R2R ENGINEERS

RIFFLES TO RIPPLES

MEMORANDUM

DATE:	February 8, 2023
TO:	Jane Clary, Wright Water Engineers, CCBWQA Technical Manager
CC:	Jon Erickson, CCBWQA Technical Advisory Committee Chairman
FROM:	Richard Borchardt, PE & CFM
SUBJECT:	Cherry Creek Stream Reclamation at 12-mile Park Phase 3 - Project Summary

Background and Purpose:

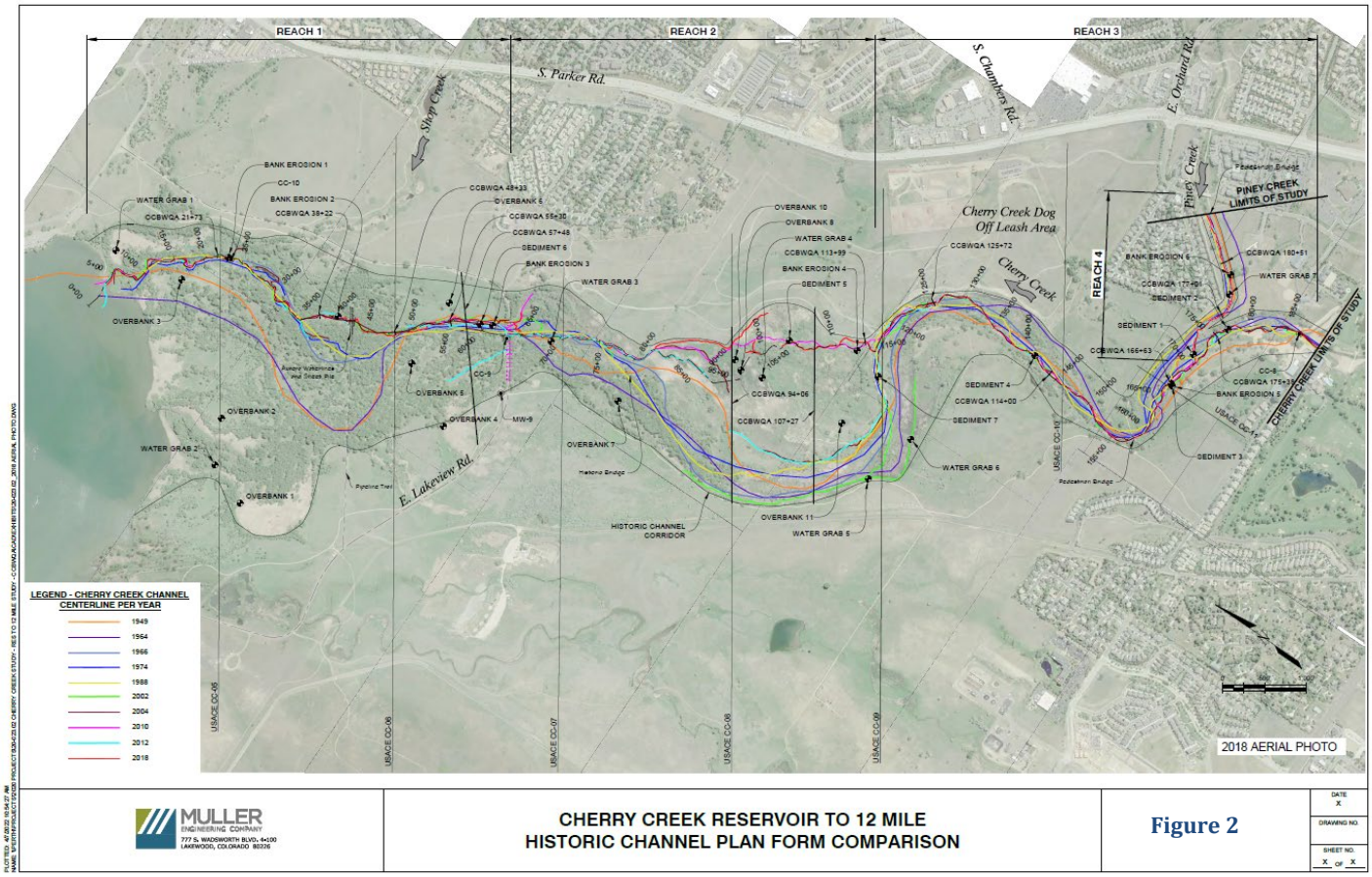
In June 2012, the Cherry Creek Basin Water Quality Authority (CCBWQA) completed the first phase of the Cherry Creek Stream Reclamation at 12-mile Park (Phase 1).[1] In June 2014, CCBWQA completed the second phase of the Cherry Creek Stream Reclamation at 12-mile Park (Phase 2).[2] In 2015, sediment began to deposit within the Phase 1 reach. In 2017, a breach occurred downstream of Phase 1. In November 2018, CCBWQA hired CH2M Hill Engineers, a subsidiary of Jacobs Engineering Group (Jacobs/ch2m), to provide alternative analysis and ultimately design of the third phase of Cherry Creek Stream Reclamation at 12-mile Park (Phase 3). **Figure 1** shows the location of Phases 1 to 3.

