

Fourmile Canyon Creek Greenways Improvement Project Upland Avenue to West of Broadway



Community and Environmental Assessment Process Report

DRAFT April 2016

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COMMUNITY & ENVIRONMENTAL ASSESSMENT PROCESS OVERVIEW

A Community and Environmental Assessment Process (CEAP) is a formal review process to assess potential impacts of conceptual project alternatives in order to inform the selection and refinement of a preferred alternative. It provides an opportunity to balance multiple community goals by assessing a project against the policies outlined in the Boulder Valley Comprehensive Plan and department master plans.

EXECUTIVE SUMMARY OF PROJECT

In 2009, a Major Drainageway Plan was approved by City Council for Fourmile Canyon Creek and Wonderland Creek. The recommendations of the 2009 plan were finalized in the Fourmile Canyon Creek and Wonderland Creek Major Drainageway Planning (Final Plan) in May 2011 (MDP). The MDP proposed specific levels of flood mitigation for each reach along Fourmile Canyon Creek between Violet Avenue and Upland Avenue. In 2013, a formal CEAP process was underway for the mitigation measures outlined in the 2011 MDP as well as mitigation measures further upstream, from Violet to Broadway. Then, the September 2013 flood occurred, effectively halting further development of the CEAP analysis.

The September 2013 flood event produced high quantities of sediment, spill flows outside of the channel, and impassable roadways in the Fourmile Canyon Creek drainageway and created incentive for staff to revisit the mitigation measures outlined in the 2011 MDP. It also gave an incentive to revisit mitigation measures west of Broadway to see if new alternatives were feasible. Staff reviewed the 2011 MDP alternatives and investigated further options for spill flow control, sediment capture, and large scale detention ponds.

The existing Fourmile Canyon Creek floodplain between Violet and Upland Avenue extends beyond the creek channel, resulting in:

- One fire station in the 500year floodplain,
- One Preschool (New Horizons Cooperative) in the 500year floodplain,
- One Waldorf School (Shining Mountain) and one Elementary School (Crest View Elementary) in the 100year floodplain,
- One residential structure in the high hazard zone, and
- Water depths along Violet Avenue and Upland Avenue that preclude safe vehicular access to and from Crest View Elementary during a major storm event.

Staff reviewed the following flood mitigation alternatives:

- FM1: Multiple Detention Facilities
- FM2: Single Detention Facility
- FM3: Fourmile Canyon Creek 100-year Channel Improvements
- FM4: Spill Flow Diversion to Wonderland Creek
- FM5: Fourmile Canyon Creek 50-year Channel Improvements
- FM6: Fourmile Canyon Creek Sediment Capture Facility
- FM7: 2011 MDP recommendations

Please see Figure 1 for an overview of these alternatives.

In 2012, a CEAP was developed for Fourmile Canyon Creek from 19th to 22nd Street that proposed alternatives for flood improvements, emergency access improvements, as well as pedestrian and bicycle access. The selected alternative includes an underpass at 19th Street that will allow the passage of the 100year flood, as well as a grade-separated multi-use path extension and emergency access to Tamarack Avenue. Construction of these improvements is anticipated to begin in 2016-2017. This CEAP will also evaluate alternatives for extending the multi-use path that was approved in the 2012 CEAP.

For this CEAP analysis, staff reviewed the following multi-use path alignment alternatives:

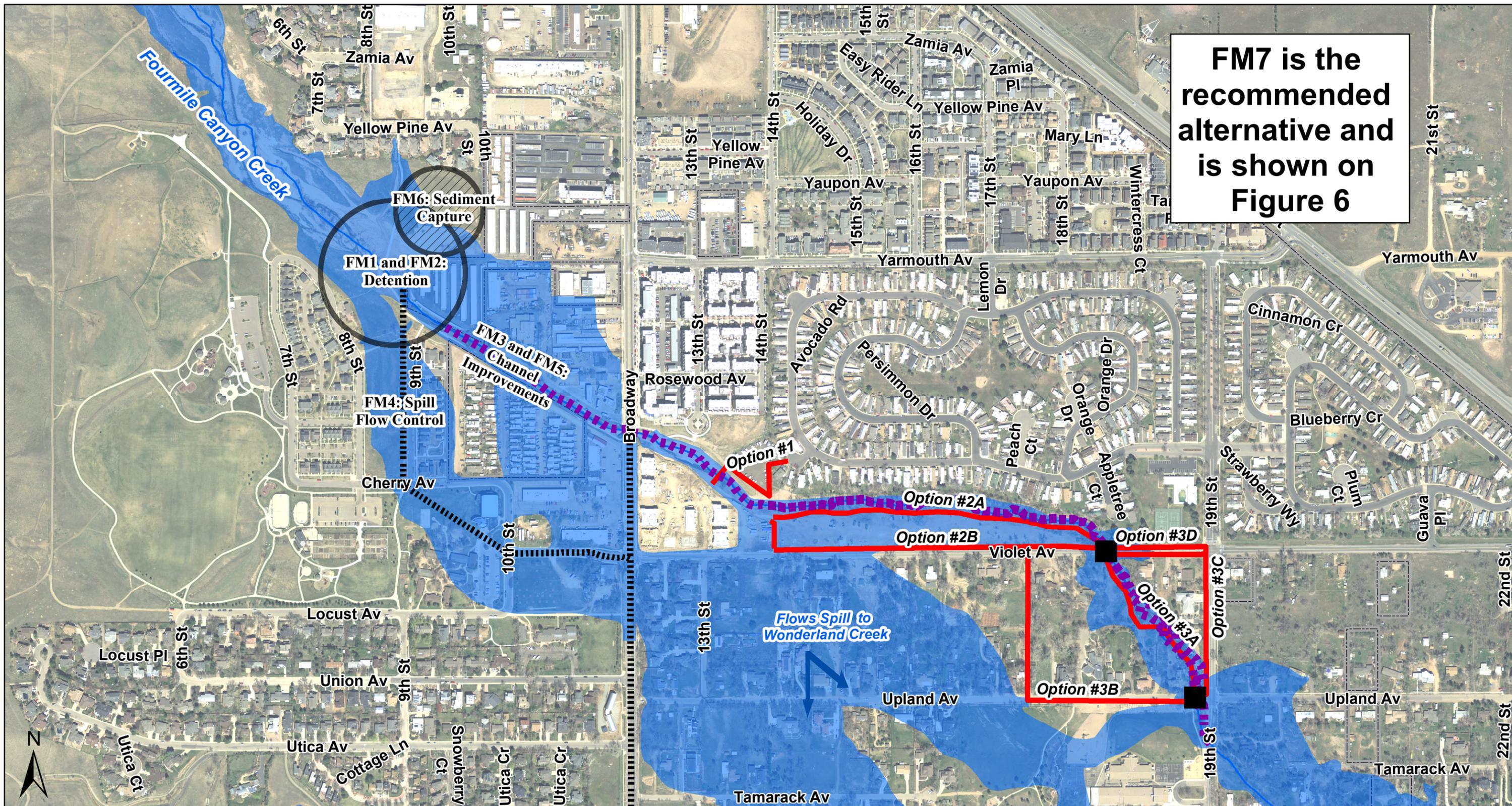
- Option 1: Connection to Countryside Village (mobile home park)
- Option 2A: North Alignment through Violet Park
- Option 2B: South Alignment through Violet Park
- Option 3A: Connect Upland to Violet via Fourmile Canyon Creek
- Option 3B: Connect Upland to Violet via 17th Alignment
- Option 3C: Connect Upland to Violet via South Alignment on Violet Avenue
- Option 3D: Connect Upland to Violet via North Alignment on Violet Avenue

Please see Figure 1 for an overview of these alternatives.

STAFF RECOMMENDATION

Based on analysis that will be presented in this CEAP, the primary recommendation from City of Boulder staff is to pursue the recommendations outlined in the 2011 Major Drainageway Plan. These include replacing existing culverts under Violet and Upland Avenue, modifying the channel between these culverts to eliminate high hazard zone risk, and allowing for safer vehicular access to Crest View Elementary School. Sediment capture is recommended within Violet Park and staff recommends multi-use path alignment options 1, 2A, and 3A.

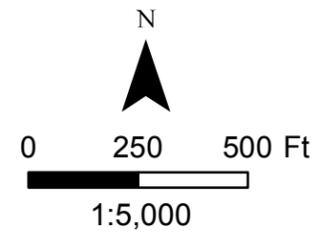
This approach allows for uninterrupted access to both the fire station and Crest View Elementary and the potential for the Fourmile Canyon Creek multi-use path to be integrated into the flood improvements including underpasses at Violet Avenue, Upland Avenue, and 19th Street. Improvements have been budgeted in the Greenways and Flood Utility Capital Improvement Programs (CIP).



FM7 is the recommended alternative and is shown on Figure 6

Legend

-  Effective 100 Year Floodplain
-  Creek
-  Channel Improvements
-  Multi-Use Path Alignment
-  Spill Flow Control Alignment
-  Detention Area
-  Sediment Capture
-  Underpass Location



**Fourmile Canyon Creek
Community & Environmental
Assessment Process
Figure 1
All Alternatives**

1.0 DESCRIPTION AND LOCATION OF THE PROJECT

The project is located in northwest Boulder and extends along Fourmile Canyon Creek from Upland Avenue through Violet Park to west of Broadway Avenue (Figure 2).

This project includes the following proposed improvements:

- Extension of a multi-use path from 19th Street west to the recently constructed segment located in the Violet Crossing development (northeast corner of Broadway and Violet Avenue)
- Pedestrian and bicycle underpasses at Violet Avenue and Upland Avenue sized to convey the 100year flood flows
- Channel improvements between Violet Avenue and Upland Avenue to eliminate high hazard zone impacts to existing structures and convey floodwaters through the two new underpasses

Figure 2: Project Location



2.0 BACKGROUND, PURPOSE & NEED FOR THE PROJECT

Fourmile Canyon Creek originates in the foothills west of the City of Boulder and has a total drainage area of approximately 10 square miles. Wonderland Creek has a total drainage area of approximately 2 square miles and begins at Wonderland Lake located on the western side of the city approximately 1,300 feet west of Broadway. Both creeks flow east and south through the City of Boulder and eventually flow into Boulder Creek. A vicinity map of Fourmile Canyon Creek CEAP Mitigation Planning area is provided in Figure 2 above. Both creeks have been extensively studied by major drainageway planning, flood hazard area delineation, letter of map revision, and other special report studies.

In 2007, a Letter of Map Revision (LOMR) (Case No. 06-08-B289P) identified significant spill flows (during the 50-year flood and larger flood events) from Fourmile Canyon Creek that leave the south bank of the channel between 10th Street (west of Broadway) and 19th Street. These spill flows travel overland to the south and east and the majority of the spill flows enter Wonderland Creek, resulting in a significant increase in Wonderland Creek's regulatory floodplain discharge. This change in the regulatory floodplain motivated the City of Boulder and the Urban Drainage and Flood Control District (UDFCD) to produce the 2007 (phase A) and 2011 (phase B / Final Plan) Major Drainageway Planning (MDP) reports.

The 2011 MDP recommendations for Fourmile Canyon Creek upstream of 19th Street were to:

- Provide safer access to Crest View Elementary School via 19th Street and Upland Avenue,
- Create high hazard containment upstream of Broadway and between Violet Avenue and Upland Avenue,
- Provide stream maintenance between Broadway and Violet Avenue, and
- Coordinate floodproofing of private property.

The 2011 MDP originally called for 100year floodplain containment from Violet Avenue to 26th Street, but due to lack of public support this recommendation was changed to high hazard containment and floodproofing only. Please see Figure 3 for a complete overview of the 2011 MDP recommendations.

The September 2013 flooding event caused significant flooding damage to homes, public infrastructure, and utilities resulting in significant sediment transportation throughout the Fourmile Canyon Creek length. The peak discharge of the flooding event was estimated at approximately 1800cfs at the canyon mouth, which is between the 10-year and 50-year events. As a result of the 2013 flood event, staff re-examined the conclusions in the 2011 MDP. Our first step was to create and calibrate a FLO-2D model in an effort to model the spill flow behavior between Fourmile Canyon Creek and Wonderland Creek for both this event and larger regulatory flood events. The 2D model confirmed the likelihood of spill flows leaving Fourmile Canyon Creek west of Broadway and entering Wonderland Creek during large flooding events as identified in the 2007 LOMR. Figure 3, located in Appendix A, illustrates ICON's FLO-2D model output.

In early 2015, the City of Boulder reviewed alternatives and plans for greenway trail extensions and connections along Fourmile Canyon Creek. The review helped to determine that potential improvements for the multi-use paths along greenways could reasonably combine with floodplain mitigation efforts to make a singular, more beneficial project. This project would serve a two-fold

purpose. First, it would complete a missing link in the multi-use path system between 19th Street and Broadway as shown in the Greenways Master Plan, Transportation Master Plan and the North Boulder Sub-Community Plan. Second, it would likely decrease risk for structures currently within the 100-year floodplain for Fourmile Canyon Creek. This effort would also allow access to Crest View Elementary School during major flood events and would reduce costs for both transportation and flood mitigation alternatives compared to completing these alternatives separately. This CEAP analyzes and reviews flood mitigation alternatives to address spill flows, sediment containment and high hazard zone containment in conjunction with feasible multi-use path alternatives.

In 2012, a CEAP was completed for a multi-use path underpass at 19th Street and multi-use path and secondary emergency access extension of 19th Street to Tamarack Avenue. The design for the 2012 CEAP is currently underway and construction funds are provided in the Flood Utilities and Greenways CIP. Completing this CEAP would provide an opportunity to create cost savings by combining construction of both projects at one time.

3.0 DESCRIPTION OF PROJECT ALTERNATIVES & SUMMARY OF MAJOR ISSUES

Project alternatives fall into two main categories: 1) Flood mitigation (including detention, channel improvements, spill flow diversion, and sediment capture) and 2) Multi-use path alignments between 19th Street and the western end of Violet Park.

FLOOD MITIGATION ALTERNATIVES

ICON Engineering analyzed seven flood mitigation alternatives for their feasibility and costs. Below is a summary of each flood mitigation alternative including any major issues and costs for each alternative. A summary of project capital costs, operation costs, and land acquisitions are available at the end of this section in Tables 1 and 2.

Flood Mitigation Alternative 1 (FM1) - Multiple Flood Detention Facilities

Several City of Boulder owned properties were identified for potential detention facilities along Fourmile Canyon Creek. These include Violet Park, as well as between 4th and 10th Streets, located in areas predominately managed by the City's Open Space and Mountain Parks (OSMP) Department. A small area further south of the Fourmile Canyon Creek channel is within the Foothills Community Park and is managed by the City's Parks and Recreation Department. A small undeveloped area on the south bank is owned by Foothills Community LLC.

Flood Mitigation Alternative 1 includes three detention facilities located within these undeveloped properties at Violet Park and two west of 10th Street. In order to develop enough detention volume, the two embankments west of 10th Street would need to be 13-foot high, while the Violet Park embankment would be 10-foot high. The general footprint locations of the proposed detention facilities are illustrated in ICON's Figure 5 located in Appendix A.

Even though the detention areas would result in a reduced 100year discharge within Fourmile Canyon Creek, effectively eliminating spill flows between 10th and 19th Street, this alternative is not recommended due to the high cost relative to the benefits and the negative environmental

impacts. The resulting detention would extensively use City of Boulder OSMP land, require high costs for private land acquisition, create negative visual impacts due to embankments, and create negative impacts to existing habitat and riparian areas. This detention option would also offer little protection in a longer duration storm event, such as the September 2013 flood, and would be overtopped. The 2011 MDP report also investigated detention options along Fourmile Canyon Creek upstream of Broadway. However, detention alternatives were rejected at that time due to the “enormity of the project, extensive construction cost and the negative impacts it would have on park or open space lands”. The total cost of FM1 is \$27.1M

Flood Mitigation Alternative 2 (FM2) – Single Flood Detention Facility

Flood Mitigation Alternative 2 combines the three detention facilities from Alternative 1 into a single detention facility located west of Broadway on OSMP land, including the Ace Self Storage property and additional Foothills Community LLC property, which allowed adequate space for the proposed footprint of the detention facility. However, in order to accommodate such a large detention requirement, the embankment height would need to be increased to 25 feet, and channel improvements are required between 10th Street and Broadway to contain the outlet discharge during the 100-year event. The general footprint location of the proposed detention facility and channel improvements are illustrated in ICON’s Figure 6 in Appendix A.

Even though the detention areas would result in a reduced 100-year discharge within Fourmile Canyon Creek, effectively eliminating spill flows out of Fourmile Canyon Creek, this alternative is not recommended due to the high cost relative to the benefits and the negative environmental impacts. The resulting detention would require significant use of OSMP property as well as private property acquisitions, and creates potentially negative impacts to existing habitat, recreation, and riparian areas. This detention option would also offer little protection in a longer duration storm event, such as the September 2013 flood, and would be overtopped. The 2011 MDP report also investigated detention options along Fourmile Canyon Creek upstream of Broadway. However, detention alternatives were rejected at that time due to the “enormity of the project, extensive construction cost and the negative impacts it would have on park or open space lands”. The total cost of FM2 is \$27.1M.

