



Board Summary Report

Date: June 25, 2018
To: Board of County Commissioners
Through: Chuck Haskins, Engineering Services Division Manager
From: Cathleen Valencia, Engineering Services Division
Subject: Master Drainage Plan for Kiowa Creek and Tributaries

Direction/Information: The Engineering Services Division (ESD) is requesting a public hearing to introduce the BOCC to the Master Drainage Plan for Kiowa Creek and Tributaries (MDP) that was recently finalized and to explain how it can be used as a reference for future development within the watershed study area. ESD is requesting that the Board formally adopt the MDP.

Once adopted, ESD recommends that Engineering Services be directed to study funding options for the drainage improvements called for in the MDP, including the adoption of a Kiowa Creek Drainage Basin Fee that would be applied as an impact fee to all new development and would be based on new impervious areas that would be created by development in the area. This fee would be intended to cover or defray the costs of the bridge, culvert or other drainageway improvements that are recommended under the MDP.

On May 22, 2018, the Arapahoe County Board of County Commissioners commenced a Public Hearing at 5334 S. Prince Street, East Hearing Room, Littleton, CO 80102; at which the MDP was presented in consideration and interested persons were given an opportunity to be heard concerning the above-described application for adoption of the MDP, Case No. C15-006.

The Board of County Commissioners then continued the Public Hearing to June 26, 2018 to take additional public comment prior to making a decision on the adoption of the proposed MDP.

Request and Recommendation

This MDP presents the results of hydrologic and hydraulic analyses for Kiowa Creek and its tributaries within Arapahoe County, Colorado. The analyses were focused on select drainage infrastructure to evaluate flood risk at known roadway crossing locations.

Hydrologic and hydraulic results were used to propose drainage infrastructure recommendations throughout the study area adequate in detail to properly plan bridges and culvert crossings, plan for new drainageway facilities, permit the acquisition of needed right-of-way and enable the County to permit new subdivisions and buildings in the study area with full knowledge of the area floodplains and stormwater infrastructure requirements.

General flood control and flood mitigation recommendations for the Kiowa Creek watershed study area are as follows:

1. The County continue to monitor land use changes in the watershed. As development occurs and the future land use differs from those assumed in the MDP, the County should take steps to reduce the proposed new development runoff rates and volumes to those outlined in the MDP.
2. The County should continue to implement floodplain management policies and regulations. Development of habitable structures within the 100-year floodplain should be avoided.
3. The County should continue to participate in FEMA's flood insurance Community Rating System and educational programs.
4. The County and applicable property owners should proactively attempt to stabilize waterways as the surrounding watershed continues to develop. Erosion and sediment transport should be monitored and mitigated during all construction activities. Existing waterways that exhibit signs of degradation or instability should be monitored and mitigated, to the greatest extent possible, preferably using stream restoration best practices that promote a healthy, natural waterway.
5. Discuss waterway crossings, in association with Arapahoe County 2035 Transportation Plan.

The Public Works and Development Department (PWD) and ESD recommend that the Board adopt the MDP so that it can be used as a reference for future development. For larger developments adjacent to the Kiowa Creek floodplain, staff may make recommendations to improve channel stability pursuant to recommendations within the MDP.

If directed by the Board, ESD would study funding for the drainage improvements called for in the MDP. At this time ESD is only requesting the Board adopt the MDP. Any fees, if desired by the Board, would need to be first studied and an appropriate amount determined, all of which would have to be separately adopted/approved by the Board.

Background

Kiowa Creek is a northward-flowing stream with source areas in the Platte River-Arkansas River divide area east of the Front Range. The MDP study area included Kiowa Creek and its tributaries north of the Arapahoe County/Elbert County borderline and south of the Arapahoe County/Adams County borderline. Kiowa Creek is the first drainageway studied by the County outside of Urban Drainage and Flood Control District (UDFCD) and Southeast Metro Stormwater Authority (SEMSWA) boundaries.

