings . The boulders and armored structures were not impacted by the flood stage. Following that review, a restoration plan has been completed and construction is anticipated this fall / winter to restore the site to its post construction condition. Photos 8 and 9 show some of the typical damage from the storm.



Photo 8 - Trail Damage



Photo 9 - Sand Deposition on Trail & Vegetation

WATER QUALITY BENEFITS:

An assessment of the water quality benefits was made in 2008 by the Authority³ as part of the ongoing water quality analysis of projects on the 5-year capital improvement program. Based on the outcome of this assessment it is calculated that 54 lbs of phosphorus per year will be eliminated from directly entering the reservoir from the shoreline improvements. Additionally the discharge of sediment and other pollutants from the two parking lots is also minimized from entering the reservoir by the infiltration basins.

³ *Water Quality Benefits of Shoreline Stabilization Memorandum, dated October 23, 2008; William Ruzzo, P.E.*