Flood Mitigation Alternative 3 (FM3) – Fourmile Canyon Creek Channel Improvements

Flood Mitigation Alternative 3 includes 100year channel improvements to Fourmile Canyon Creek between 10th Street and 19th Street. The channel improvements eliminate spill flow out of Fourmile Canyon Creek, but do not include detention. Consequently, in order to avoid downstream impacts along Fourmile Canyon Creek, the historic spill flow discharge must be transferred to Wonderland Creek at the downstream limits of the channel improvements. This transfer is accomplished with a storm sewer system within the 19th Street right-of-way. The general location of the proposed channel and storm sewer improvements are illustrated in ICON’s Figure 7 in Appendix A.

Even though the channel improvements would effectively eliminate spill flows entirely between 10th and 19th Street and remove the 100year floodplain from this area, this alternative is not recommended due to the high cost relative to the benefits and the negative environmental impacts.

The proposed storm sewer system would not be operational until a 25year or greater storm event. Additionally, this alternative could create negative impacts to existing habitat and riparian areas. The total cost of FM3 is \$26.8M.

Flood Mitigation Alternative 4 (FM4) – Spill Flow Diversion to Wonderland Creek

Flood Mitigation Alternative 4 includes channel improvements that capture spill flows from Fourmile Canyon Creek and route them to Wonderland Creek. This alternative increases discharges along Wonderland Creek upstream of 19th Street, resulting in adverse impacts to the floodplain. These adverse impacts are limited to 10 structures that are included in the project cost as property acquisitions. The general location of the proposed channel improvements are illustrated in ICON's Figure 8 located in Appendix A.

Even though the channel improvements would effectively eliminate spill flows entirely between Broadway and 19th Street and would remove the 100year floodplain from this area, this alternative is not recommended due to the high cost relative to the benefits and the negative downstream flood impacts. The total cost of FM4 is \$19.6M.

Flood Mitigation Alternative 5 (FM5) – Fourmile Canyon Creek 50-Year Channel Improvements

Flood Mitigation Alternative 5 includes 50year channel improvements to Fourmile Canyon Creek between 10th Street and 19th Street. The channel improvements eliminate spill flow out of Fourmile Canyon Creek up to and including the 50year event. As with the 100year channel improvement (FM3), the historic spill flow discharge must be transferred to Wonderland Creek at the downstream limits of the channel improvements to prevent negative downstream impacts along Fourmile Canyon Creek. This transfer is accomplished with a storm sewer system within the 19th Street right-of-way. The general location of the proposed channel and storm sewer improvements are illustrated in ICON's Figure 9 located in Appendix A.

This alternative is not recommended due to the high cost relative to the benefits and this alternative does not fully reduce the 100year floodplain and could create adverse impacts for greater than a 50year storm event. The total cost of FM5 is \$14.7M.

Flood Mitigation Alternative 6 (FM6) – Fourmile Canyon Creek Sediment Capture Facility

Flood Mitigation Alternative 6 includes a sediment capture facility located west of Broadway Avenue. In 2012, the UDFCD performed an Evaluation of Fourmile Canyon Creek Sediment Basin Alternatives and identified an area upstream of Broadway and on OSMP property. A sediment basin in this location would reduce the amount of sediment available for transport downstream of 7th Street. This alternative is not recommended because the sediment capture facility west of Broadway negatively impacts habitat. Excerpts from UDFCD's Evaluation can be found in Appendix C. The general location of the proposed sediment capture facility is illustrated in ICON's Figure 10 located in Appendix A.

However, sediment capture in this area would be beneficial to the drainageway and could be designed and constructed in cooperation with a potential future OSMP restoration project in this area. Instead of basin form, as this alternative suggests, the sediment capture could be incorporated into floodplain grading that uses the principles of natural channel design and would provide a more natural, meandering channel able to better withstand high flows and transport sediment.

During this CEAP analysis, Violet Park was identified as an alternative location for the sediment capture facility. This location eliminates the need to use City of Boulder OSMP property; however, it does not address sediment issues upstream of Violet Avenue. Although not included in the costs or evaluation of FM6, a sediment capture at Violet Park was identified in the 2011 MDP and is incorporated into the recommended alternative (FM7).

The total cost of FM6 is \$435,360 (sediment capture west of Broadway only).

Flood Mitigation Alternative 7 (FM7) – 2011 MDP Recommendations

Flood Mitigation Alternative 7 incorporates the 2011 MDP recommendations and includes:

- Replacing existing culverts under Violet and Upland Avenue
- Modifying the channel between these culverts to eliminate high hazard zone risk, and allowing for safer vehicular access to Crest View Elementary School
- Providing sediment capture within Violet Park

The general locations of these recommendations are illustrated in ICON's Figure 11 located in Appendix A.

It should be noted that the underpass at 19th Street has already been approved and is currently in design. The underpass at this location will serve as a bicycle and pedestrian underpass; however, flood mitigation benefits will be limited unless the upstream improvements (including the underpasses at Violet and Upland Avenue) are completed.

FM7 is the preferred and recommended alternative because it provides other important benefits such as:

- Safer access to critical facilities,
- Improved life safety by containing high hazard areas,
- Improved flood emergency response capability,
- Reduced 100year floodplain,
- The ability to leverage funding for other Greenways Program objectives (including providing grade separated crossings and multi-use path connections), and
- Fiscal savings that result from combining the channel and culvert improvements with the preferred multi-use path alternatives.

The total cost of FM7 is \$6.5M.

Cost of FM7	\$6,300,000
Sediment Capture at Violet Park	\$80,000
Preferred Multi-Use Path Alternatives	\$170,500
TOTAL Alternative Cost	\$6,550,500

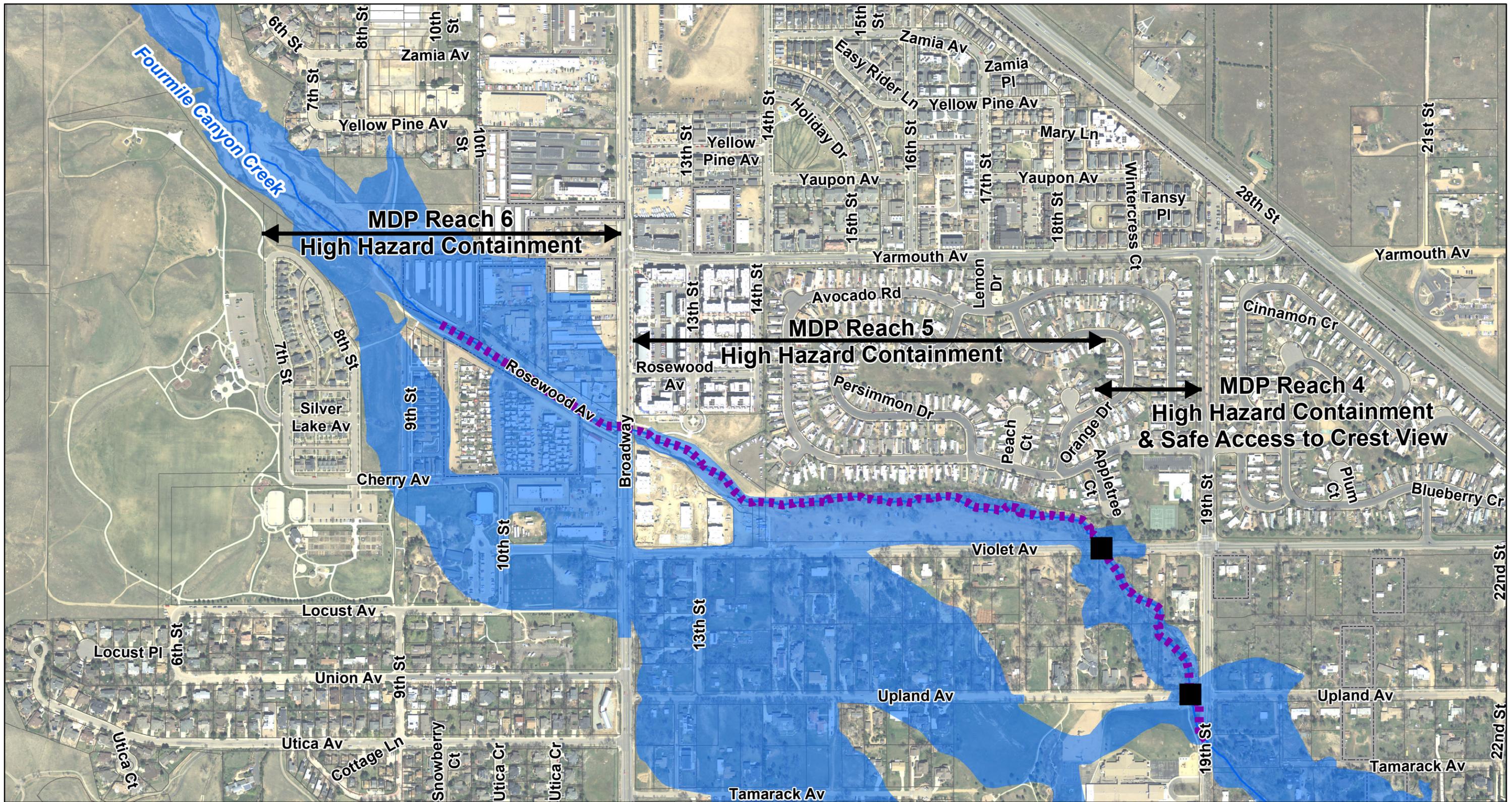
MULTI-USE PATH ALTERNATIVES

Multi-use Path alignment alternatives include:

- Option 1: Connection to Countryside Village Mobile Home Park
- Option 2A: North Alignment through Violet Park
- Option 2B: South Alignment through Violet Park
- Option 3A: Connect Upland to Violet via Fourmile Canyon Creek
- Option 3B: Connect Upland to Violet via 17th Alignment
- Option 3C: Connect Upland to Violet via South Alignment on Violet Avenue
- Option 3D: Connect Upland to Violet via North Alignment on Violet Avenue

Options 3A and 3B may require the purchase of easements. Figure 1 presents the multi-use path alignment options in association with the flood mitigation measures.

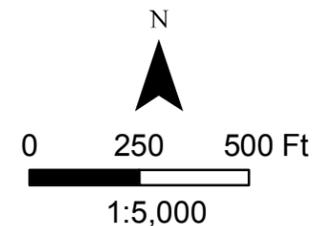
Although not the overwhelmingly preferred alternative, Option 3B had significant interest from the public and is included in the North Boulder Sub-Community Plan. The northern half of this alignment is currently under construction as part of local development.



Legend

-  Effective 100 Year Floodplain
-  Creek

-  MDP Recommended Channel Improvements
-  MDP Recommended Underpass Location



**Fourmile Canyon Creek
Community & Environmental
Assessment Process
Figure 3
2011 MDP Recommendations**

Table 1: Summary of Major Issues for Flood Mitigation Alternatives

	<u>Reduces 100yr Spill Flows</u>	<u>Reduces Regulatory 100yr Floodplain</u>	<u>Visual Impacts</u>	<u>Captures Sediment</u>	<u>Wetland/ Riparian & Habitat Impacts</u>	<u>Collaborate with other Greenways Objectives</u>	<u>Impacts on Adjacent Property</u>	<u>Provides Safer Access to Critical Facilities</u>
FM1: Multiple Detention Facilities	✓	✓		✓				✓
FM2: Single Detention Facility	✓	✓		✓				✓
FM3: Channel Improvements	✓	✓				✓		✓
FM4: Spill Flow Diversion	✓	✓						✓
FM 5: 50year Channel Improvements						✓		✓
FM6: Sediment Capture Facility west of Broadway				✓				
FM7: 2011 MDP Recommendations			✓	✓		✓	✓	✓

Best	✓
Medium	
Worst	

Greenways Objectives		to protect and restore riparian, floodplain, & wetland habitat
		to enhance water quality
		to facilitate storm drainage & mitigate floods
		to provide alternative transportation routes or trails for pedestrians & bicyclists
		to provide recreation opportunities
		to protect cultural resources

ICON Engineering provided a Cost analysis for each flood alternative. Results are summarized in the following table.

Table 2: Flood Mitigation Alternatives Project Costs

Flood Alternative	Project Cost	Necessary Property Acquisition	O&M Cost (50 years)
FM1: Multiple Detention Facilities	\$24.3 M	OSMP Land	\$1.6 M
FM2: Single Detention Facility	\$27.1 M	OSMP and Private Land	\$898,729
FM3: Channel Improvements	\$26.8 M	Easements	\$1.1 M
FM4: Spill Flow Diversion	\$19.6 M	Easements	\$1.1 M
FM5: 50year Channel Improvements	\$14.7 M	Easements	\$1.1 M
FM6: Sediment Capture Facility	\$435,360*	OSMP Land	\$434,262
FM7: 2011 MDP Recommendations	\$6.5 M	Easements	\$740,942

* 2012 study done by others

Figure 4: Flood Mitigation Alternatives Project Costs

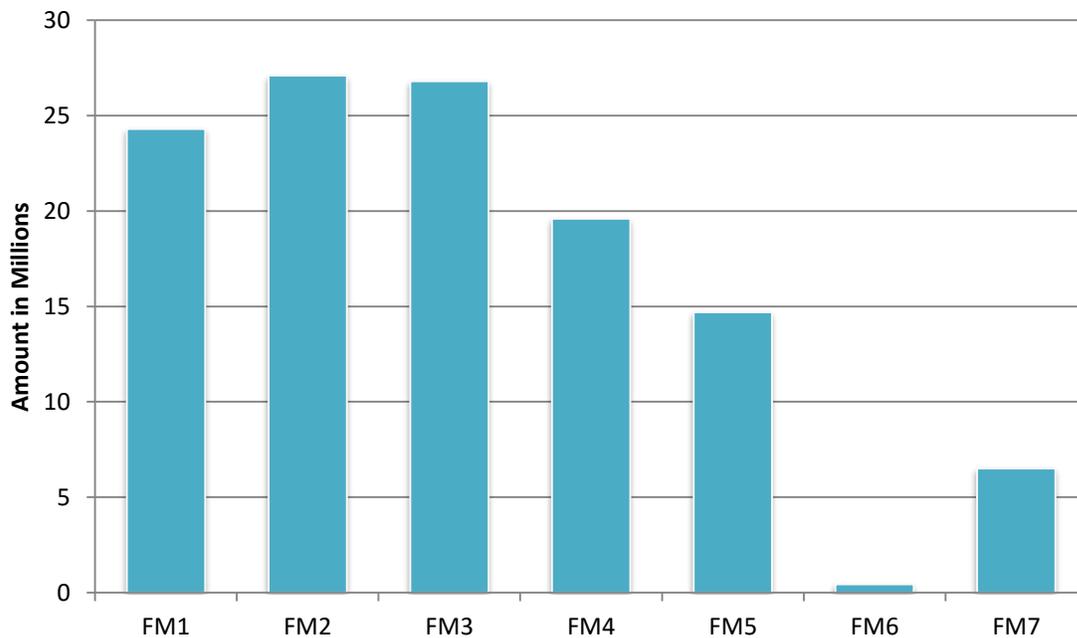


Table 3: Summary of Major Issues for Multi-Use Path Alternatives

	<u>Wetland Impacts</u>	<u>Habitat Impacts</u>	<u>Most Direct Route</u>	<u>Vehicle and Pedestrian Separation</u>	<u>User Experience</u>	<u>Combine with Flood Work</u>	<u>In Current Master Plan</u>
Option 1: Connection to Countryside Village	✓	✓	✓	✓	✓		
Option 2A: North Alignment through Violet Park			✓	✓	✓	✓	
Option 2B: South Alignment through Violet Park	✓	✓					✓
Option 3A: Connect Upland to Violet via Fourmile Canyon Creek			✓	✓	✓	✓	✓
Option 3B: Connect Upland to Violet via 17 th Alignment	✓			✓			✓
Option 3C: Connect Upland to Violet via South Alignment on Violet Ave	✓	✓					
Option 3D: Connect Upland to Violet via North Alignment on Violet Ave	✓	✓					

Best	✓
Medium	
Worst	

Table 4: Multi-Use Path Alternatives Cost Summary

<u>Transportation Alternative</u>	<u>Project Cost</u>	<u>Necessary Property Acquisition</u>
Option 1: Connection to Countryside Village	\$27,000	None
Option 2A: North Alignment through Violet Park	\$91,500	None
Option 2B: South Alignment through Violet Park	\$73,000	None
Option 3A: Connect Upland to Violet via Fourmile Canyon Creek	\$52,000	Easements
Option 3B: Connect Upland to Violet via 17 th Alignment	\$89,000	Easements
Option 3C: Connect Upland to Violet via South Alignment on Violet Ave	\$55,000	None
Option 3D: Connect Upland to Violet via North Alignment on Violet Ave	\$55,000	None

PERMITS, WETLANDS PROTECTION & HABITAT ENHANCEMENT

This CEAP is located entirely within the City of Boulder and within the 100-year floodplain. The proposed multi-use path alignments were developed to minimize impacts to the City’s wetlands and the majority of the selected alternative multi-use path alignment is located outside of the wetland buffer zone. Construction of this CEAP project may require the following permits:

- City of Boulder Floodplain Development Permit
- City of Boulder Construction Dewatering Discharge Agreement
- City of Boulder Standard Wetland Permit
- Colorado Department of Public Health and Environment (CDPHE) Colorado Stormwater Discharge Permit (Construction Activity General Permit and Stormwater Management Plan)
- CDPHE Colorado Construction Dewatering Permit
- United States Army Corps of Engineers 404 Wetlands Permit

The project will not require a County Areas and Activities of State Interest 1041 Review Application.