The MDP focuses on the portion of Kiowa Creek and its tributaries within Arapahoe County, which cover approximately 42 square miles. In the study area, Kiowa Creek winds its way from the Elbert County line to the Adams County line, traversing roughly 75,000 ft. with an average slope of 0.0046 ft/ft. The creek crosses County Line Road, East Quincy Avenue, and I-70, with each crossing being a multi-span bridge configuration. There are several tributaries primarily to the west of Kiowa Creek that cross Brick Center Road (CR 129) and East Quincy Avenue that were also studied as part of this MDP.

The Arapahoe County Comprehensive Master Plan (ACCMP) was used to develop hydrology in the drainage basin. The ACCMP indicated that the area north of E. 6th Avenue could develop as densely as one dwelling unit per acre, while the area south of E. 6th Avenue is proposed to remain more rural with A-1 and A-E zoning with 19-acre and 35-acre sites, respectively. These densities were used to estimate future impervious area in the basin. Future flow increases in the basin are mostly due to upstream potential development in Elbert County and El Paso County.

Two public outreach meetings were held with residents adjacent to the main stem of Kiowa Creek and its tributaries. The first public meeting was an “open house” to give residents the opportunity to comment on the project and inform the County to any known drainage problems. The second public meeting was an overview of the project with another opportunity for public comment. In addition to the public meetings a Kiowa Creek MDP website was created to allow for public comment. Upon completion of the MDP the County reached out to El Paso County and Elbert County but neither commented on the study.

There are no plans to modify the effective Flood Insurance Rate Map (FIRM) with a Letter of Map Revision (LOMR) of the newly delineated floodplain for Kiowa Creek. The County plans on continuing to use the Approximate A-Zone as the regulatory floodplain while using the MDP as a supplement. The current regulatory floodplain is more conservative but the MDP delineates the floodplain for the tributaries, therefore both will be beneficial as development occurs.

Discussion

Based on the hydrologic and hydraulic analysis, the main alternatives that were considered for this analysis include floodplain preservation, crossing structure improvements, detention ponds, and maintaining the status quo. The Recommended Plan was chosen based on a combination of quantitative and qualitative measurements. The Recommended Plan consisted of:

- Floodplain preservation in most reaches
- Crossing structure improvements
- Maintaining the status quo in several reaches

The proposed recommendations in the MDP may be implemented at any time, in any sequence. However, certain improvements may be qualitatively deemed more critical considering a number of factors including: risk to public infrastructure users, magnitude of existing deficiency, and impacts to public and private properties. For instance, replacing a bridge on a major arterial highway that may be overtopped in frequent storm events is typically considered a higher priority project than the construction of a small grade control structure located in a rural, undeveloped area without any immediately adjacent habitable structures or infrastructure. As such, it is recommended that the Crossing Structures on East Quincy Avenue in Kiowa Creek Reach 3 and on East County Line Road in Kiowa Creek Reach 5 be prioritized given the roadway designations when other roadway improvements are made. The bank stabilization measures and grade control structures should be constructed in accordance with watershed development unless significant erosion is observed along the reach. Individual structures and bank stabilization measures may be implemented as field conditions dictate.

For Crossing Structures in this area, the County and CDOT have several key criteria: bridges on County roads require 3 feet of freeboard, and bridges on CDOT roads require 4 feet of freeboard. The capacity for culverts on local roads limits the maximum allowable headwater of 1.5 times the culvert diameter, and arterial roads limit the maximum allowable headwater to 1.2 times the culvert diameter. For culvert crossings that required additional capacity, it was assumed that existing structures would typically remain in place, and additional culverts of similar size would be added. For bridges that did not meet the respective design criteria, improvements were based on reconstructing the bridges to raise the bridge’s low chord elevation rather than lengthening the bridge to provide additional capacity until the required freeboard was met. Raising rather than lengthening will better fit the geometry of the existing drainageways and should be more cost effective as well.

The three bridges over the main stem of Kiowa Creek are proposed to be raised to meet the freeboard criteria for high-debris streams, which is 3 feet for Quincy Avenue and County Line Road which are County arterial roads (although this section of County Line Road is maintained by Elbert County) and 4 feet for I-70 which is a CDOT facility. Ten culverts are proposed to be upgraded where the roadways are overtopped or the County's headwater to diameter (HW/D) ratio criteria are not met. Existing culvert materials vary but primarily consist of corrugated metal pipes (CMP), reinforced concrete pipe (RCP), and concrete box culvert (CBC); however, the proposed improvements are limited to either RCP or CBC.

