

**CITY OF BOULDER
WATER RESOURCES ADVISORY BOARD
AGENDA ITEM**

MEETING DATE: APRIL 27, 2015

AGENDA TITLE: Public Hearing and consideration of a recommendation to City Council regarding the Gregory Canyon Creek Flood Mitigation Plan

PRESENTER/S:

Jeff Arthur, Director of Public Works for Utilities
Annie Noble, Acting Principal Engineer for Flood and Greenways
Katie Knapp, Engineering Project Manager
Kristin Dean, Utilities Planner

EXECUTIVE SUMMARY

The purpose of this memorandum is to present the Gregory Canyon Creek *Draft* Flood Mitigation Plan (**Attachment A**) for the WRAB's consideration, input and recommendation to Council.

The city has retained CH2MHill to evaluate potential alternatives to help alleviate future flooding along Gregory Canyon Creek. CH2MHill's Alternative Analysis Memorandum ("Analysis") is included as Appendix A of the *Draft* Flood Mitigation Plan (**Attachment A**). This Analysis contains a detailed description of the data and models used to determine the improvements which would help flood conveyance along Gregory Canyon Creek. The intent of the Analysis was to identify various types of improvements which could be constructed along the creek corridor, assess the costs and benefits associated with each improvement, and include an engineer's recommendation.

Staff reviewed the Analysis and developed a staff recommended plan based on the engineering recommendation, input from the public and observations from the 2013 flood event. The staff recommended plan is illustrated graphically in Section 6 of the *Draft* Flood Mitigation Plan (**Attachment A**) which also includes additional information about the Gregory Canyon Creek watershed, the planning process and the alternatives considered. Please note that not all sections of the document have been completed. Pending consideration and input from WRAB, conceptual drawings will be developed and the mitigation plan will be finalized and presented to City Council for acceptance.

STAFF RECOMMENDATION:

Staff requests Water Resources Advisory Board consideration of this matter and action in the form of the following motion:

Motion to recommend the Gregory Canyon Creek Flood Mitigation Plan be finalized based on the Staff Recommended Plan and presented to City Council for acceptance.

BOARD AND COMMISSION FEEDBACK

The Gregory Canyon Creek flood mitigation study was presented to WRAB as an information item on October 20, 2014. In general, the WRAB was supportive of the approach being taken and the alternatives under consideration. Much of the WRAB discussion focused on outreach and education and has been shared with the city's watershed sustainability and outreach group. The feedback from WRAB is summarized in the minutes from that meeting as **Attachment B**.

PUBLIC FEEDBACK

There have been many opportunities for public involvement and feedback throughout this mitigation study. Open Houses were held on October 13, 2013 (post flood-67 people attended), June 12, 2014 (17 people attended), October 20, 2014 (22 people attended) and March 30, 2015 (20-25 people attended). Eight people provided public comments at the October 20, 2015 WRAB meeting and their comments are also included in the attached minutes. Staff conducted neighborhood site walks with residents in the area on Feb. 9 and Feb. 10, 2015 (a total of approximately 25 residents participated). Staff has also met individually with several property owners and was available to meet with small focus groups. The project website provided opportunities for comments to be submitted electronically and so far, 13 comments have been submitted through this option.

Public notification post cards about the WRAB meetings, the preceding Open Houses, and the neighborhood site walks were sent to all property owners in the study area and a project web site has been developed to provide information:

(<https://bouldercolorado.gov/flood/gregory-canyon-creek-flood-mitigation-study>).

Additionally, posters notifying the neighborhood of the meetings and open house were posted at various visible locations along the creek corridor. Emails have been sent to all interested parties whom have signed up for email notifications and to all parents of children attending Flatirons Elementary School. The most recent school newsletter included a flyer about the March 30, 2015 open house.

BACKGROUND

A detailed description of the scope of the mitigation study and the preliminary alternatives were presented to WRAB at their Oct. 20, 2014 meeting. The memo and attachments can be accessed here:

<https://documents.bouldercolorado.gov/weblink8/0/doc/126654/Electronic.aspx>. This memo also included detailed background information and a discussion about the applicable master plan policies from the Boulder Valley Comprehensive Plan, the Comprehensive Flood and Stormwater Utility Master Plan, the Greenways Master Plan and the Urban Drainage and Flood Control District Drainage Criteria Manual.

Considering the limited opportunities for mitigating a 100-year storm along Gregory Canyon Creek, a mitigation study was not a part of the Utilities work program until the September 2013 flood occurred. Because of the flood, there was increased public support for infrastructure improvements in the area. Following the storm, the trash racks at the culverts on Willowbrook St. and on 7th St. across from Flatirons Elementary School were removed, redesigned and replaced with ones that meet current design standards. Also, the wire fencing on the downstream side of the culvert at 6th St. and Aurora Ave. was

removed because it trapped considerable debris. This mitigation study looks at other opportunities along the creek to improve flood conveyance, enhance the creek corridor and facilitate routine maintenance.