In October of 1999, a Greenways Riparian Habitat Assessment was completed for Boulder Creek and each of its tributaries on a reach by reach basis. The Greenways Riparian Habitat Assessment evaluated the native species present, the structural diversity of the vegetation and the diversity of birds as an indicator of the quality of habitat. This CEAP project encompasses three of the riparian habitat reaches along Fourmile Canyon Creek (FCC):

- 1) FCC4 starts upstream of Broadway and extends through a portion of Violet Park.
- 2) FCC5 continues east through Violet Park and then south past Violet Avenue, and
- 3) FCC7 completes the eastern portion of the project.

The results for these reaches are as follows:

Table 5: Environmental Assessment Results

Habitat Reach	Score	Rank	Description
Native Plant Habitat Evaluation Score			
FCC4	11	46/136	Good
FCC5	9	68/136	Poor
FCC7	12	37/136	Good
Vegetative Structure Evaluation Score			
FCC4	12	12/135	Very Good
FCC5	11.5	33/135	Very Good
FCC7	11.5	33/135	Very Good
Bird Diversity Score			
FCC4	106	-	Good
FCC5	79	-	Poor
FCC7	71	-	poor

Source: Greenways Riparian Habitat Assessment October 23, 1999

ERO Resources Corp. conducted a field survey in August 2013 of the area along Fourmile Canyon Creek between 19th Street and the upstream end of Violet Park. Riparian corridors are particularly important in urban areas where they are often used as movement corridors for larger mammals such as deer and for nesting by songbirds and raptors. Species that use riparian corridors in developed areas are typically common species tolerant of human encroachment. As a result, although diverse, most plant and wildlife species in urban riparian areas are not unique or uncommon. The ERO memorandum summarizing their findings is presented as Attachment B.

The Greenways Riparian Habitat Assessment did not identify any of these reaches as potential habitat for Ute Ladies' Tresses Orchid or the Preble's meadow jumping mouse. ERO found that the project area is suitable nesting substrate for raptors, however, no raptor nests were observed in the project area. In the event an active nest is present, the city would need to comply with the Migratory Bird Treaty Act. ERO also concluded that there is no suitable habitat for federally listed threatened and endangered species within their study area.

Although the proposed project would not affect any unique or significant natural resources, there would be impacts on regulated resources including Fourmile Canyon Creek and its riparian areas. Multi-use path construction in a riparian area does have an incremental effect on habitat, but the majority of this project will be outside the riparian area and pose minimal negative impact on wetland habitat. Flood mitigation improvements will include replacing non-native vegetation with native species and an enhancement of the creek channel which could result in a new positive habitat, riparian and wetland impact. However, these impacts would be addressed through the Clean Water Act Section 404 and City of Boulder Wetland permitting processes.

4.0 PUBLIC INPUT TO DATE

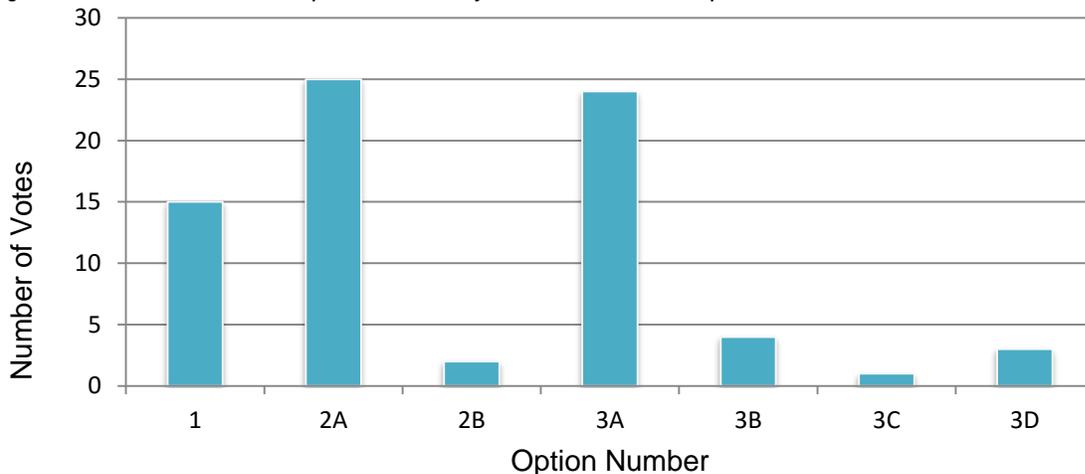
A public open-house meeting was held on September 26th, 2013, at Wild Sage Village on Zamia Avenue in North Boulder. Project and meeting notification was sent to approximately 1,715 residents, businesses and property owners in the area generally bounded by city limits to the west,

US36 to the north, 26th Street to the west, and Quince/Poplar Avenue to the south. The meeting was advertised on the project webpage and city calendar. Originally, the project meeting was scheduled before the September 2013 flood event to evaluate flood mitigation, path connection and park development alternatives. After the flood event, however, the meeting purpose was changed to provide an opportunity for residents to speak with city staff about the September flood and to obtain information and assistance with flood recovery.

A public open-house meeting was held on November 18th, 2015, at Crest View Elementary on 19th Street and Upland Avenue. This open-house was hosted by a variety of city departments to showcase projects in north Boulder, in conjunction with a listening session on Boulder Valley Comprehensive Plan update. Project and meeting notification was sent to residents, businesses and property owners in the area generally bounded by city limits to the west, US36 to the north, 26th Street to the west, and Linden Avenue to the south. The meeting was advertised on the project webpage and city calendar. Approximately 124 people attended to learn more about flood improvement alternatives and to provide input on the multi-use path alignment options.

The following provides a summary of the comments received on multi-use path alignment alternatives:

Figure 5: Public Comment Response Summary for Multi-Use Path Options



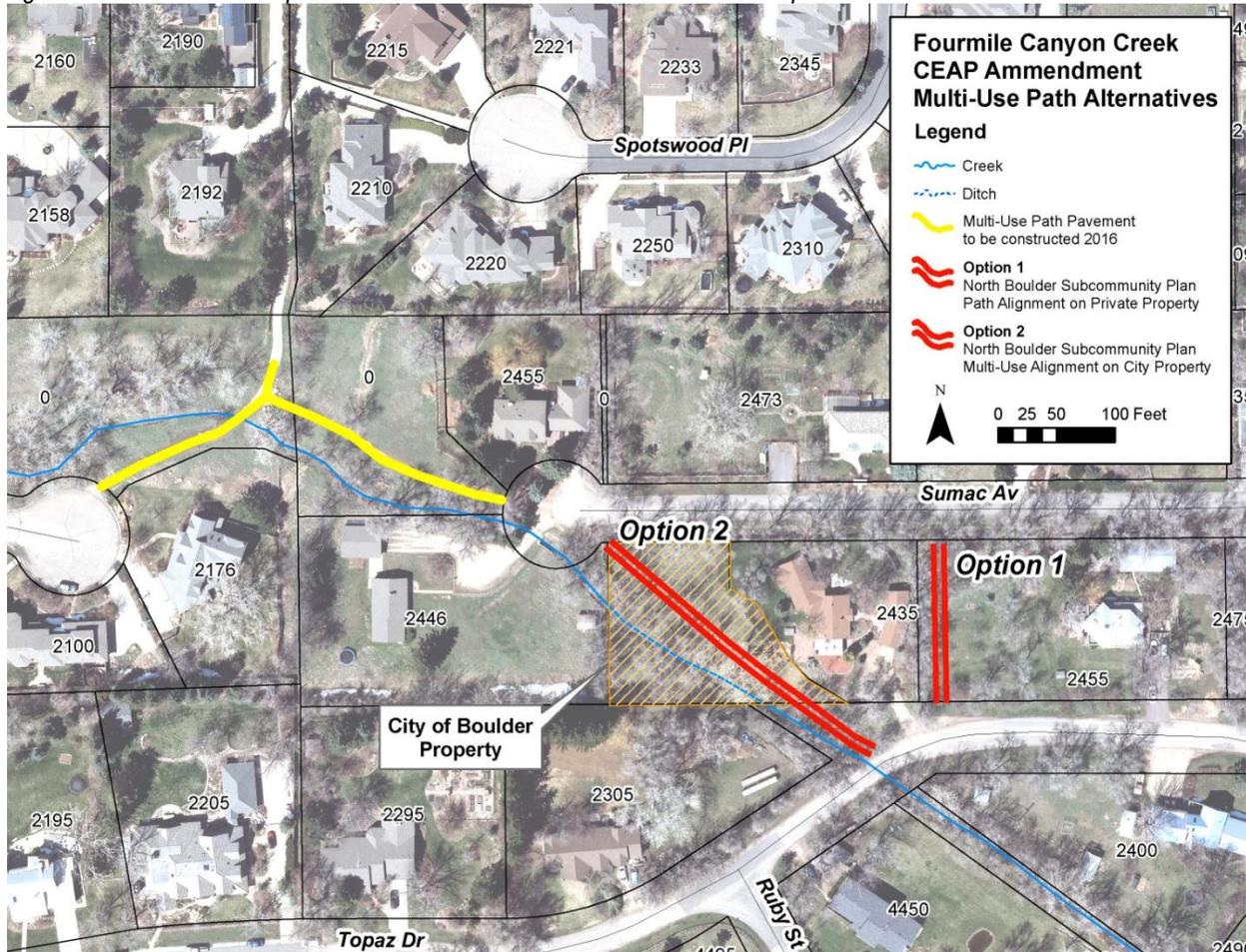
Comments were also received on two multi-use path alternatives options for a connection between Sumac and Topaz Avenue as shown in the figure below. Most residents were generally in opposition of any multi-use path alignment in this area at all. Thirty-seven people filled out the survey, 33 lived in the neighborhood, and only 5 believed the path would be of use to the multi-use system. The following represents the final tally:

- 3 people preferred Option #1,
- 12 preferred Option #2 (alignment through City Property),
- 15 people said they would NOT use the multi-use path alignment, and
- 1 person said they had a child of elementary school age who would use the multi-use path alignment.

Based on comments received from the second open house, city staff decided to remove the multi-use path alignment between Sumac and Topaz Avenue from this project CEAP and will not be pursuing options at this time.

No e-comments have been received to date on the project website.

Figure 6: Multi-Use Path Options for a Connection between Sumac and Topaz



5.0 PREFERRED PROJECT ALTERNATIVE

The estimated costs of all Fourmile Canyon Creek flood mitigation projects are not cost effective. Additionally, many of the mitigation alternatives have other significant obstacles including:

- Significant use of OSMP and Parks property for flood detention facilities
- High cost of desirable property adjacent to the Broadway corridor
- State jurisdictional requirements of detention facilities
- Limited benefit of detention in longer duration storms
- Potential acquisition of structures along Wonderland Creek
- Potential unintended consequences of disruption to sediment transport balance (requires additional analysis for downstream impacts)

- Potential adverse impacts to 100year regulatory floodplains as a result of 50year design limitations

However, benefits exist in other forms such as access to critical facilities, debris and sediment clean up, non-structural property damage, human injury, or loss of life. After evaluating all flood mitigation alternatives, the primary recommendation is to pursue Flood Mitigation Alternative 7 which incorporates the 2011 MDP recommendations and includes:

- Replacing existing culverts under Violet and Upland Avenue
- Modifying the channel between these culverts to eliminate high hazard zone risk, and allowing for safer vehicular access to Crest View Elementary School
- Collaborating with Parks to provide sediment capture within Violet Park
- Cooperating with OSMP to incorporate sediment capture in their future potential restoration plan
- Flagging the development area west of Broadway Channel for high hazard containment improvements to work in conjunction with future development in this area
- Providing safer access to Crest View Elementary School via 19th Street and Upland Avenue

This approach allows for safer access to critical facilities and the potential for the Fourmile Canyon Creek multi-use path to be integrated into the improvements including underpasses at Violet Avenue, Upland Avenue, and 19th Street. The relative cost of this alternative as compared to other improvements evaluated as part of this CEAP is significantly lower. In addition, these improvements address critical needs such as:

- Removing a fire station from the 500yr floodplain
- Reduced flood risk within the project limits including safer vehicular access to Crest View Elementary School
- Increased use of non-mechanized modes of transportation and a corresponding decrease in greenhouse gas emissions by extending the city's multi-use path system
- Increased safety of pedestrians and bicyclists by eliminating at-grade crossing at Violet Avenue and Upland Avenue
- Increased recreational opportunities for the neighborhood by extending the multi-use path system to and through Violet Park

Multi-use path Options 1, 2A, and 3A had significant public support and are the recommended alternatives. These alternatives allow for safer access to Crestview Elementary School and minimize disturbance by taking advantage of the area that is already being impacted by the preferred flood mitigation alternative.

The project involves construction activities in and around Fourmile Canyon Creek, which will likely limit the use of the area by wildlife typical of Boulder's urban creek corridors. The project will temporarily remove habitat during construction. Native vegetation will be used for site landscaping and it is anticipated that overall, habitat will therefore be enhanced by the project. It is anticipated that these species will return to the area following the construction period. Once in place, the proposed multi-use path alignment will have some disturbance impacts to wildlife along the stream corridor. However, increased use by humans or domestic animals is not anticipated to greatly impact the wildlife that currently inhabits the area. Precaution will be taken during design

to keep path alignments out of the wetlands and wetland buffer as much as possible to allow for the ecology of the stream corridor to remain continuous.

The total cost of these three alternatives is approximately \$170,500.

COORDINATION WITH OTHER DEPARTMENTS

ICON engineering analyzed high hazard containment strategies west of Broadway, sediment capture west of Broadway on OSMP lands and sediment capture at Violet Park. This analysis provided an opportunity for these improvements to be coordinated with future OSMP restoration west of Broadway, future planning and design of Violet Park, and future development west of Broadway. It should be noted that these coordination efforts are conceptual level only and not considered to be a technical addition or part of this CEAP.

GoBoulder and the 17th Street ROW

The multi-use path option at 17th Street did not receive significant public support when compared with the other path alternatives. However, this stretch of multi-use path is currently in the North Boulder Sub-community Plan and the north half is under construction as part of local development.

Sediment Capture at Violet Park

Boulder Parks and Recreation owns property along Violet Avenue adjacent to Fourmile Canyon Creek for a proposed neighborhood park as indicated in the recent Parks and Recreation Master Plan. This land is needed to satisfy park land level of service needs based on the population and proximity of the surrounding neighborhood. Department staff have reviewed the recommended flood and transportation alternatives and believe the concepts could be incorporated into the future design of the park and still fulfill the requirements of a neighborhood park. However, as the project proceeds to final design, staff will coordinate the design to integrate the needs of the neighborhood park with the flood mitigation. Please see Figure 19C in Appendix A for a potential sediment capture location within Violet Park. This figure is only conceptual and the final design will be integrated with the future park design as mentioned.

It should also be noted that there is room in Violet Park for a small detention pond. However, if the entire park area is utilized for detention, the site would not meet the requirements of a neighborhood park and the trade-offs would have to be considered. There is approximately 11 ac-ft of storage available, which is relatively small and would have a negligible impact on peak discharges during the 100-year event. However, it may be enough volume to reduce minor spill flows from the park and offset minor impacts (i.e. increased discharges) on the main stem.