As part of the MDP, Pinyon Environmental completed an Environmental Assessment Report to address existing conditions regarding biological resources and protected species in the area immediately around Kiowa Creek and its main tributaries in Arapahoe County in order to inform the development of drainage alternatives to help minimize adverse environmental impacts. The following conditions were assessed:

- Wetland and riparian zones in the study area were mapped and represented graphically.
- Suitable habitat for federal and state threatened and endangered species was assessed.
- Wetlands were classified using the Colorado Functional Assessment of Colorado Wetlands methodology.

Alternatives

If so directed by the Board, ESD can bring more detail on basin impact fees for further consideration by the Board. As alternatives relative to the basin fees the Board would likewise have the alternative of adopting appropriate basin fees or not.

Fiscal Impact

All construction costs were estimated through the UDFCD Cost Estimator for Master Planning, UD-COST Version 2.1. This master planning cost estimation tool was populated for crossing structure improvements, channel stabilization, and detention ponds.

Crossing Structure-only capital costs are estimated to be \$4,235,734.00. A total construction cost of the master planned improvements is \$79,680,118 for the capital improvements or \$86,514,008 when considering the maintenance costs over 50 years. These costs are summarized in the following Appendix A.

Concurrence

The Engineering Services Division, Capital Improvement Program and Open Space, Parks and Trails will be affected by the recommendation of the BOCC. All Divisions support the adoption of the MDP.

Attorney Comments

None at this time.

Reviewed By:

Cathleen Valencia, Engineering Services Division
Chuck Haskins, Engineering Services Division Manager
Brian Love, CIP Program Manager
Robert Hill, County Attorney