Figure 1

[1] Cherry Creek Stream Reclamation @ 12-Mile Park Phase I – Project Summary; William P. Ruzzo, PE, LLC; January 28, 2013

[2] Cherry Creek Stream Reclamation @ 12-Mile Park Phase II – Project Summary; JRS Engineering Consultant, LLC; October 21, 2014

The urbanization in the watershed upstream of the Cherry Creek State Park (CCSP) results in increased rate, frequency, and magnitude of storm flows in Cherry Creek which in turn contribute to the complex and dynamic nature of Cherry Creek in CCSP. In June 2020, CCBWQA hired Muller Engineering Company (MEC) to take a broader look at Cherry and Piney Creeks within Cherry Creek State Park. MEC included in their Report[3] the historic channel plan **Figure 2** which highlights the existing condition and nature of Cherry Creek within CCSP.



The primary purpose of Phase 3 was to protect the infrastructure installed upstream in Phases 1 and 2. Phase 3 includes a grade control structure which serves to help protect the upstream infrastructure of Phases 1 and 2 with the associated water quality benefit and about 30 feet of bank protection which provides an additional water quality benefit.

[3] Cherry Creek Stream and Water Quality Assessment Reservoir to State Park Boundary; Muller Engineering; November 2022

Existing Conditions:

Cherry Creek in the breach area previously flowed towards top right of **Photo 1**, compared with the current flow path which is towards the bottom right in **Photo 1**. There is approximately a 2-foot head cut at the existing boulder edging (see middle of **Photo 1**) which has been displaced, and the riprap installed below the boulder edging has moved downstream (see right side of **Photo 1**). Upstream of the breach area, near the concrete access trail, the water surface is at the bottom of the boulders (**Photo 2**); if the head cut continues to move upstream, this will likely undercut additional boulder edging thereby threatening additional infrastructure.