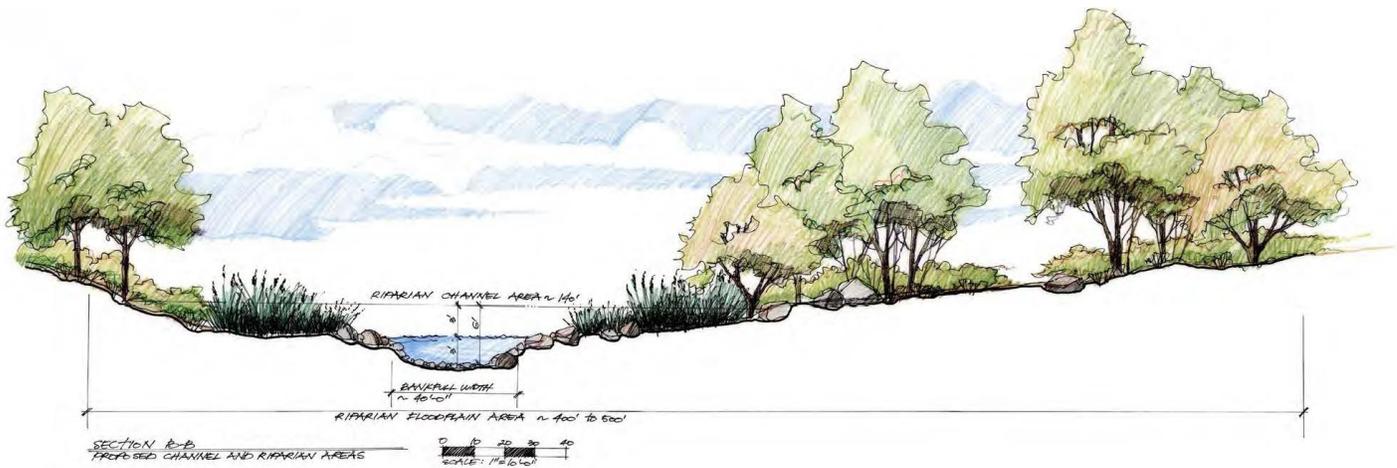
High Hazard Containment West of Broadway

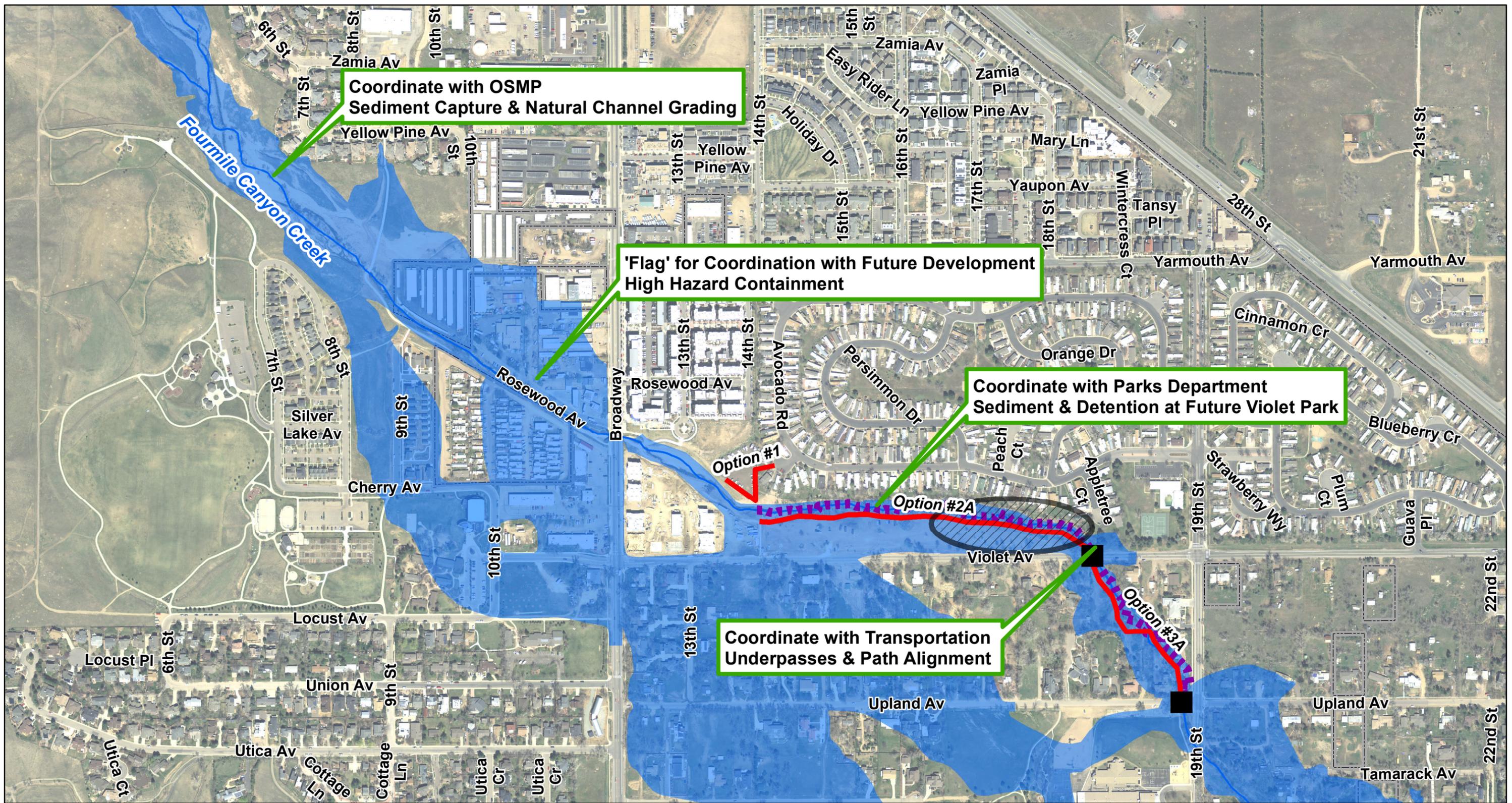
ICON also analyzed high hazard containment of Fourmile Canyon Creek west of Broadway and discovered that significant adverse impacts would result downstream. To design an engineering solution that would mimic current spill flows to Wonderland would require additional engineering

analysis. It is our recommendation that high hazard containment west of Broadway be ‘flagged’ as an opportunity to work with the future development of property located either north or south of the channel. This effort must adhere to floodplain and wetland regulations, preserving wetlands, and providing development potential, but the technical analysis is beyond the scope of this CEAP.

Sediment Capture West of Broadway on OSMP Property

Sediment capture upstream of Broadway Avenue could be designed and constructed in cooperation with OSMP’s future restoration plans for this area. Grading the floodplain in this area using the principles of natural channel design as a multi-stage channel would provide a more natural, meandering channel able to better withstand high flows and transport sediment. This approach would be intended for higher level storm events only and not intended for regular maintenance on Open Space properties. Please see Figure 21 in Appendix A for a conceptual layout of channel design and off-line sediment capture. Please see the rendering below that illustrates this type of channel work.





Legend Effective 100 Year Floodplain Creek	Channel Improvements	Sediment Capture	Future Coordination Opportunities	 0 250 500 Ft 1:5,000	Fourmile Canyon Creek Community & Environmental Assessment Process Figure 6 Staff Recommendations
	Multi-Use Path Alignment	Underpass Location			

6.0 STAFF PROJECT MANAGER

The public process, CEAP and alternatives analysis is being coordinated by Ward Bauscher (Engineering Project Manager) and Christin Shepherd (Flood and Greenways Engineer) in conjunction with Annie Noble (Flood and Greenways Engineering Coordinator), and Marni Ratzel (Senior Transportation Planner). Aspects relating to OSMP property west of Broadway were coordinated with Don Damico from Open Space and Mountain Parks. Aspects relating to Violet Park were coordinated with Jeff Haley and Doug Godfrey from the Parks and Recreation Department.

After a city staff review by the CEAPers group and staff that have an interest in the Greenways Program, the CEAP will be routed to the Greenways Advisory Committee for review and recommendation for approval. The City of Boulder Public Works Utilities Division will be responsible for design and construction of the multi-use path and flood mitigation improvements. The City of Boulder Parks and Recreation Department will be responsible for design and construction of the Violet Park improvements.

7.0 OTHER CONSULTANTS OR RELEVANT CONTACTS

ICON Engineering assisted with the development of conceptual alternatives and Merrick & Company, a civil engineering consulting firm, will provide engineering design services for the selected alternative. ERO Resources Corporation provided input on the environmental aspects of this CEAP and will assist in securing permits for the selected project alternative.

8.0 GOALS ASSESSMENT

- 1) Using the Boulder Valley Comprehensive Plan and department master plans, describe the primary city goals and benefits that the project will help to achieve:
 - a) Community Sustainability Goals – How does the project improve the quality of economic, environmental and social health with future generations in mind?

The project will help to achieve multiple objectives and city goals by combining transportation, recreation, and aesthetic improvements to the Fourmile Canyon Creek Greenways corridor in the project area. Completing a missing link in the city's multi-use path network will enable and encourage more people to commute by bike and foot, reducing vehicle miles traveled and associated greenhouse gas emissions. Replacing non-native and invasive species with native species as part of the project plan and mitigation measures will enhance both habit and area aesthetics.

- b) BVCP Goals related to:

- i) Community Design

The Greenways system is an example of a positive community design feature. This project contributes to the Greenways Program and meets multiple objectives for stream management.

ii) Facilities and Services

The proposed project includes transportation, flood mitigation and environmental facilities. These facilities further the BVCP Utility and Parks and Trails policy goals. The multi-use path will be maintained by the City of Boulder Streets and Bikeways Maintenance staff. The creek will be maintained by City of Boulder Greenways Habitat Maintenance crew and the Urban Drainage and Flood Control District.

iii) Environment

The project will enhance the environment of the Fourmile Canyon Creek corridor by providing water quality and habitat enhancement improvements. These improvements include replacing non-native and invasive species with native species. In addition, the multi-use path connection will facilitate alternative modes of transportation and shift single occupant trips to biking and walking thereby reducing vehicle miles traveled and associated greenhouse gases. This project will further the BVCP policy goals presented in the Preservation and Enhance Biodiversity and Native Ecosystems, Protect and Enhance the Quality of the Urban Environment, Protect Geologic Resources and Manage Natural Hazards, and Protect and Improve Water and Air Quality sections.

iv) Economy

The multi-use path will help facilitate use of alternative transportation for commuters and therefore help to reduce dependency on foreign oil.

v) Transportation

This project will complete the multi-use path connection between 19th Street and the recently constructed multi-use path located at the west end of Violet Park. This connection will provide an important connection for multi-use path users traveling east-west along Fourmile Canyon Creek, particularly school children traveling to Crest View Elementary School. This project will further the BVCP multi-modal transportation goals.

vi) Housing

The multi-use path will connect to several residential areas and will facilitate alternative transportation to these areas as well as areas east and west of the project.

vii) Social Concerns and Human Services

The flood mitigation components of the project will reduce the flood risk within the project limits, eliminate the 500-year flood risk for one of the city's fire stations and provide safer vehicular access to Crest View Elementary School during a major storm event.

c) Describe any regional goals (potential benefits or impacts to regional systems or plans?)

This project will make an important connection to the city's multi-use path system that is connected to regional systems.

2) Is this project referenced in a master plan, sub-community or area plan? If so, what is the context in terms of goals, objectives, larger system plans, etc.? If not, why not?

This multi-use path connection is shown in the North Boulder Sub-community Plan, the Fourmile Canyon Creek Flood Mitigation Final Plan, the Greenways Master Plan, BVCP trail

map, and in the Transportation Master Plan. Completion of this project will fulfill these important plan components.

- 3) Will this project be in conflict with the goals or policies in any departmental master plan and what are the tradeoffs among city policies and goals in the proposed project alternative? (e.g. higher financial investment to gain better long-term services or fewer environmental impacts)

Project alternatives will have some impacts to wetlands. Every attempt will be made during the design phase to preserve as much of the wetland and wetland buffer area as is feasible along with complying with the city's wetlands protection ordinance.

- 4) List other city projects in the project area that are listed in a departmental master plan or the CIP.

A CEAP was prepared in 2012 that evaluated alternatives to improve safety and accessibility in the area of Fourmile Canyon Creek between 19th and 22nd Street. The selected alternatives in the final CEAP included construction of a pedestrian and bicycle underpass at 19th Street and a combined multi-use path and secondary emergency access route from 19th Street to Tamarack Avenue. These features are currently being designed and funds for construction of these features are provided in the 2013-2019 Utilities and Greenways CIP. In addition, as part of a private development located at the southeast corner of Broadway and Violet Avenue, the multi-use path was extended along Fourmile Canyon Creek from Broadway to the western edge of Violet Park in 2012. The development project also included channel improvements along Fourmile Canyon Creek from Broadway to Violet Park. Completing the missing link in the multi-use path between 19th Street and the recently completed segment at Violet Park is shown in the Greenways Master Plan, Transportation Master Plan and the North Boulder Sub-community Plan.

- 5) What are the major city, state and federal standards that will apply to the proposed project? How will the project exceed city, state or federal standards and regulations (e.g. environmental, health, safety or transportation standards)?

The project's multi-use path system will be designed to meet or exceed ADA requirements, meet or exceed city and national standards for the development of bikeway facilities, meet or exceed the city's wetland ordinance requirements, include water quality and habitat enhancements, meet or exceed Urban Drainage and Flood Control District standards and comply with all required city, state and federal permits.

- 6) Are there cumulative impacts to any resources from this and other projects that need to be recognized and mitigated?

The project will result in temporary impacts to wetlands and habitat during construction that will be fully mitigated based on compliance with the city's wetland ordinance.

9.0 IMPACT ASSESSMENT

The following checklists table identifies potential short and long-term impacts from the project. Each of the Flood Mitigation Alternatives (FM) and Transportation Alternatives are presented separately.

- + indicates a positive effect or improved condition
- indicates a negative effect or impact
- O indicates no effect

Checklist questions are answered following each table for all categories identified as having a potential + or - impact. The preferred alternative components are highlighted in green.

CHECKLIST

Project Title: Fourmile Canyon Creek Greenways Improvement Project Upland Avenue to West of Broadway	Flood Mitigation Alternatives						Transportation Alternatives							
	FM1	FM2	FM3	FM4	FM5	FM6	FM7	Option 1	Option 2A	Option 2B	Option 3A	Option 3B	Option 3C	Option 3D
A. Natural Areas or Features														
1. Disturbance to species, communities, habitat or ecosystems due to:														
a. Construction activities	-	-	-	-	-	-	-	-	-	-	-	-	0	0
b. Native vegetation removal	-	-	+	-	+	-	+	-	-	-	-	-	0	0
c. Human or domestic animal encroachment	-	-	-	-	-	-	-	-	-	0	-	-	0	0
d. Chemicals (including petroleum products, fertilizers, pesticides, herbicides)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
e. Behavioral displacement of wildlife species (due to noise from use activities)	0	0	0	0	0	0	0	0	-	-	-	-	0	0
f. Habitat removal	-	-	+	0	+	-	+	+	+	+	+	+	0	0
g. Introduction of non-native plant species in the site landscaping	0	0	0	0	0	0	0	0	0	0	0	0	0	0
h. Changes to groundwater or surface runoff	+	+	+	+	+	+	+	+	+	+	+	+	+	+
i. Wind erosion	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Loss of mature trees or significant plants?														
	-	-	-	0	-	-	-	-	-	0	-	-	0	0
B. Riparian Areas / Floodplain														
1. Encroachment upon the 100-year, conveyance or high hazard flood zones?														
	+	+	+	+	+	+	+	0	+	+	+	0	0	0
2. Disturbance to or fragmentation of a riparian corridor?														
	-	-	-	0	-	-	+	-	-	+	-	+	+	+
C. Wetlands														
1. Disturbance to or loss of a wetland on site?														
	-	-	-	+	-	-	+	-	-	0	-	0	0	0
D. Geology and Soils														
1. a. Impacts to unique geological or physical features?														
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. Geological development constraints?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c. Substantial changes in topography?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d. Changes in soil or fill materials on the site?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
e. Phasing of earth work?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E. Water Quality														
1. Impacts to water quality from any of the following?														
a. Clearing, excavation, grading or other construction activities	-	-	-	0	-	+	-	-	-	0	-	0	0	0

Project Title: Fourmile Canyon Creek Greenways Improvement Project Upland Avenue to West of Broadway	Flood Mitigation Alternatives						Transportation Alternatives							
	FM1	FM2	FM3	FM4	FM5	FM6	FM7	Option 1	Option 2A	Option 2B	Option 3A	Option 3B	Option 3C	Option 3D
b. Change in hardscape	0	0	0	0	0	0	-	-	-	0	-	0	0	0
c. Change in site ground features	+	+	+	+	+	+	+	0	0	0	0	0	0	0
d. change in storm drainage	+	+	+	+	+	+	+	0	0	0	0	0	0	0
e. change in vegetation	+	+	+	0	+	-	+	-	-	0	-	-	0	0
f. change in pedestrian and vehicle traffic	0	0	0	0	0	0	0	+	+	+	+	+	+	+
g. pollutants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Exposure of groundwater contamination from excavation or pumping?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F. Air Quality														
a. From mobile sources?	0	0	0	0	0	0	0	+	+	+	+	+	+	+
b. From stationary sources?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G. Resource Conservation														
1. Changes in water use?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Increases or decreases in energy use?	0	0	0	0	0	0	0	+	+	+	+	+	+	+
3. Generation of excess waste?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H. Cultural / Historic Resources														
1. a. Impacts to a prehistoric or archaeological site?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. Impacts to a building or structure over fifty years of age?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c. impacts to a historic feature of the site?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d. Impacts to significant agricultural land?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I. Visual Quality														
1. a. Effects on scenic vistas or public views?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. Effects on the aesthetics of a site open to public view?	-	-	+	0	+	+	+	+	+	+	+	+	+	+
c. Effects on views to unique geological or physical features?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d. Changes in lighting?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J. Safety														
1. Health hazards, odors or radon?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Disposal of hazardous materials?	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Project Title: Fourmile Canyon Creek Greenways Improvement Project Upland Avenue to West of Broadway	Flood Mitigation Alternatives						Transportation Alternatives							
	FM1	FM2	FM3	FM4	FM5	FM6	FM7	Option 1	Option 2A	Option 2B	Option 3A	Option 3B	Option 3C	Option 3D
3. Site hazards?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K. Physiological Well-being														
1. Exposure to excessive noise?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Excessive light or glare?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Increase in vibrations?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L. Services														
1. Additional need for:														
a. Water or sanitary sewer services?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b. Storm sewer / flood control features?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c. Maintenance of pipes, culverts and manholes?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d. Police services?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
e. Fire protection services?	+	+	+	+	+	+	+	0	0	0	0	0	0	0
f. Recreation or parks facilities?	0	0	0	0	0	0	+	+	+	+	+	+	+	+
g. Library services?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
h. Transportation improvements / traffic mitigation?	0	0	0	0	0	0	0	+	+	+	+	+	+	+
i. Parking	0	0	0	0	0	0	0	+	+	+	+	+	+	+
j. Affordable housing?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
k. Open space / urban open land?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
l. Power or energy use?	0	0	0	0	0	0	0	+	+	+	+	+	+	+
m. Telecommunications?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
n. Health care / social services?	0	0	0	0	0	0	0	+	+	+	+	+	+	+
o. Trash removal or recycling services?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M. Special Populations														
1. Effects on:														
a. Persons with disabilities?	0	0	0	0	0	0	0	+	+	+	+	+	+	+
b. Senior population?	0	0	0	0	0	0	0	+	+	+	+	+	-	-
c. Children or youth?	0	0	0	0	0	0	0	+	+	+	+	+	-	-