Appendix A
Recommended Plan Cost Summary

Table 8-1 – Conceptual Design Cost Summary

Reach	Capital	Easement / Row	Engineering	Legal / Administrative	Contract Admin/CM	Contingency	Total Capital Cost	Annual O&M Cost	50-Year O&M Cost
Kiowa 1	\$11,927,135.00	\$60,000.00	\$1,789,070.00	\$596,357.00	\$1,192,714.00	\$2,981,784.00	\$18,547,060.00	\$8,192.00	\$175,982.00
Kiowa 2	\$2,311,356.00	\$50,000.00	\$346,703.00	\$115,568.00	\$231,136.00	\$577,839.00	\$3,632,602.00	\$63,771.00	\$1,369,940.00
Kiowa 3	\$3,778,815.00	\$50,000.00	\$566,822.00	\$188,941.00	\$377,882.00	\$944,704.00	\$5,907,164.00	\$12,350.00	\$265,305.00
Kiowa 4	\$2,400,046.00	\$50,000.00	\$360,007.00	\$120,002.00	\$240,005.00	\$600,012.00	\$3,770,072.00	\$5,960.00	\$128,034.00
Kiowa 5	\$3,156,499.00	\$124,000.00	\$473,475.00	\$157,825.00	\$315,650.00	\$789,125.00	\$5,016,574.00	\$16,052.00	\$344,832.00
REACH SUBTOTAL	\$23,573,851.00	\$334,000.00	\$3,536,077.00	\$1,178,693.00	\$2,357,387.00	\$5,893,464.00	\$36,873,472.00	\$106,325.00	\$2,284,093.00
Tributary A	\$566,869.00	\$30,000.00	\$85,030.00	\$28,343.00	\$56,687.00	\$141,717.00	\$908,646.00	\$3,576.00	\$76,820.00
Tributary A.1	\$648,370.00	\$72,000.00	\$97,256.00	\$32,419.00	\$64,837.00	\$162,093.00	\$1,076,975.00	\$13,902.00	\$298,645.00
Tributary A.1.a	\$340,746.00	\$30,000.00	\$51,112.00	\$17,037.00	\$34,075.00	\$85,187.00	\$558,157.00	\$3,576.00	\$76,820.00
Tributary A.1.a.1	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Tributary A.1.a.2	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Tributary A.1.b	\$1,962,439.00	\$120,000.00	\$294,366.00	\$98,122.00	\$196,244.00	\$490,610.00	\$3,161,781.00	\$14,304.00	\$307,281.00
Tributary A.1.b.1	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Tributary A.1.b.2	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Tributary A.2	\$1,444,327.00	\$90,000.00	\$216,649.00	\$72,216.00	\$144,433.00	\$361,082.00	\$2,328,707.00	\$9,536.00	\$204,854.00
REACH SUBTOTAL	\$4,962,751.00	\$342,000.00	\$744,413.00	\$248,137.00	\$496,276.00	\$1,240,689.00	\$8,034,266.00	\$44,894.00	\$964,420.00
Tributary B	\$804,837.00	\$30,000.00	\$120,726.00	\$40,242.00	\$80,484.00	\$201,209.00	\$1,277,498.00	\$3,576.00	\$76,820.00
Tributary B.1	\$4,090,520.00	\$968,000.00	\$613,578.00	\$204,526.00	\$409,052.00	\$1,022,630.00	\$7,308,306.00	\$32,958.00	\$708,010.00
Tributary B.2	\$3,883,857.00	\$200,000.00	\$582,579.00	\$194,193.00	\$388,386.00	\$970,964.00	\$6,219,979.00	\$25,104.00	\$539,289.00
Tributary B.2.a	\$615,716.00	\$0.00	\$92,357.00	\$30,786.00	\$61,572.00	\$153,929.00	\$954,360.00	\$6,030.00	\$129,538.00
Tributary B.2.b	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
REACH SUBTOTAL	\$9,394,930.00	\$1,198,000.00	\$1,409,240.00	\$469,747.00	\$939,494.00	\$2,348,732.00	\$15,760,143.00	\$67,668.00	\$1,453,657.00
Tributary C	\$2,287,432.00	\$144,000.00	\$343,115.00	\$114,372.00	\$228,743.00	\$571,858.00	\$3,689,520.00	\$16,528.00	\$355,058.00
Tributary C.1	\$480,261.00	\$40,000.00	\$72,039.00	\$24,013.00	\$48,026.00	\$120,065.00	\$784,404.00	\$4,768.00	\$102,427.00
Tributary C.1.a	\$1,227,098.00	\$110,000.00	\$184,065.00	\$61,355.00	\$122,710.00	\$306,775.00	\$2,012,003.00	\$13,112.00	\$281,674.00
Tributary C.1.b	\$1,678,467.00	\$150,000.00	\$251,770.00	\$83,923.00	\$167,847.00	\$419,617.00	\$2,751,624.00	\$17,880.00	\$384,101.00
Tributary C.2	\$2,448,467.00	\$150,000.00	\$367,270.00	\$122,423.00	\$244,847.00	\$612,117.00	\$3,945,124.00	\$18,600.00	\$399,569.00
REACH SUBTOTAL	\$8,121,725.00	\$594,000.00	\$1,218,259.00	\$406,086.00	\$812,173.00	\$2,030,432.00	\$13,182,675.00	\$70,888.00	\$1,522,829.00
Tributary D	\$1,615,570.00	\$90,000.00	\$242,336.00	\$80,779.00	\$161,557.00	\$403,893.00	\$2,594,135.00	\$12,848.00	\$276,003.00
Tributary D.1	\$889,883.00	\$70,000.00	\$133,482.00	\$44,494.00	\$88,988.00	\$222,471.00	\$1,449,318.00	\$8,344.00	\$179,247.00
Tributary D.2	\$1,113,618.00	\$60,000.00	\$167,043.00	\$55,681.00	\$111,362.00	\$278,405.00	\$1,786,109.00	\$7,152.00	\$153,641.00
REACH SUBTOTAL	\$3,619,071.00	\$220,000.00	\$542,861.00	\$180,954.00	\$361,907.00	\$904,769.00	\$5,829,562.00	\$28,344.00	\$608,891.00
Tributary E	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
REACH SUBTOTAL	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
GRAND TOTAL	\$49,672,328.00	\$2,688,000.00	\$7,450,850.00	\$2,483,617.00	\$4,967,237.00	\$12,418,086.00	\$79,680,118.00	\$318,119.00	\$6,833,890.00