

CHERRY CREEK STREAM RECLAMATION AT ECO-PARK

Cherry Creek Stream Reclamation @ Eco Park Project

Cherry Creek Basin Water Quality Authority

BACKGROUND AND PURPOSE:

In October 2009, UDFCD and SEMSWA entered into an Intergovernmental Agreement (IGA) for design of Cherry Creek stream reclamation improvements at Eco Park. In April 2010, upon SEMSWA's request, the Authority entered into an IGA with SEMSWA to participate in funding the project following the Authority's inspection and analysis of the Project area and hydrologic data. The project area is approximately 4,850 linear feet long and connects to the downstream end of the Parker Jordan Centennial Open Space stream reclamation project. The Project site is shown on Figure 1 - Area Map.

The Authority's inspection of the Project area found the channel to be in a severe state of degradation (i.e., "down cutting"); bank erosion resulting in steep slopes and material sloughing; lateral channel migration and loss of wetlands and upland vegetation due to lowering of the water table by the streambed erosion.

The Authority assessed the water quality benefits of the project and determined the Project meets the Authority's goal for stream reclamation. The Project was added to the Authority's Capital Improvement Plan in 2010 and the Authority began monitoring the project design performed by Muller Engineering through 2010 and 2011. On April 15, 2010 the Authority entered into an IGA with SEMSWA for design finds in the amount of \$56,000. On May 19, 2011 the Authority approved contributing \$905,000 of the total Project cost and entered into an agreement with SEMSWA, dated effective on December 31, 2011.

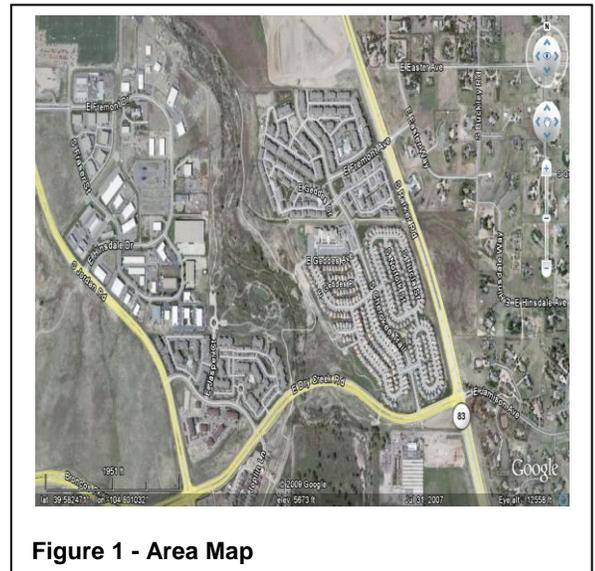


Figure 1 - Area Map

EXISTING CONDITIONS:

Urbanization and the resulting increase in the rate, frequency, duration and magnitude of stormwater runoff accelerated degradation of the streambed and banks. Typical pre-project conditions are shown on Photos 1, 2 and 3 documenting that Cherry Creek has degraded up to 10-feet within the streambed.



Photo 1 - Existing Condition



Photo 2 - Existing Condition



Photo 3 - Existing Condition

DESIGN APPROACH:

Because of the severity of the channel degradation, areas of topographical constraints and floodplain regulations limiting increases in flood elevations, the approach to reclamation of this reach is a combination of a natural bioengineering approach connecting the streambed to the overbanks and a more engineered approach where topography constrains the channel. In some locations essentially all of the existing channel bank and riparian vegetation had to be removed and replanted due to the substantive changes in channel geometry necessary to accommodate topographic and floodplain limitations. In several areas the preferred design approach for stream reclamation was used whereby much of the existing vegetation was retained and protected, minimizing disturbances and improving the chances of revegetation success.

Hand sculpted concrete drop structures, as shown on Photo 4, are incorporated into the project to flatten and control the longitudinal grade, with sheet pile cut-off walls to protect the structure from damages during the larger flood events. Riffle-pool structures, constructed entirely of rock, were constructed in the channel to aide in conveyance of the mean flood event in the narrower channel. Larger floods in these areas then spread over the broader floodplain, This design approach lowers the runoff velocities allowing for more filtration and infiltration.



Photo 4 - Sculpted Concrete Drop

The Project was designed to raise the streambed and reestablish the water table to prevent further loss of vegetation and down cutting, erosion and sediment transport. The overall project goal was to restore and enhance the aquatic, wetland and riparian functions of Cherry Creek.

CONSTRUCTED PROJECT:

Two bids were advertised for this project. The first was for construction of four sculpted concrete drop structures and the second was for the stream reclamation work. Bids for the project were opened on August 15, 2012. The successful bidders, ECI Site Construction (stream reclamation) and Naranjo Civil

Constructors (sculpted concrete drops), were awarded contracts in the combined amount of \$3,607,351.60. Two notices to proceed were issued for September 24, 2012. The work was substantially complete on September 9, 2013. The final project cost totaled \$3,780,899.37.