Project Title: Fourmile Canyon Creek Greenways Improvement Project Upland Avenue to West of Broadway	Flood Mitigation Alternatives						Transportation Alternatives							
	FM1	FM2	FM3	FM4	FM5	FM6	FM7	Option 1	Option 2A	Option 2B	Option 3A	Option 3B	Option 3C	Option 3D
d. Restricted income persons	0	0	0	0	0	0	0	+	+	+	+	+	+	+
e. People of diverse backgrounds (including Latino and other immigrants)?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
f. Neighborhoods	+	+	+	+	+	+	+	+	+	+	+	+	+	+
g. Sensitive populations located near the project (e.g. schools, hospitals and nursing homes)?	+	+	+	+	+	+	+	+	+	+	+	+	-	-
N. Economy														
1. Utilization of existing infrastructure?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Effect on operating expenses?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Effect on economic activity?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Impacts to businesses, employment, retail sales or city revenue?	+	+	+	+	+	+	+	+	+	+	+	+	+	+

CHECKLIST QUESTIONS

Note: The following questions are a supplement to the CEAP checklist. Only checklist items having a – or + anticipated impact have questions answered in full.

A. Natural Areas

1. Describe the potential for disturbance to or loss of significant: species, plant communities, wildlife habitats, or ecosystems via any of the activities listed below (significant species include any species listed or proposed to be listed as rare, threatened or endangered on federal, state or county lists)
 - a. Construction activities
 - b. Native vegetation removal
 - c. Human or domestic animal encroachment
 - d. Chemicals to be stored or used on the site (including petroleum products, fertilizers, pesticides, herbicides) – *no impacts anticipated*
 - e. Behavioral displacement of wildlife species (due to noise from use activities)
 - f. Habitat removal
 - g. Introduction of non-native plant species in the site landscaping - *no impacts anticipated*
 - h. Changes to groundwater (including installation of sump pumps) or surface runoff (storm drainage, natural stream) on the site
 - i. Potential for discharge of sediment to any body of water either in the short term (construction-related) or long term
 - j. Potential for wind erosion and transport of dust and sediment from the site - *no impacts anticipated*

Please see number 2 below for complete response.

2. Describe the potential for disturbance to or loss of mature trees or significant plants.
If the potential impacts have been identified, please provide any of the following information that is relevant to the project:
 - A description of how the proposed project would avoid, minimize or mitigate identified impacts
 - A habitat assessment of the site, including: 1) a list of plant and animal species and plant communities of special concern found on the site; 2) a wildlife habitat evaluation of the site
 - Map of the site showing the location of any Boulder Valley Natural Ecosystem, Boulder County Environmental Conservation Area, or critical wildlife habitat - *Not Applicable*

The impacts and proposed mitigation for the preferred flood and transportation alternatives are described below.

The project involves construction activities in and around Fourmile Canyon Creek. Construction activities will likely limit the use of the area by wildlife typical of Boulder's urban creek corridors. It is anticipated that these species will return to the area following the construction period. Sediment and erosion would be controlled during construction by contractor adherence to the project's Stormwater Pollution Prevention Plan as required by the city and state.

The proposed multi-use path is located in an urban area. Increased use by humans or domestic animals is not anticipated to greatly impact the wildlife that currently inhabits the area. The project will temporarily remove habitat during construction. Native vegetation will be used for site landscaping and it is anticipated that overall, habitat will be therefore be enhanced by the project. Following the project, the corridor would be maintained by the Greenways Habitat Maintenance crew, resulting in a reduction of noxious and weed species and increased health of native species. The final design will work to reduce the number of native mature trees that would need to be removed. The City Forester will be consulted regarding the health of any existing trees that could be impacted and an evaluation will be conducted for the presence of nesting birds. Once in place, the proposed multi-use path alignment will have some disturbance impacts to wildlife along the stream corridor.

A Greenways Riparian Habitat Assessment was completed in October 1999. Boulder Creek and all of the tributaries were evaluated on a reach by reach basis. This project encompasses three of the riparian habitat reaches, Fourmile Canyon Creek (FCC) 4, FCC5 and FCC7. Reach FCC4 starts at the western end of the project and extends through a portion of Violet Park. Reach FCC5 continues east through Violet Park and then south past Violet Avenue. Reach FCC7 completes the eastern portion of the project. The riparian habitat assessment evaluated the native species present, the structural diversity of the vegetation and the diversity of birds as an indicator of the quality of habitat. The results for these reaches were as follows:

Native Plant Habitat Evaluation Score			
Habitat Reach	Score	Rank	Description
FCC4	11	46/136	Good
FCC5	9	68/136	Poor
FCC7	12	37/136	Good
Vegetative Structure Evaluation Score			
Habitat Reach	Score	Rank	Description
FCC4	12	12/135	Very Good
FCC5	11.5	33/135	Very Good
FCC7	11.5	33/135	Very Good
Bird Diversity Score			
Habitat Reach	Score	Rank	Description
FCC4	106	-	Good
FCC5	79	-	Poor
FCC7	71	-	poor

Source: Greenways Riparian Habitat Assessment October 23, 1999

The Riparian Habitat Assessment did not identify any of these reaches as potential habitat for Ute ladies' tresses orchid or the Preble's meadow jumping mouse. While the construction of a path in a riparian area has an incremental effect on the habitat, the majority of this project will be outside the riparian area and will therefore have a minimal negative impact. The replacement of non-native vegetation with natives could have a net positive impact. The flood mitigation improvements will include native plantings and enhancement of the creek channel.

*ERO Resources Corp. conducted a field survey in August 2013 of the project site. They concluded that there is no suitable habitat for federally listed threatened and endangered species. Riparian corridors are particularly important in urban areas where they are often used as movement corridors for larger mammals such as deer and for nesting by songbirds and raptors. Species that use riparian corridors in developed areas are typically common species tolerant of human encroachment. As a result, although diverse, most plant and wildlife species in urban riparian areas are not unique or uncommon. The report states that although the proposed project would not affect any unique or significant natural resources, there would be impacts on regulated resources including Fourmile Canyon Creek and its riparian areas but that these impacts would be addressed through the Clean Water Act Section 404 and City of Boulder Wetland permitting processes. Although ERO noted there is suitable nesting substrate, no raptor nests were observed in the project area. In the event an active nest is present, the city would need to comply with the Migratory Bird Treaty Act. The ERO memorandum summarizing their findings is presented as **Appendix B***

B. Riparian Areas / Floodplains

1. Describe the extent to which the project will encroach upon the 100-year, conveyance or high hazard flood zones.

One of the primary objectives of this project is flood mitigation. The project will greatly reduce the flood risk for residents in the neighborhood as well as provide safer vehicular access to Crest View Elementary School during a major storm event.

2. Describe the extent to which the project will encroach upon, disturb, or fragment a riparian corridor (this includes impacts to the existing channel of flow, stream banks, adjacent riparian zone extending 50 feet out from each bank, and any existing drainage from the site to a creek or stream).

If potential impacts have been identified, please provide any of the following information that is relevant to the project:

- A description of how the proposed project would avoid, minimize, or mitigate identified impacts to habitat, vegetation, aquatic life or water quality
- A map showing the location of any streams, ditches and other water bodies on or near the project site
- A map showing the location of the 100-year flood, conveyance, and high hazard flood zones relative to the project site

Below is a figure that presents the existing floodplain conditions along the project reach. The project will be within the 100-year flood, conveyance, and high hazard flood zones, but the majority of the multi-use path will be constructed outside the wetland buffer area as shown on the Fourmile Canyon Creek Greenway Project map. Mitigation would be done in compliance with the city's wetland permit requirements. It is anticipated that the completed project will enhance the riparian corridor and water quality enhancement features will improve water quality.



C. Wetlands

1. Describe any disturbance to or loss of a wetland on site that may result from the project.

If potential impacts have been identified, please provide any of the following information that is relevant to the project:

- A description of how the proposed project would avoid, minimize, or mitigate identified impacts.
- A map showing the location of any wetlands on or near the site. Identify both those wetlands and buffer areas which are jurisdictional under city code (on the wetlands map in our ordinance) and other wetlands pursuant to federal criteria (definitional).

Below is a figure that presents the existing mapped wetlands and inner and outer buffer areas. The majority of the path will be constructed outside the wetland buffer area as shown on the Fourmile Canyon Creek Greenway Project map. Mitigation would be done in compliance with the city's wetland permit requirements. It is anticipated that the completed project will enhance the riparian corridor and water quality enhancement features will improve water quality.



D. Geology and Soils

1. Describe any:
 - a. impacts to unique geologic or physical features;
 - b. geologic development constraints or effects to earth conditions or landslide, erosion or subsidence;
 - c. substantial changes in topography; or
 - d. changes in soil or fill material on the site that may result from the project

No impacts anticipated.

E. Water Quality

1. Describe any impacts to water quality that may result from any of the following:
 - a. Clearing, excavation, grading or other construction activities that will be involved with the project

Construction of the proposed project features will require clearing, excavation and grading. This work will be done in accordance with construction site best management practices.

- b. Changes in the amount of hardscape (paving, concrete, brick, or buildings) in the project area.
- c. Permanent changes in site ground features such as paved areas or changes in topography.

The project includes construction of a concrete multi-use path. This feature will increase the impervious surface area along the project reach. Runoff from the trail will be routed to pervious surfaces prior to discharge to Fourmile Canyon Creek.

- d. Changes in the storm drainage from the site after project completion

Fourmile Canyon Creek through the project reach is currently primarily a gravel bottom channel that provides little to no water quality benefits. The project's proposed channel modifications will include enhancement of the riparian area including wetland plantings that will enhance water quality.

- e. Change in vegetation

The project will disrupt / remove vegetation during construction. The project landscaping will use native plantings.

- f. Change in pedestrian and vehicle traffic

The project includes extension of a multi-use path that will facilitate alternative modes of transportation and therefore help to decrease vehicle traffic.

- g. Potential pollution sources during and after construction (may include temporary or permanent use or storage of petroleum products)

Construction of the project features will require heavy equipment with associated petro-chemicals. Source control of these chemicals will be included as part of the construction specifications.

- 2. Describe any pumping of groundwater that may be anticipated either during construction or as a result of the project. If excavation or pumping is planned, what is known about groundwater contamination in the surrounding area (1/4 mile radius of the project) and the direction of groundwater flow?

No anticipated impacts.

F. Air Quality

- 1. Describe potential short or long term impacts to air quality resulting from this project. Distinguish between impacts from mobile sources (VMT/trips) and stationary sources (APEN, HAPS).

Construction of the project will result in temporary increases in emissions. The multi-use path components of the project will, however, facilitate use of alternative transportation modes and therefore help to reduce overall city emissions. The project will not result in any stationary air quality impacts.

G. Resource Conservation

- 1. Describe potential changes in water use that may result from the project.
 - a. Estimate the indoor, outdoor (irrigation) and total daily water use for the facility
 - b. Describe plans for minimizing water use on the site (Xeriscape landscaping, efficient irrigation system)

No anticipated impacts.

- 2. Describe potential increases or decreases in energy use that may result from the project.
 - a. Describe plans for minimizing energy use on the project or how energy conservation measures will be incorporated into the building design
 - b. Describe plans for using renewable energy sources on the project or how renewable energy sources will be incorporated into the building design
 - c. Describe how the project will be built to LEED standards

The multi-use components of the project will facilitate use of alternative transportation modes and therefore help to reduce overall city emissions. The project will not result in any stationary air quality impacts.

3. Describe the potential for excess waste generation resulting from the project. If potential impacts to waste generation have been identified, please describe plans for recycling and waste minimization (deconstruction, reuse, recycling, green points).

No anticipated impacts.

H. Cultural / Historic Resources

1. Describe any impacts to:
 - a. prehistoric or historic archaeological site
 - b. building or structure over fifty years of age
 - c. historic feature of the site such as an irrigation ditch
 - d. significant agricultural lands that may result from the project

No anticipated impacts.

I. Visual Quality

1. Describe the effects on:
 - a. scenic vistas or views open to the public

No anticipated impacts.

- b. the aesthetics of a site open to public view

There is opportunity to work in conjunction with the Parks and Recreation Department to significantly improve the aesthetic and usable park space at Violet Park. Channel grading and trail connection will also provide improved aesthetics to public view.

- c. view corridors from the site to unique geologic or physical features that may result from the project

No anticipated impacts.

J. Safety

1. Describe any additional health hazards, odors or exposure of people to radon that may result from the project
2. Describe measures for the disposal of hazardous materials

3. Describe any additional hazards that may result from the project (including risk of explosion or the release of hazardous substances such as oil, pesticides, chemicals or radiation)

No anticipated impacts.

K. Physiological Well-being

1. Describe the potential for exposure of people to excessive noise, light or glare caused by any phase of the project (construction or operations)
2. Describe any increase in vibrations or odor that may result from the project
If potential impacts have been identified, please provide the following:
 - A description of how the project would avoid, minimize or mitigate identified impacts

The project will result in increased vibrations and noise during construction. This disruption will be minimized by conducting construction only during weekdays during normal business hours.

L. Services

1. Describe any increased need for the following services as a result of the project:
 - a. Water or sanitary sewer services
 - b. Storm sewer / flood control features
 - c. Maintenance of pipes, culverts and manholes
 - d. Police services
 - e. Fire protection

The preferred flood mitigation alternative would remove a fire station from the 500year floodplain.

- f. Recreation or parks facilities

Extension of the multi-use path will provide recreational opportunities and facilitate increased use of Violet Park

- g. Libraries
- h. Transportation improvements / traffic mitigation

Extension of the multi-use path may increase the amount of alternative transportation miles and therefore increase the maintenance requirements

- i. Parking

The construction of a multi-use path will provide alternative travel to vehicular options, thereby reducing the need for parking.

- j. Affordable housing
- k. Open space / urban open land
- l. Power or energy use

Extension of the multi-use path may increase the amount of alternative transportation miles and therefore decrease the use of oil and gas.

- m. Telecommunications
- n. Health care / social services
- o. Trash removal or recycling services

2. Describe any impacts to any of the above existing or planned city services or department master plans as a result of this project (e.g. budget, available parking, planned use of the site, public access, automobile / pedestrian conflicts, views)

No anticipated impacts.

M. Special Populations

1. Describe any effects the project may have on the following special populations:
 - a. Persons with disabilities
 - b. Senior populations
 - c. Children or youth
 - d. Restricted income persons
 - e. People of diverse backgrounds
 - f. Sensitive populations located near the project (e.g. adjacent neighborhoods or property owners, schools, hospitals, nursing homes)

If potential impacts have been identified, please provide the following:

- A description of how the proposed project would avoid, minimize, or mitigate identified impact
- A description of how the proposed project would benefit special populations

The proposed multi-use path extension would be designed to ADA standards, providing a safer alternative mode of transportation for persons with disabilities, children and all other users. Restricted income people could use the multi-use path to commute via biking or walking instead of needing to rely on more expensive modes of transportation.