Photo 1, 6/1/22

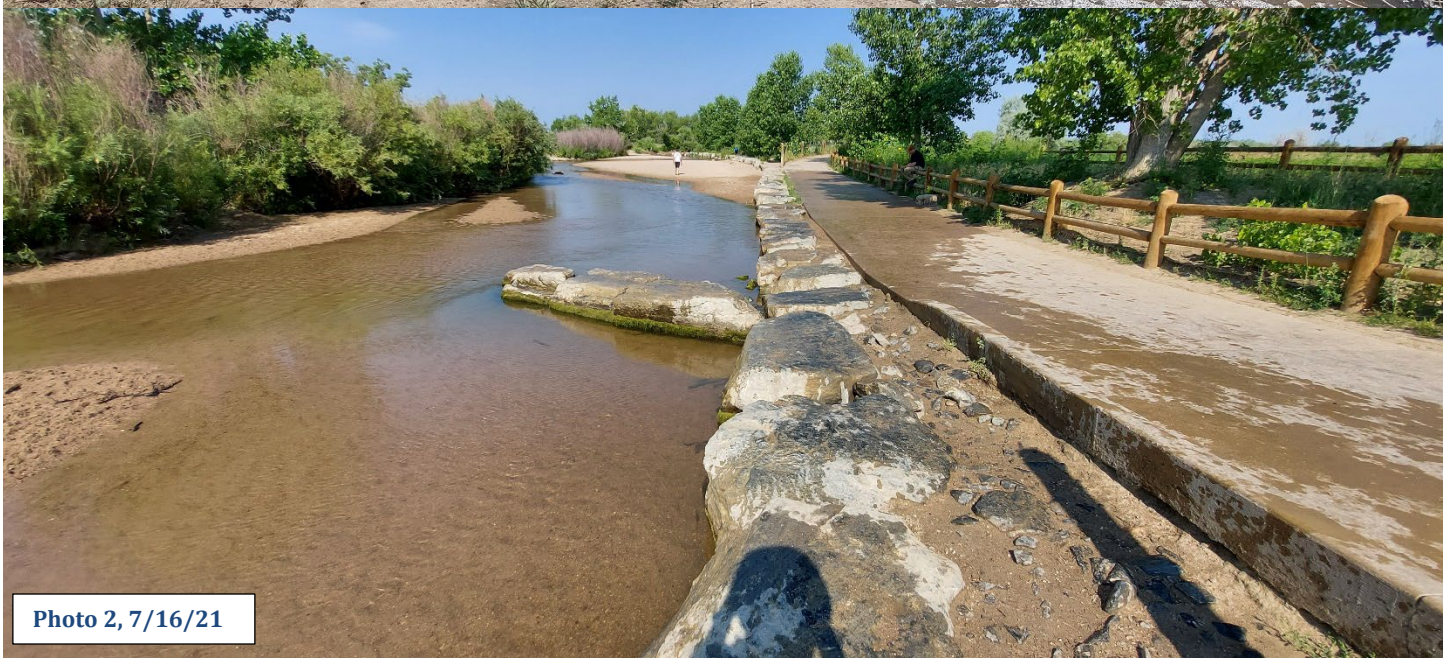


Photo 2, 7/16/21

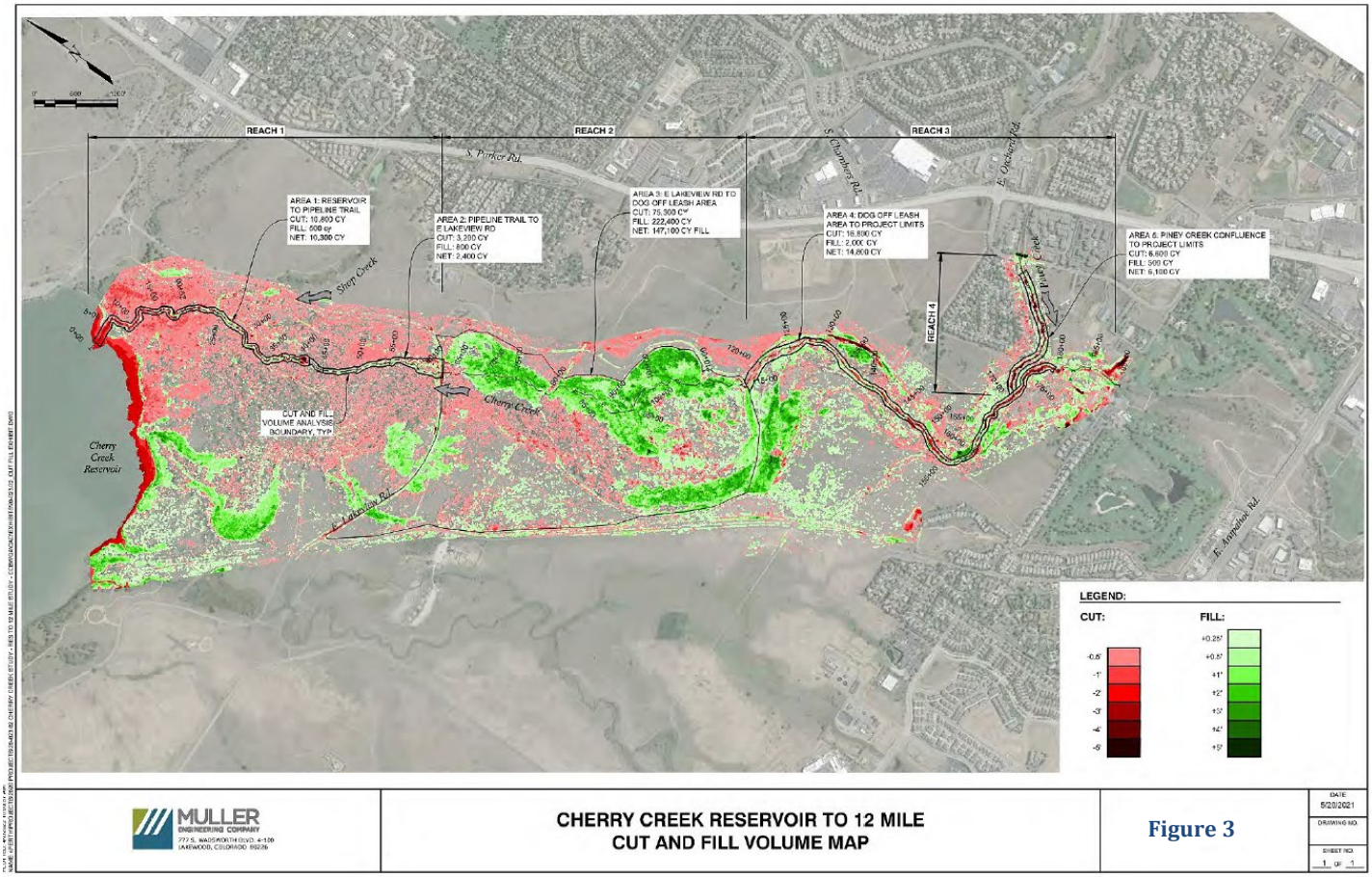
Although wetland and riparian vegetation exist, it is stressed due to the lowering of the groundwater table, corresponding to the lower stream level. Trees and willows in the project area were not budding out (**Photo 3**) when other trees and willows just upstream were budding out (**Photo 4**).