Since obtaining feedback from WRAB and the public, staff and the engineering consultants have worked towards refining the alternatives and also formulating the benefit cost analysis for each improvement. Site walks were conducted with additional maintenance and engineering staff including stormwater management, drainage maintenance, flood control and transportation maintenance to obtain their feedback about the potential alternatives.

The alternatives analysis includes an Engineer's Recommended Plan. Staff has thoroughly evaluated this recommended plan and has used it as the basis for the Staff Recommended Plan, which includes some additional enhancements, mitigation opportunities and maintenance considerations. Input from the public and WRAB has also been considered and incorporated into the Staff Recommended Plan.

ANALYSIS

The city has retained CH2MHill to evaluate potential alternatives to help mitigate future flooding along Gregory Canyon Creek. CH2MHill's Alternative Analysis Memorandum ("Analysis") is included in Appendix A of the *Draft* Flood Mitigation Plan (**Attachment A**). This Analysis contains a detailed description of the data and models used to determine the improvements which would help flood conveyance along Gregory Canyon Creek. The intent of the Analysis was to identify various types of improvements which could be constructed along the creek corridor, assess the costs and benefits associated with each improvement, and include an engineer's recommendation.

Currently, the Gregory Canyon Creek channel does not have adequate capacity to contain a 10-year event. Flood mitigation plans are typically developed with the intent to adequately convey a 100-year storm event. Due to the existing residential development, channel mitigation to convey a 100-year event would not be feasible unless many of the existing homes along the creek corridor were removed. Under the Analysis, it was determined that improvements along the creek could be constructed which would facilitate flows from a 10-year event.

Since the topographical and development constraints along Gregory Canyon Creek prevent modification which would convey flows that are greater than a 10-year event, it was recognized that the streets in the neighborhoods could be modified to better convey floodwaters in larger events. During the September 2013 event, floodwaters were observed in various roadways, with primary conveyance paths being 6th Street, 7th Street and 8th Street. Thus, street improvements have been considered which would direct and retain additional water within the streets.

Areas for detention and sediment traps were also evaluated, as well as opportunities for the acquisition of properties within the designated High Hazard Zone.

Channel and Culvert Improvements

These improvements include channel maintenance, brush and debris clearing, replacements and improvements to culvert crossings and creek channel modifications. The proposed culvert improvements are predominantly within city ROW, but most would

also require creek channel work on private property in order to accommodate the larger culvert sizes. Three private culverts were also included in this analysis. Each culvert was evaluated for existing conditions, the size required to convey a 10-year event, and the maximum size that could feasibly be constructed without impacting existing buildings.

Improvements Outside of the Channel

The Analysis includes street conveyance improvements proposed along 6th Street, 7th Street and 8th Street as well as on Willowbrook Rd. at the more southerly area of the stream reach (i.e. in close proximity to Flagstaff Road). Segments of these streets already convey 50-year flows. Thus, the improvements considered are to segments which do not adequately convey a 50-year flow under current conditions.

Detention

An evaluation of detention along Gregory Canyon Creek was performed to identify possible areas where detention facilities could help improve flows by attenuation or other means. The following areas were reviewed for potential detention:

- Immediately upstream of Flagstaff Rd.
- Smith Park
- Flatirons Elementary School

More detail about these proposed detention areas is included in the Analysis. Detention is not a recommendation due to the limited benefit.

Acquisition of High Hazard Properties

The city's property acquisition program, in conjunction with flood mitigation improvements has been very successful over the years and has resulted in 134 of 279 identified high hazard structures being removed from the high hazard floodplain. As a part of mitigation along Gregory Canyon Creek, the city should consider purchasing certain properties in the high hazard zone. Removing structures in the high hazard zone would allow for additional channel improvements in selected areas. Opportunity-based property acquisition is a key element of the floodplain management program given the city's interest in working with a willing seller.

In 2012, 810 Marine St., which is located along Gregory Canyon Creek, was purchased by the city and the structure was removed. Along this creek, there are 32 structures located in the high hazard zone. Through this flood mitigation planning effort, the city has identified several properties in the high hazard zone along Gregory Canyon Creek which should be prioritized for purchase. These properties are along the downstream section of Gregory Canyon Creek, in close proximity to each other and to the recently purchased 810 Marine St. property, and therefore could facilitate a more consolidated and comprehensive flood mitigation planning effort.

Other Improvements

Additionally, areas for sediment traps and habitat improvements were evaluated as well as opportunities to implement other improvements based on public input and observations from the 2013 Flood, such as a sanitary sewer main relocation and additional drainage inlets and possible grates.