N. Economic Vitality

1. Describe how the project will enhance economic activity in the city or region or generate economic opportunities. – no impacts
2. Describe any potential impacts to:
 - a. businesses in the vicinity of the project (ROW, access or parking)
 - b. employment

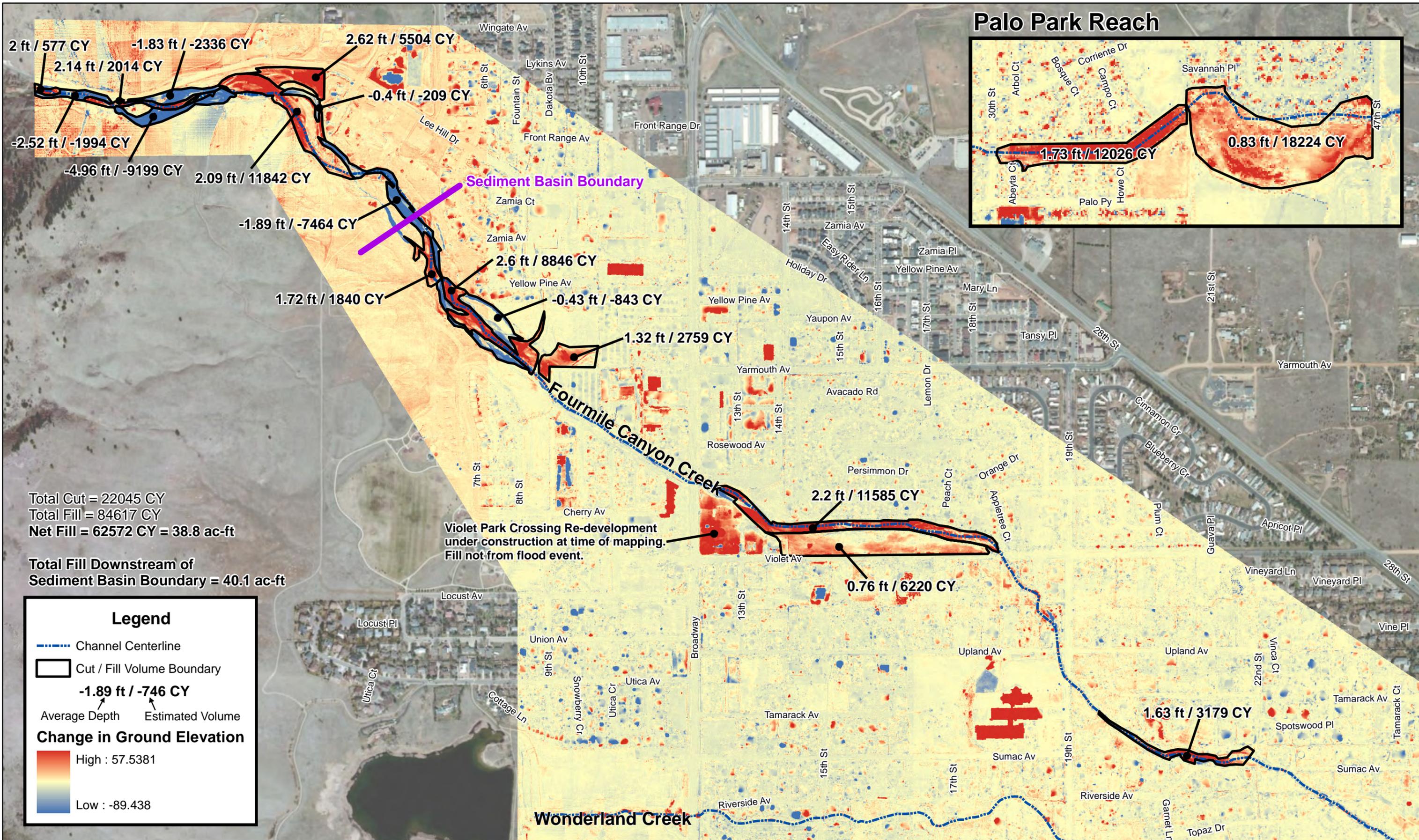
- c. retail sales or city revenue and how they might be mitigated

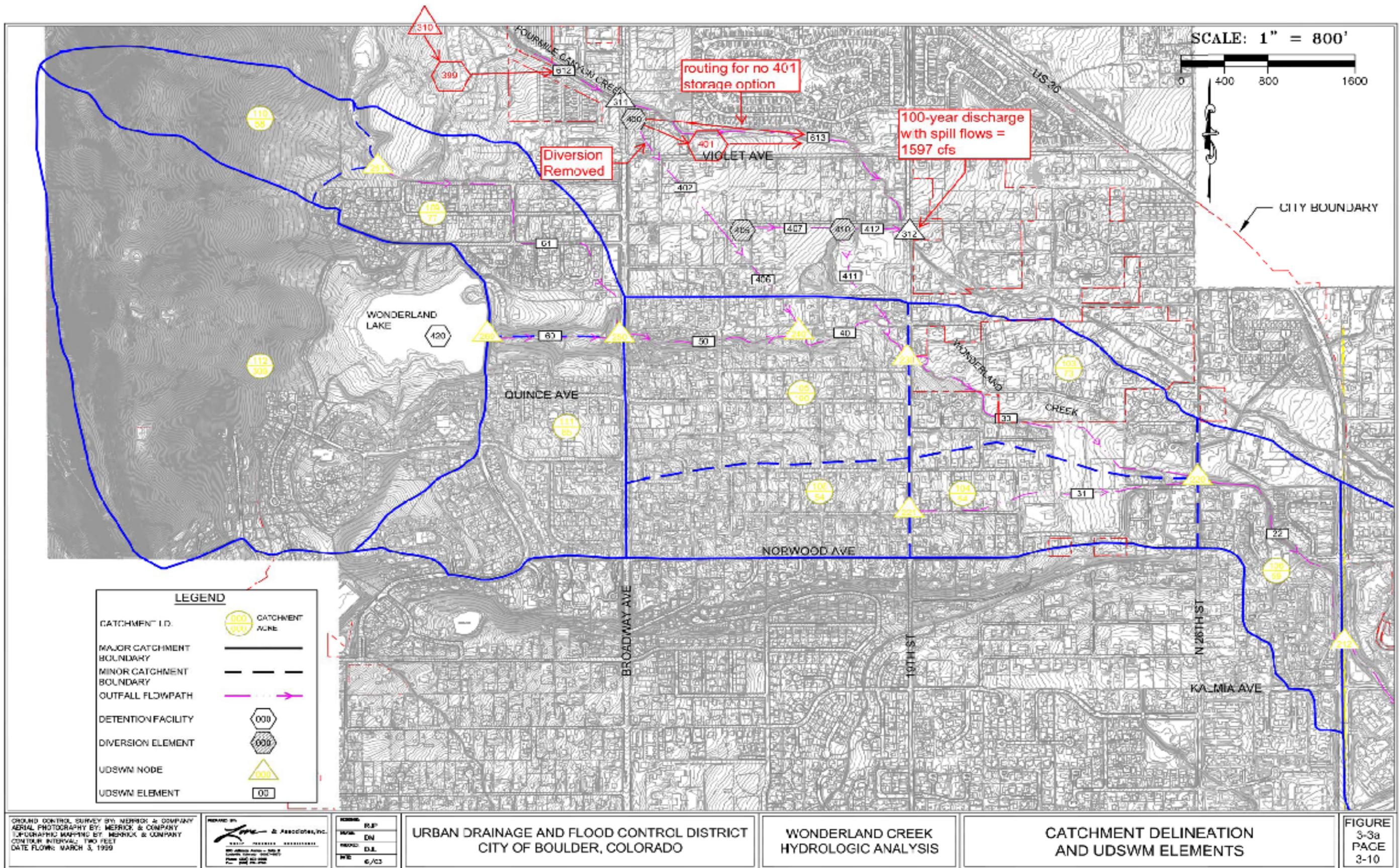
This corridor will create opportunity and ease of access for local businesses located just off of the corridor and new multi-use path. The improvements proposed in this CEAP will provide a natural ambiance for the surrounding establishments.