Photo 3, 5/4/22

Photo 4, 5/4/22

Design Approach:

Due to the complex and dynamic nature of Cherry Creek in CCSP, CCBWQA set up a design review committee[4] to navigate the opportunities and constraints of Phase 3. In MEC's report, it was noted that there is a valley floor alluvial fan downstream of the breach area that serves as a natural depositional area (**Figure 3**). This depositional area allows sediment and other nutrients to settle out; thus, improving the water quality in Cherry Creek.



Jacobs/ch2m and MEC coordinated with the final location of the control structure which was placed at the upstream apex of the valley floor alluvial fan to allow for the stream to take its natural courses over time and allow for the continued natural and beneficial uses of the valley floor alluvial fan and wetlands. The project includes a sheet-pile grade control structure with riprap to reduce bed erosion and help protect the infrastructure installed upstream in Phases 1 and 2 and about 30 feet of bank protection which provides an additional water quality benefit. The design review committee evaluated many options, worked through several difficult constraints, and brought together the recommendations of two different consulting teams determining that Phase 3 should protect the upstream infrastructure, maintain the current flow path of the

[4] The design review committee consisted of David Van Dellen, Jacob James, Casey Davenhill, Bahman Hatami/Jon Erickson, and Richard Borchardt.

breach, and provide enough flexibility to allow for future movement of the stream downstream of the control structure.


Photo 5, 6/14/22

Construction:
Construction of Phase 3 occurred from May to June 2022 and was performed by 53 Corporation. Phase 3 constructed stream stabilization measures that include about 30 feet of bank protection (**Photo 5**) and a sheet-pile grade control structure with riprap (**Photo 6**).

Funding:
CCBWQA funded the Phase 3 project at a total cost of $443,000.

Water Quality Benefits:
Phase 3 stream stabilization helps to maintain the existing water quality benefit of Phases 1 and 2, and it provides an additional water quality benefit from the bank protection. Phase 3 reduces erosion and immobilizes nutrients (including phosphorus and nitrogen) in the soils, reducing nutrient loading to Cherry Creek and Cherry Creek Reservoir.[5] Phase 3 immobilizes an estimated 1 pound of phosphorus per year.[6]


Photo 6, 6/14/22

[5] CCBWQA Stream Reclamation, Water Quality Benefit Evaluation – Interim Status Report; CCBWQA Technical Advisory Committee; June 16, 2011.
[6] CCBWQA 2022 Capital Improvement Program Supporting Data, Board Adopted Version November 18, 2021.

Summary:

Helps to Maintain Water Quality Benefit of Phases 1 and 2 ≈ 52 pounds of phosphorus per year[7]
New Water Quality Benefit of reduction of ≈ 1 pounds of phosphorus per year
Total Project Cost = $443,000
Authority's Share = $443,000
Engineer: Jacobs/ch2m
Contractor: 53 Corporation

Additional information for the third phase of Cherry Creek Stream Reclamation at 12-mile Park (Phase 3) can be found at the project sponsors websites below.
CCBWQA website link: https://www.cherrycreekbasin.org/library/

[7] Table 1 of CCBWQA 2022 Capital Improvement Program Supporting Data, Board Adopted Version November 18, 2021 shows a water quality benefit of 9 pounds for Cherry Creek 12-mile Park Phase I and 43 pounds for Cherry Creek 12-mile Park Phase II of phosphorus immobilized annually.