BENEFIT COST ANALYSIS

The Analysis includes a detailed description of the methodologies used to determine the benefit cost ratio associated with the improvements. CH2M Hill, the consultants for this mitigation study, followed FEMA requirements for developing the benefit cost analysis (BCA). The following table summarizes the results of the BCA, which is explained in further detail in Appendix A of the *Draft Flood Mitigation Plan (Attachment A)*:

Benefit Cost Analysis Summary

Alternative	Benefit Cost Ratio
10-year culvert improvements	2.67
10-year culvert improvements with street conveyance improvements	1.52
Maximum size culvert improvements	1.78
Maximum size culvert improvements with street conveyance improvements	1.28

ENGINEER'S RECOMMENDED PLAN

The Engineer's Recommended Plan (ERP) to minimize the identified flooding issues along Gregory Canyon Creek is the 10-year alternative without roadway improvements. This recommendation is based on feedback from public meetings, project stakeholders, staff input and preliminary discussions with WRAB. The ERP focuses on alleviating flooding along Gregory Canyon Creek, without affecting adjacent structures and minimizing the amount of right-of-way used while providing the greatest level of service throughout the corridor in the most cost effective way possible. The recommended improvements will provide additional protection from more frequent flooding events, but will not eliminate the 100-year flood hazards. The Engineer's Recommended Plan does not include any street improvements, because they were not determined to be a cost effective option.

The ERP has a benefit-cost ratio of 2.67. This means that the city's investment in infrastructure to address flooding generates a favorable return by reducing the average annual flood damages by a factor of 2.67 over the investment cost. The improvements recommended under the ERP will have impacts on private property and in most areas, will require easements. Thus, moving forward with any of the culvert or channel improvements will necessitate obtaining easements from these property owners. Roadway improvements were not included in the ERP because they did not have as favorable of a benefit to cost ratio.

STAFF'S RECOMMENDED PLAN

Based on the Engineer's Recommended Plan, public input, input from WRAB, and a thorough analysis of the improvements proposed, Staff has developed a Staff Recommended Plan which is depicted in Section 6 of the *Draft Flood Mitigation Plan (Attachment A)*.

The Staff Recommended Plan includes the 10-year culvert improvements included in the ERP, but modifies some of the recommendations for channel improvements, eliminating

some of the improvements between Euclid and College and including continuous channel improvements between University and Arapahoe. The Staff Recommended plan also includes roadway improvements, recommending that they be incorporated with future roadway construction projects in order to be more cost effective. In addition, a pedestrian bridge is recommended at Pennsylvania Ave. instead of a box culvert and a vehicular bridge is recommended at the entrance to the Highland School property. The Staff Recommended Plan also includes sediment traps, habitat improvements, piping a section of the Anderson Ditch, a sanitary sewer relocation, new drainage inlets, possible grates installed over culverts, a prioritization for property acquisition and non-structural methods such as emergency warning systems, flood education and private property flood protection. The Staff Recommended Plan is summarized in the following table:

Recommendation	Cost
1. Culvert Replacement: Replace culverts where needed to convey the 10-year storm. Provide a pedestrian bridge at Pennsylvania Ave. and a vehicular bridge at the Highland School entrance.	\$4,692,167
2. Channel Improvements: Increase channel capacity in select locations to convey the 10-year storm and as needed to accommodate new culverts and bridges. Investigate modifications to the channel alignment in select locations to reduce the flood damage risk.	\$353,502
3. Road Improvements: Implement flood conveyance modifications in conjunction with other roadway construction.	\$2,082,217
4. Provide sediment traps at the following locations:	
a. Upstream of Culvert C1 (Willowbrook Rd.)	\$46,527
b. Upstream of Culvert C6 (7th St. across from Flatirons School)	\$80,677
c. Smith Park	\$63,766
5. Assess stream and riparian areas and identify habitat improvements	TBD
6. Pipe the Anderson Ditch to the east of 7th St.	\$23,450
7. Relocate the sanitary sewer manhole and pipes currently located within the “Gregory Gulch”.	\$164,597
8. Add new storm drainage inlets on Willowbrook Rd. to help capture floodwaters that overtop the culvert	\$147,550
9. Investigate installing grates above culverts	TBD
10. Property Acquisition: Continue acquiring high hazard zone properties, focusing on the properties identified as priority structures.	\$6,354,700
11. Non-Structural Methods: Continue to implement non-structural measures and encourage property owners to prepare for floods and protect their properties and themselves.	N/A
Total:	\$14,009,153

Note: Items marked TBD (To Be Determined) have variable scope or costs and therefore will need to be evaluated as the opportunities to incorporate the improvements are identified.

The *Draft* Flood Mitigation Plan (**Attachment A**) was prepared based on the Analysis and recommendations noted above. Section 5 of the *Draft* Flood Mitigation Plan includes a discussion about each culvert, including the existing size and conveyance

capacity, along with the size needed to convey the 10-year storm, the maximum sized culvert which could be installed, required channel grading associated with the culvert replacement options, estimated construction costs and a recommendation for replacement.

The Final Mitigation Plan will include conceptual design drawings and a prioritization for the proposed improvements.

NEXT STEPS

Following input from WRAB and a recommendation for the mitigation plan, conceptual drawings will be developed and the mitigation plan will be finalized. The Final Mitigation Plan will be presented to City Council for acceptance. Projects will then be selected and programmed into the CIP for implementation.

ATTACHMENTS

Attachment A: *Draft* Flood Mitigation Plan

Attachment B: WRAB Meeting Minutes 10/20/2014