

# MEMORANDUM

JRS ENGINEERING CONSULTANT, LLC

**TO:** Chuck Reid, Manager - CCBWQA  
**CC:** Rick Goncalves, Chairman, TAC  
**FROM:** James R. "Jim" Swanson, P.E.  
**DATE:** December 22, 2016  
**SUBJECT:** Cherry Creek Stream Reclamation at Arapahoe Road - Reach 5

## BACKGROUND AND PURPOSE:

In January 2011, the Southeast Metro Stormwater Authority (SEMSWA) issued a Request-for-Proposal stating that a group of stakeholders had been formed with shared interests in the Cherry Creek corridor upstream and downstream of Arapahoe Road. The stakeholders desired to update the Major Drainageway Plan completed by URS in 2014 to a preliminary design level through the reach of interest. Stakeholders included SEMSWA, Urban Drainage and Flood Control District (UDFCD), City of Aurora (COA), Cherry Creek Basin Water Quality Authority (Authority) and Arapahoe County (AC). In August 2013, the Cherry Creek Stream Reclamation – Eco Park to Cherry Creek State Park – Preliminary Design Report was prepared by Muller Engineering Company. This report serves as the design guideline for the 11,700 linear foot length of stream corridor identified above. Because of the extensive nature of the improvements in this corridor, the project has been divided into five phases (referred to as Reaches). Reach 5 is the upper segment of this corridor (length ≈2,200 linear feet) extending from the downstream end of the Cherry Creek Stream Reclamation Project at Eco Park to a point located south of the soccer field complex; south of Arapahoe Road near South Chambers Road in Aurora.

The Authority's inspection of the Reach 5 project area found that erosion and downcutting was resulting in steep bank slopes, lateral channel migration and loss of viable wetlands and upland vegetation due to lowering of the water table. The Authority assessed the water quality benefits of the project and determined the Project met the Authority's goals and objectives for stream reclamation. The Project was added to the Authority's Capital Improvement Plan.

In 2012, UDFCD requested Authority funding to assist with design / construction of the above referenced project, which was funded by the Authority in IGA Agreement Nos. 12-08.04, 12-08.04A and 12-08.04B dated December 21, 2012, December 6, 2013 and May 21, 2014, respectively. To date the Authority's funding contribution has totaled \$900,000.

## 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 in Photos 1, 2 and 3 documenting that Cherry Creek's degradation within this reach.



Photo 1 - Typical Pre-project Condition



Photo 2 - Typical Pre-project Condition



Photo 3 - Typical Pre-project Condition

### DESIGN APPROACH:

The design approach to reclamation of this reach is the combination of a natural bioengineering approach connecting the streambed to the overbanks and a more engineered approach in areas where topography or site conditions constrain the channel geometry. During the initial project field survey and evaluation, it was noted the channel downcutting had progressed to the point where a raw waterline, owned by COA, was exposed and the Cherry Creek channel flow was undercutting below their pipe; see the center of Photo 3. This exposed pipe condition accelerated design and construction of Drop Structure 14, located downstream of the exposed waterline. Drop Structure 14, as constructed, serves as the downstream stream channel grade anchor structure for the Reach 5 stream reclamation improvements. UDFCD, COA and the Authority funded construction of Drop Structure 14 and the stream reclamation improvements for a distance of approximately 200 linear feet upstream of the drop.

Design for the balance of the Reach 5 stream reclamation channel improvements was completed concurrently with construction of Drop Structure 14. Construction of the Reach 5 channel improvements (length = 2,300 linear feet) started in the fall of 2015 and was completed in spring of 2016. Four Void Filled Rip-Rap Riffle Drops and one Boulder Cascade Drop, in addition to the sheet-pile cut-off wall installed at the Boulder Cascade Drop, protects the channel section from damage during larger flood events. The sideslopes along the stream channel mainstem were graded with flatter slopes to reconnect higher channel flows to the riparian corridor. The channel reconstruction reduces channel velocity, shear forces and stream power allowing for more filtration and infiltration.

The Project was designed to raise the streambed and re-establish 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. In-progress construction for Drop Structure 14, constructed in 2014/2015 is shown in Photos 4 and 5.



**Photo 4 – Drop 14 Channel Grading**



**Photo 5 – Sculpted Concrete Drop 14**

In-progress construction for the Cherry Creek Stream Reclamation Channel Improvements constructed in 2015/2016 is shown in Photos 6, 7, 8 and 9.



**Photo 6 – Reach 5 Channel Grading**



**Photo 7 – Reach 5 Channel Construction**



**Photo 8 – Cascade Boulder Drop Construction**



**Photo 9 – Cascade Boulder Drop Construction**

**CONSTRUCTED PROJECT:**

The Cherry Creek Drop Structure 14 Project was split into two separate contracts; one for the stream civil reclamation, revegetation and landscaping and the second for construction of the drop structure. Edge Contracting, Inc. (stream civil reclamation, revegetation and landscaping) and Naranjo Civil Constructors, Inc. (drop structure) were awarded contracts in the combined amount of \$979,986.50. The Notice to Proceed was issued on **June 16, 2014**. The work was substantially complete on December 23, 2014. The final Project cost totaled **\$965,779.50**.

The Cherry Creek Stream Reclamation Channel Improvements Project contract was awarded to ECI Site Construction Management in the amount of \$1,403,190.70. The Notice to Proceed was issued on **August 28, 2015**. The work was substantially complete on June 14, 2016. The final Project cost totaled **\$1,322,810.80**.

The constructed improvements are shown in Photos 10, 11, 12, 13 and 14.



**Photo 10 – Drop Structure 14**



**Photo 11 – Constructed Boulder Drop & Channel**



**Photo 12 – Constructed Boulder Drop & Channel**



**Photo 13 – Constructed Channel**



**Photo 14 – Constructed Channel**

### **WATER QUALITY BENEFITS:**

An assessment of the stream stabilization and water quality benefits for the entire project was made by the Authority<sup>1</sup> and found to include reductions in sediment and other pollutant loads, including phosphorus and nitrogen. These benefits are supported by Authority data, literature research and quantitative analysis. Based on the outcome of this assessment, it is calculated that 44 lbs of phosphorus per year will be eliminated from being transported downstream from the Cherry Creek at Arapahoe Road – Reach 5 stream reclamation improvements. The project was found to lower stream velocities, channel shear and stream power from that found prior to the stream reclamation, all which minimizes the transport of sediment and pollutants.

### **SUMMARY:**

#### **Drop Structure #14:**

**Project Length = 300 linear feet.**

**Water Quality Benefits (included with Reach 5 removal below).**

**Total Construction Cost = \$965,780.**

**Authority's Share = \$280,365.**

**Project Partners: UDFCD, CCBWQA, City of Aurora & SEMSWA.**

**Engineer: Muller Engineering Company.**

**Contractors: Edge Contracting, Inc. & Naranjo Civil Constructors, Inc.**

#### **Cherry Creek Stream Improvements – Reach 5:**

**Project Length = 2,300 linear feet.**

**Water Quality Benefits ≈ 44 # / year Phosphorus removal.**

**Total Construction Cost = \$1,322,811.**

**Authority's Share = \$384,010.**

**Project Partners: UDFCD, CCBWQA, City of Aurora & SEMSWA.**

**Engineer: Muller Engineering Company.**

**Contractor: ECI Site Construction Management.**

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<sup>1</sup> CCBWQA Technical Advisory Committee, June 16, 2011. *Stream Reclamation, Water Quality Benefit Evaluation – Interim Report.*