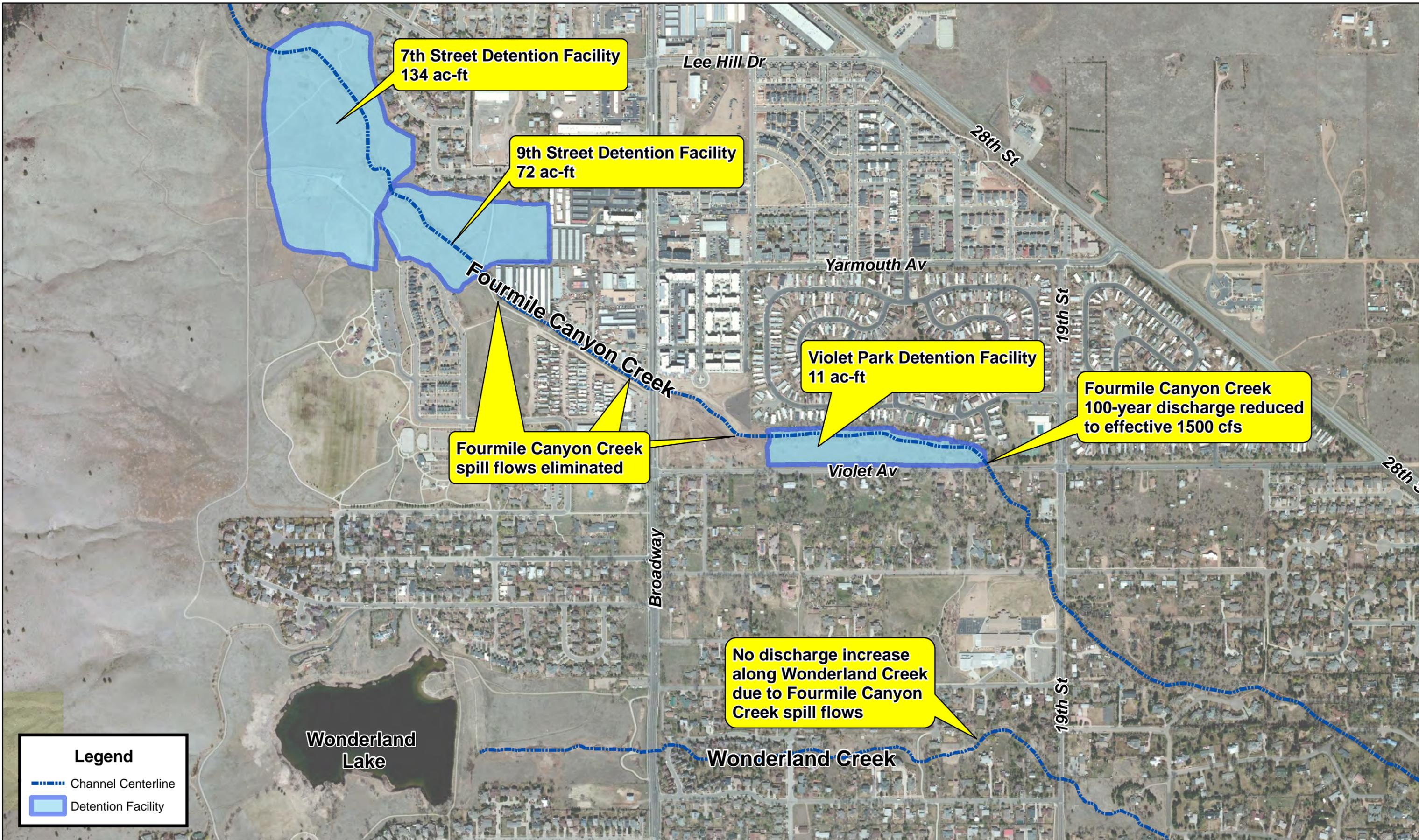
APPENDIX A

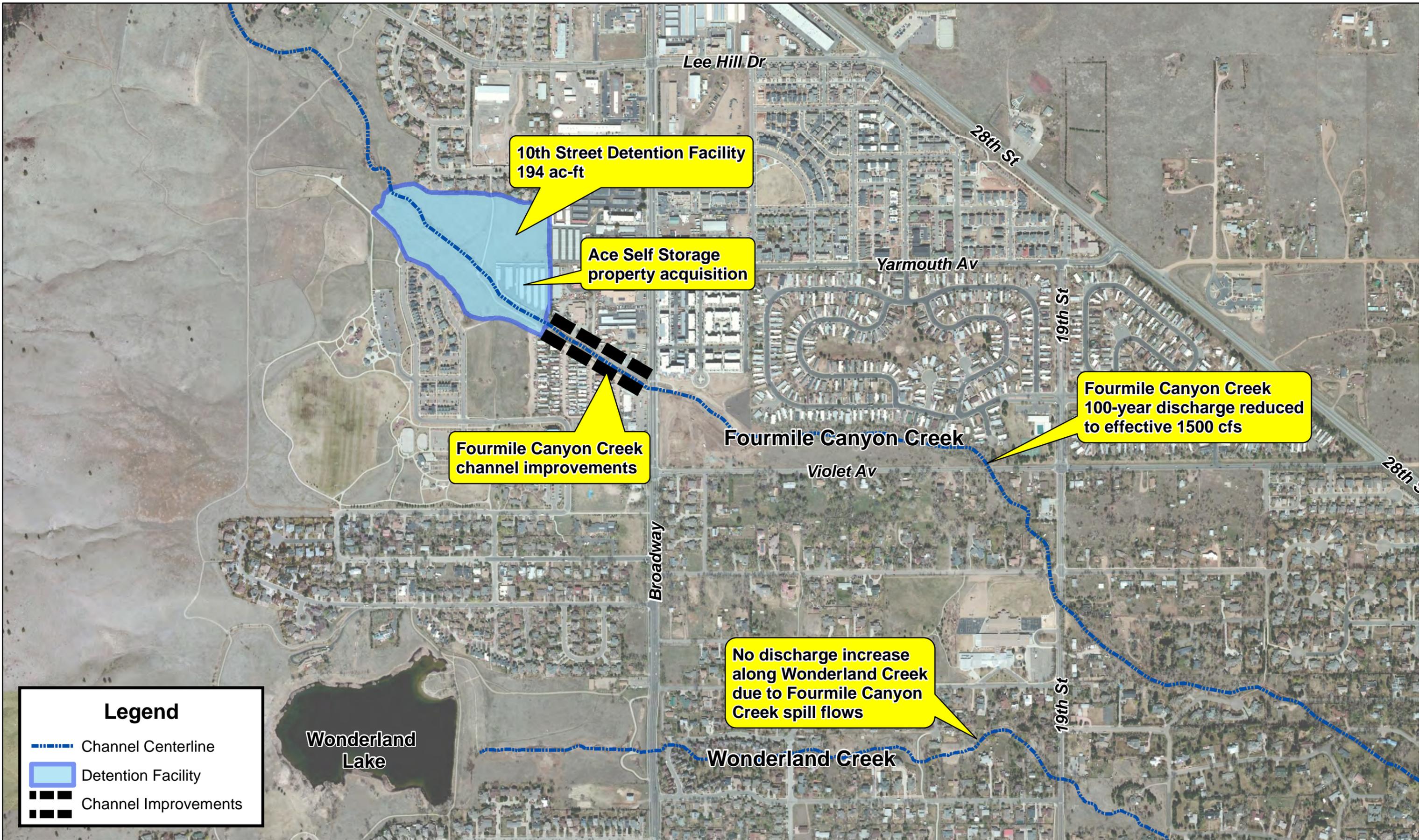
Figures from ICON Engineering

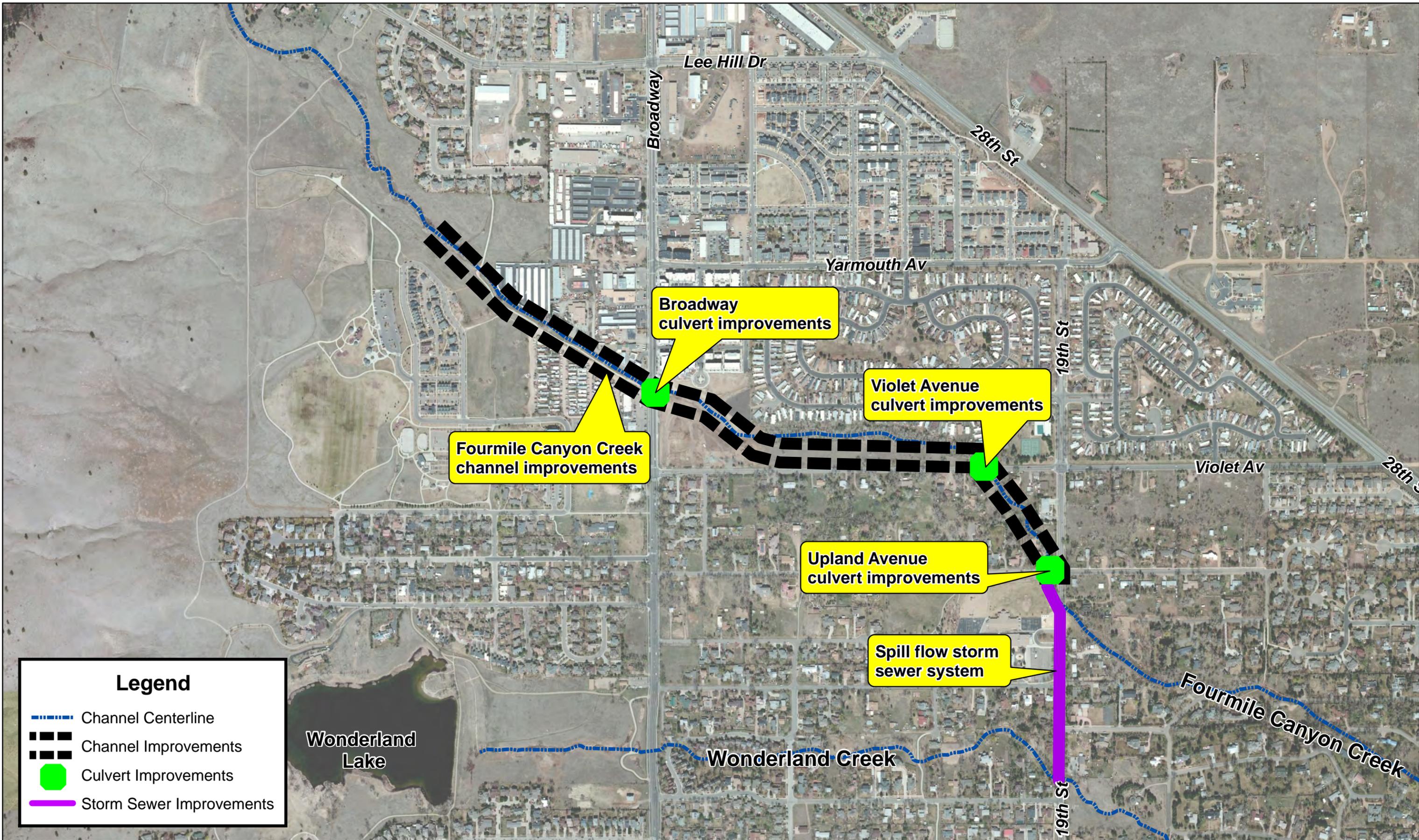








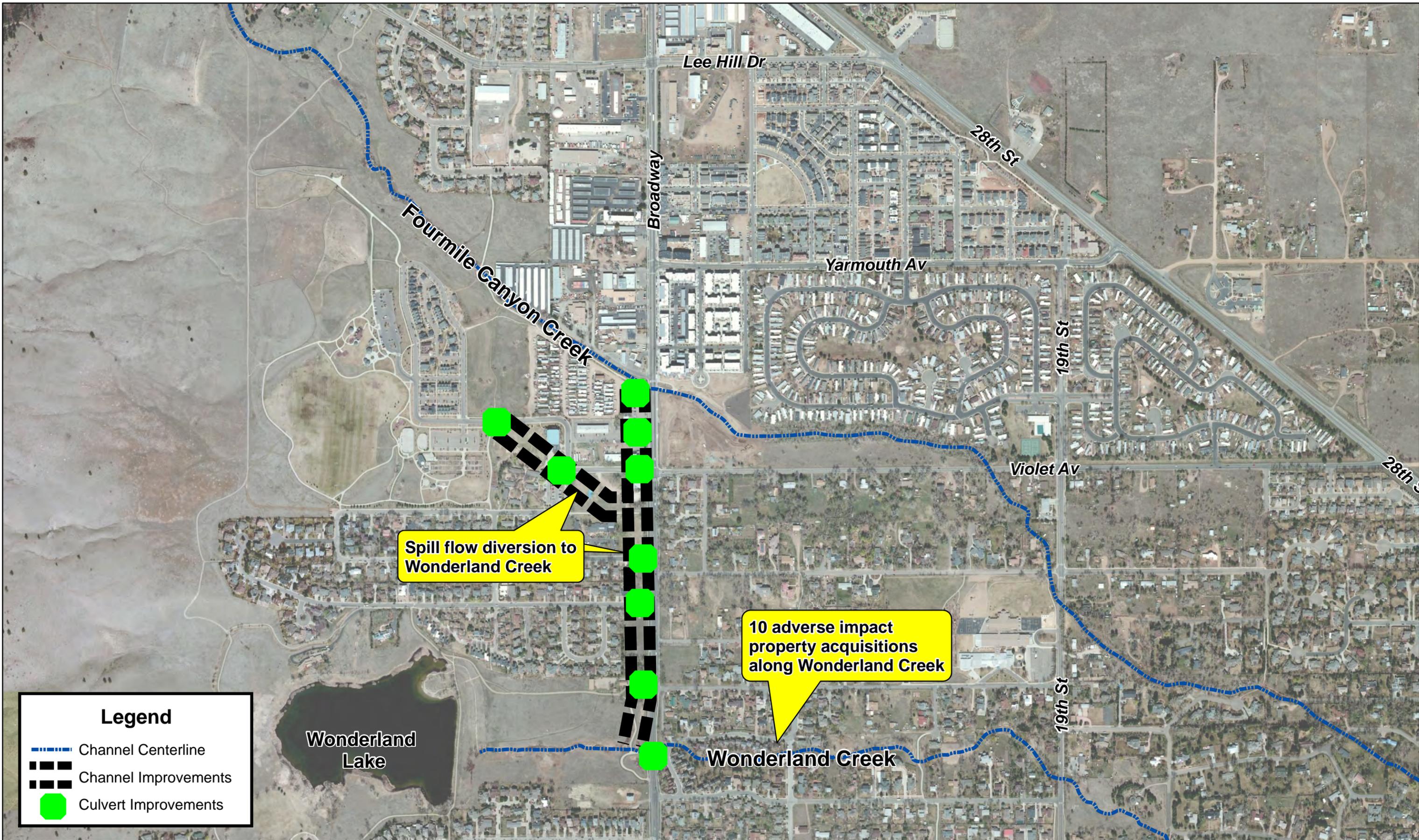




Legend

- - - - - Channel Centerline
- - - - - Channel Improvements
- Culvert Improvements
- Storm Sewer Improvements

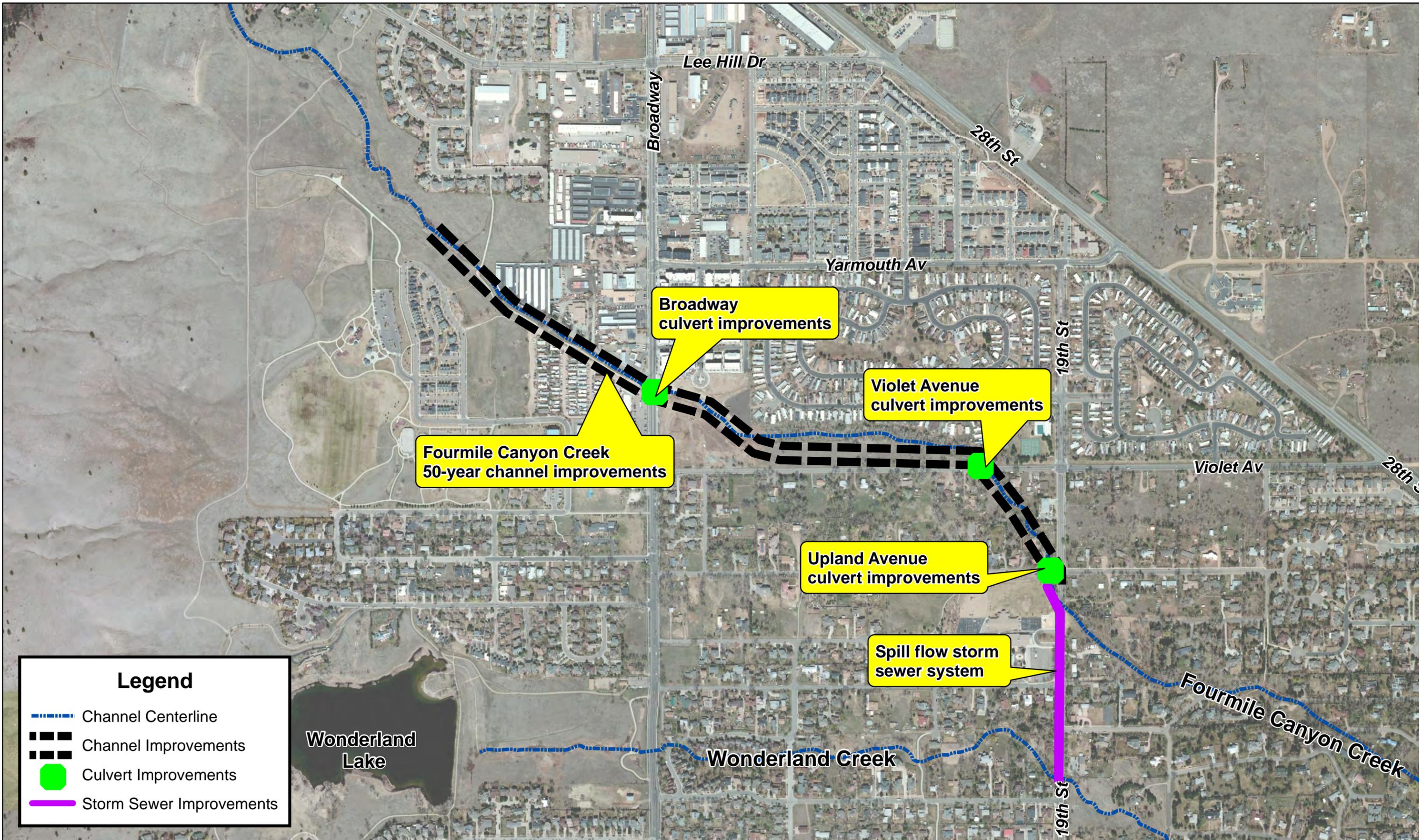




Legend

-  Channel Centerline
-  Channel Improvements
-  Culvert Improvements

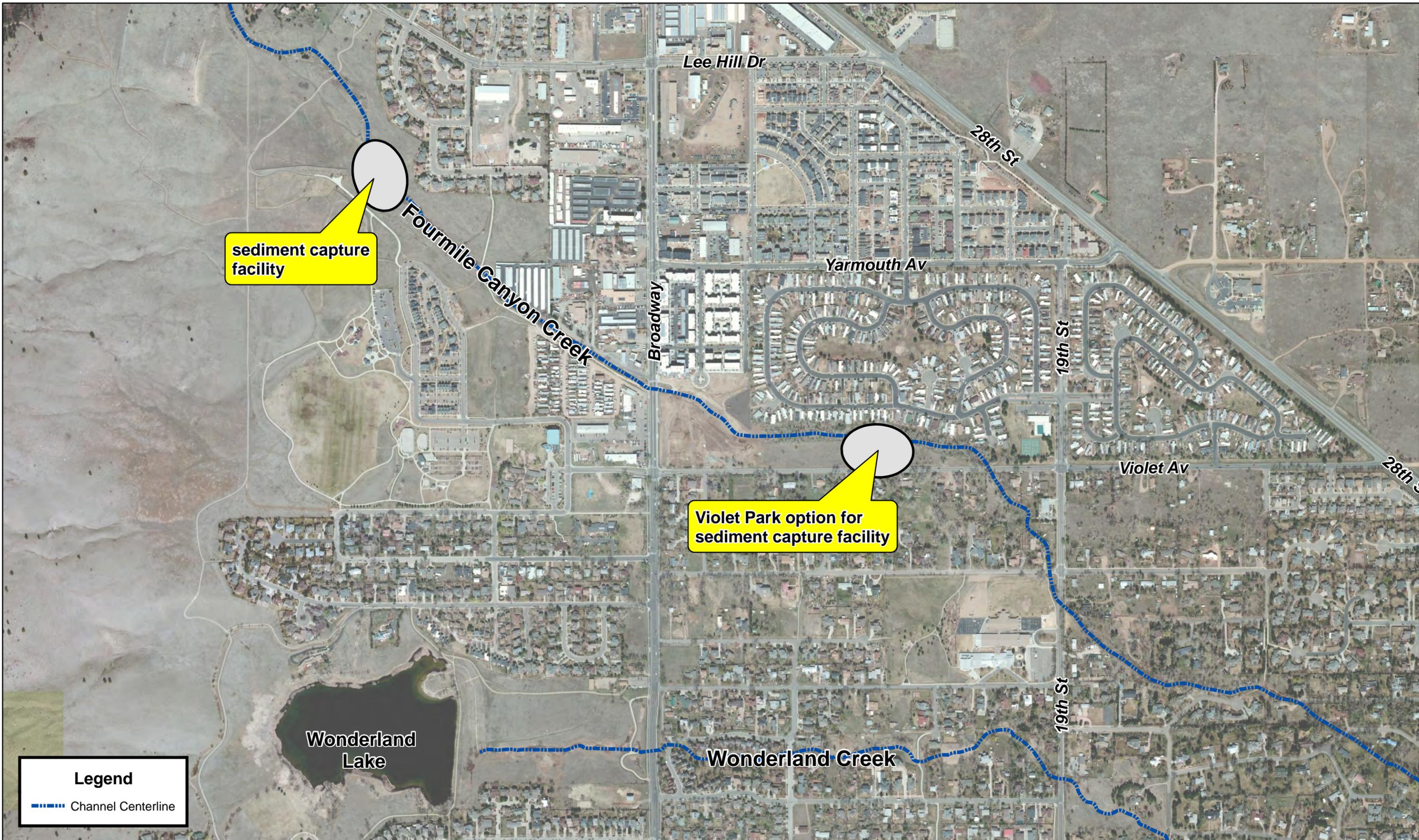




Legend

- - - Channel Centerline
- - - Channel Improvements
- Culvert Improvements
- Storm Sewer Improvements



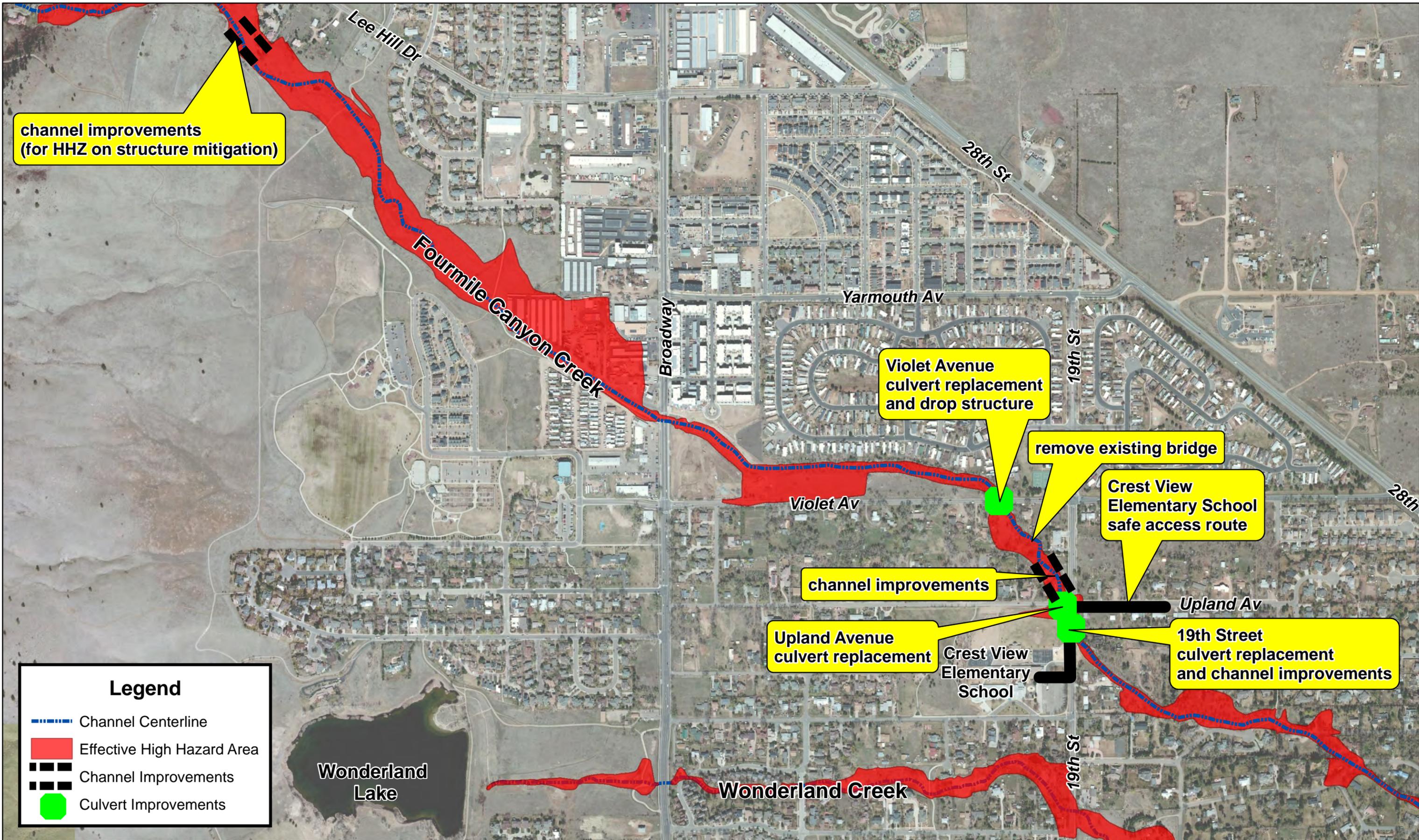


sediment capture facility

Violet Park option for sediment capture facility

Legend
 - - - - Channel Centerline





channel improvements
(for HHZ on structure mitigation)