The Project included secondary channels in two locations, three sculpted concrete drops, one sculpted concrete splitter drop, one lateral weir drop, and six riffle drops. The sculpted concrete splitter drop, located closest to the the Eco Park trail access bridge over Cherry Creek provides for an interactive creek crossing, see Photo 5.

The lateral drop weir and the sculpted concrete splitter drop each divert stream flows into a secondary channel section as the water level in Cherry Creek rises to the diversion invert elevation. This design feature allows for the stream flow to widen out into two channels and further reduce velocities. The secondary channels are beneficial for reconnection of the water table with portions of the floodplain. Six different types of bioengineered bank protection details were installed along the realigned/reshaped channel through the project. The bank protection types were unique for



Photo 5 - Sculpted Drop Creek Crossing

straight sections, inside bends, outside bends and for the secondary channel. As part of the revegetation efforts the project included installation of:

- 28 acres of seeding.
- 10,315 grass plugs.
- 11,281 willow stakes.
- 217 trees.
- 824 shrubs.

A flow monitoring and sampling station was installed near the lower end of the project to provide a data collection point for the Authority as shown on Photo 6. This data collection point is one of a series used by the Authority along Cherry Creek to monitor nutrient loading and stream flows within the Cherry Creek Basin.



Photo 6 - New Monitoring/Sampling Station

September 14, 2013 Storm Event:

On Sunday September 14, 2013 the upper reaches of Cherry Creek received heavy rainfall that at its peak was measured at approximately 1,000 cfs.

An on-site inspection followed that found that all major structures designed and installed to control the minor and significant storm runoff events each functioned as expected. None were damaged or adversely impacted. The upper banks where the revegetation work had not re-established itself yet, received the majority of the damage. Seeded areas had eroded, upper bank material was displaced and low areas filled in. Crusher fine trails were washed out in specific locations where runoff was concentrated. The project team quickly assessed the damage and the project consultant prepared an overall restoration plan. Restoration work began promptly to repair areas impacted by the flooding. It was anticipated that the flood damages would have been minimal if the project vegetation had a season or two to establish itself. This is confirmed following a brief site visit to the Parker Jordan Centennial Open Space project immediately upstream of Eco Park. It is strong testimony that bioengineering design works for stream reclamation after the vegetation is established.

Photos 8, 9, 10 and 11 show some of the typical damage from the storm.



Photo 8 - Flooding Damage



Photo 9 - Flooding at a Trail Crossing



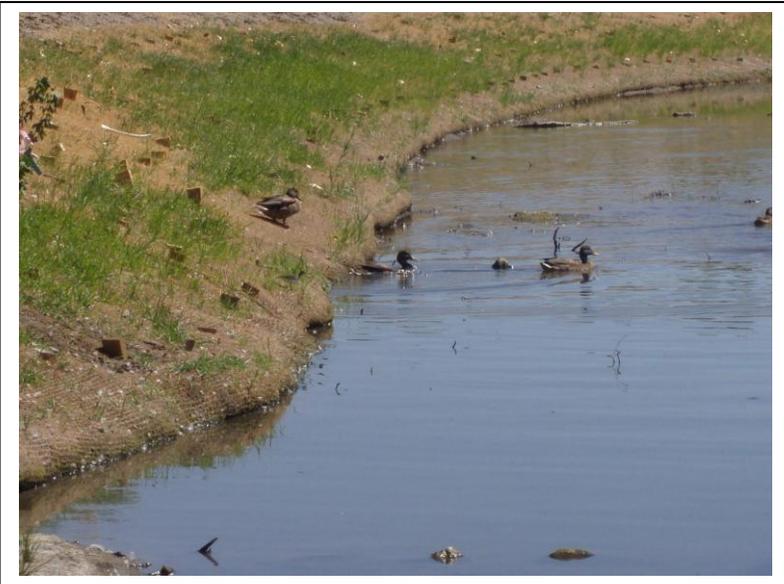
Photo 10 - Flooding Damage



Photo 11 - Flooding Damage

WATER QUALITY BENEFITS:

An assessment of the water quality benefits for the entire project was made by the Authority¹ as part of the ongoing water quality analysis of all projects listed on the 5-year capital improvement program. Based on the outcome of this assessment it is calculated that 117 lbs of phosphorus per year will be eliminated from being transported downstream from the Eco Park stream reclamation improvements. The project was found to lower stream velocities, channel shear and stream power from that found prior to reclamation, all which minimizes the transport of sediment and pollutants.



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