Violet Avenue
culvert replacement
and drop structure

remove existing bridge

Crest View
Elementary School
safe access route

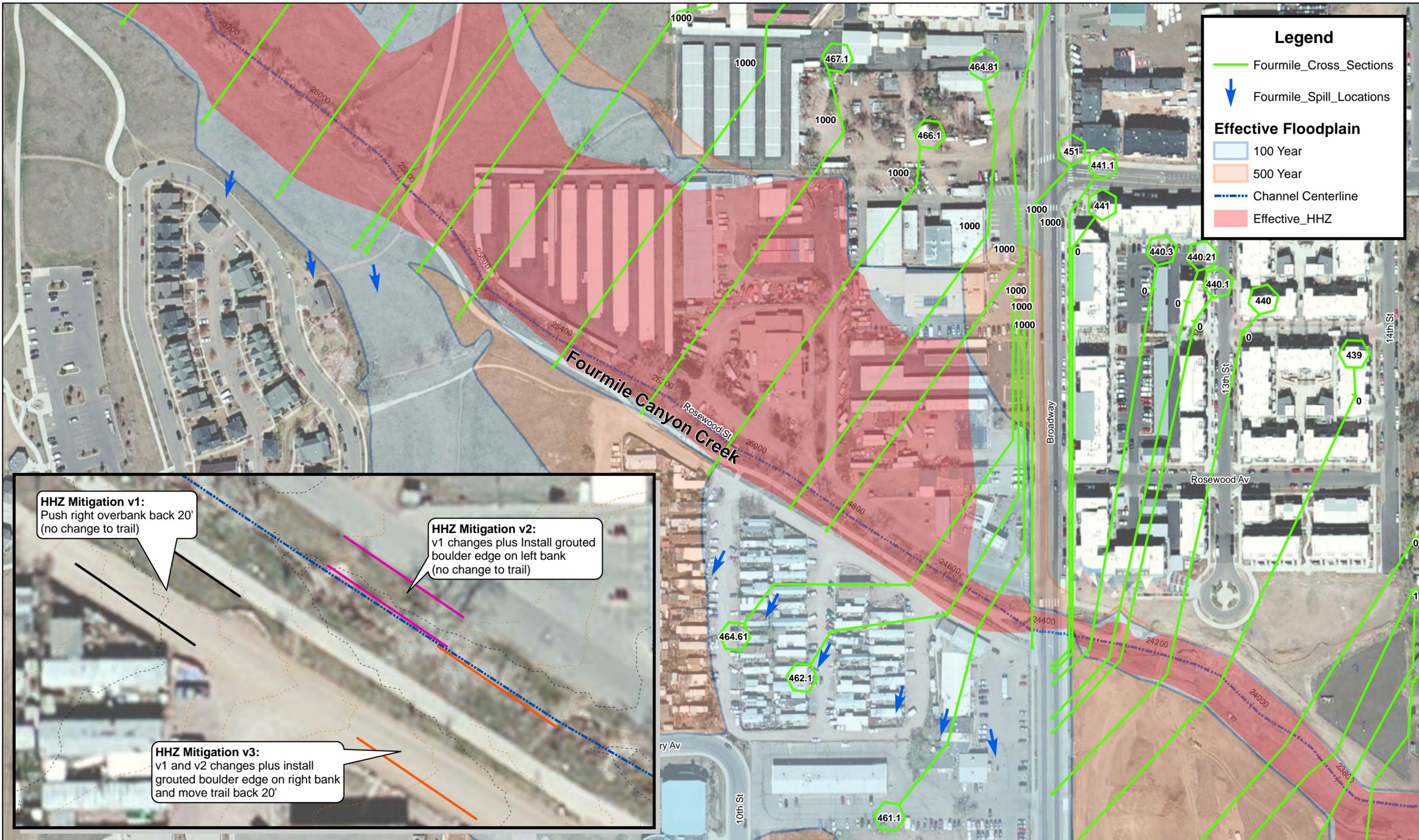
channel improvements

Upland Avenue
culvert replacement

19th Street
culvert replacement
and channel improvements

Legend

-  Channel Centerline
-  Effective High Hazard Area
-  Channel Improvements
-  Culvert Improvements



Legend

- Fourmile_Cross_Sections
- ↓ Fourmile_Spill_Locations

Effective Floodplain

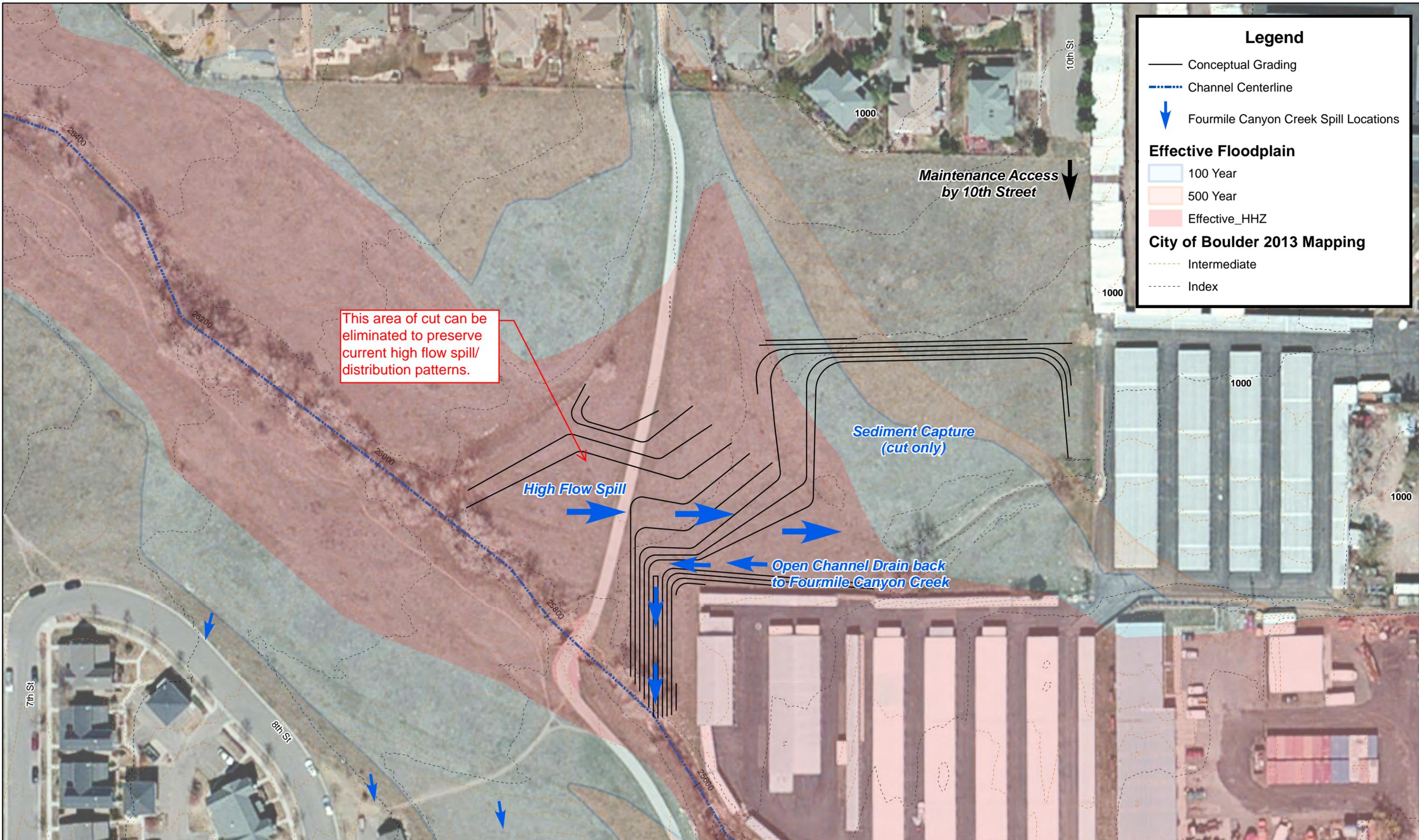
- 100 Year
- 500 Year
- - - Channel Centerline
- Effective_HHZ

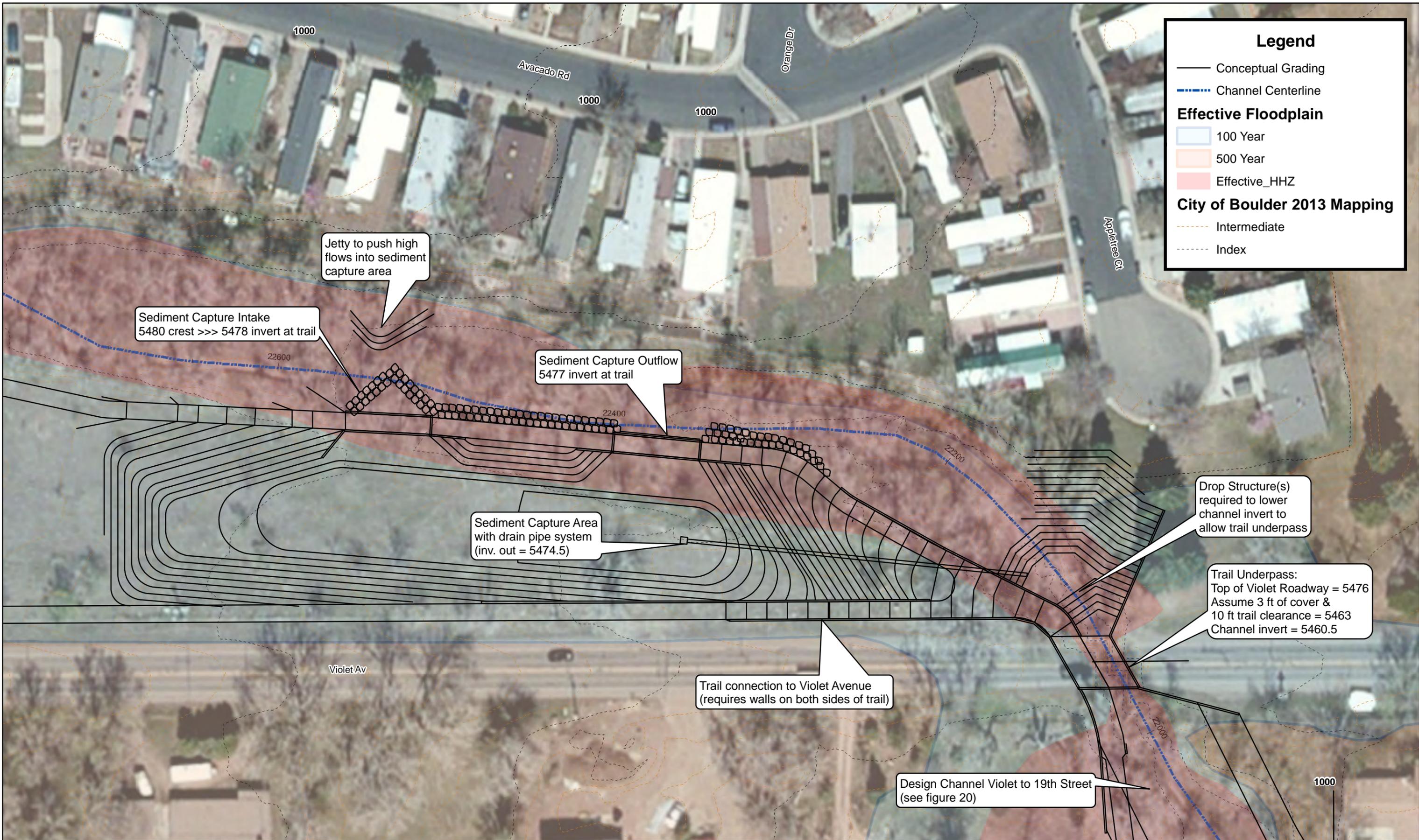
HHZ Mitigation v1:
Push right overbank back 20'
(no change to trail)

HHZ Mitigation v2:
v1 changes plus Install grouted
boulder edge on left bank
(no change to trail)

HHZ Mitigation v3:
v1 and v2 changes plus install
grouted boulder edge on right bank
and move trail back 20'







Legend

- Conceptual Grading
- Channel Centerline

Effective Floodplain

- 100 Year
- 500 Year
- Effective_HHZ

City of Boulder 2013 Mapping

- Intermediate
- Index

Sediment Capture Intake
5480 crest >>> 5478 invert at trail

Jetty to push high flows into sediment capture area

Sediment Capture Outflow
5477 invert at trail

Sediment Capture Area with drain pipe system
(inv. out = 5474.5)

Drop Structure(s) required to lower channel invert to allow trail underpass

Trail Underpass:
Top of Violet Roadway = 5476
Assume 3 ft of cover & 10 ft trail clearance = 5463
Channel invert = 5460.5

Trail connection to Violet Avenue
(requires walls on both sides of trail)

Design Channel Violet to 19th Street
(see figure 20)





Legend

- Conceptual Grading
- Channel Centerline

Effective Floodplain

- 100 Year
- 500 Year
- Effective HHZ

City of Boulder 2013 Mapping

- Intermediate
- Index





Legend

- Conceptual Grading
- Channel Centerline
- City of Boulder Wetland
- City of Boulder Wetland Buffer (inner)
- City of Boulder Wetland Buffer (outer)

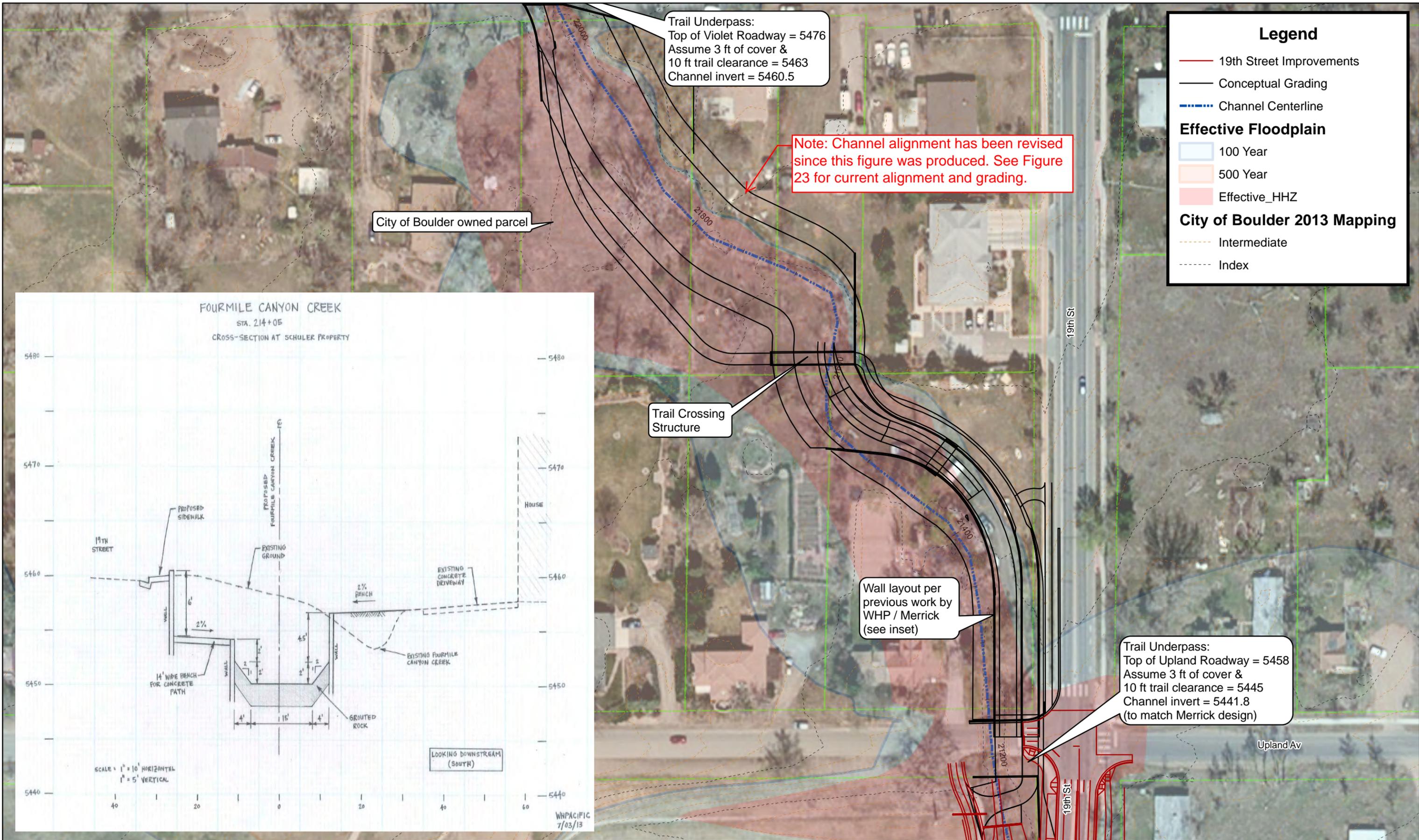
City of Boulder 2013 Mapping

- - - Intermediate
- - - Index



Fourmile Canyon Creek - CEAP Mitigation Planning
 Figure 19C: Sediment Capture at Violet Park - Overview with Wetland Buffers







Legend

- - - - Existing Channel Centerline
- Multi-Stage Open Channel Concept

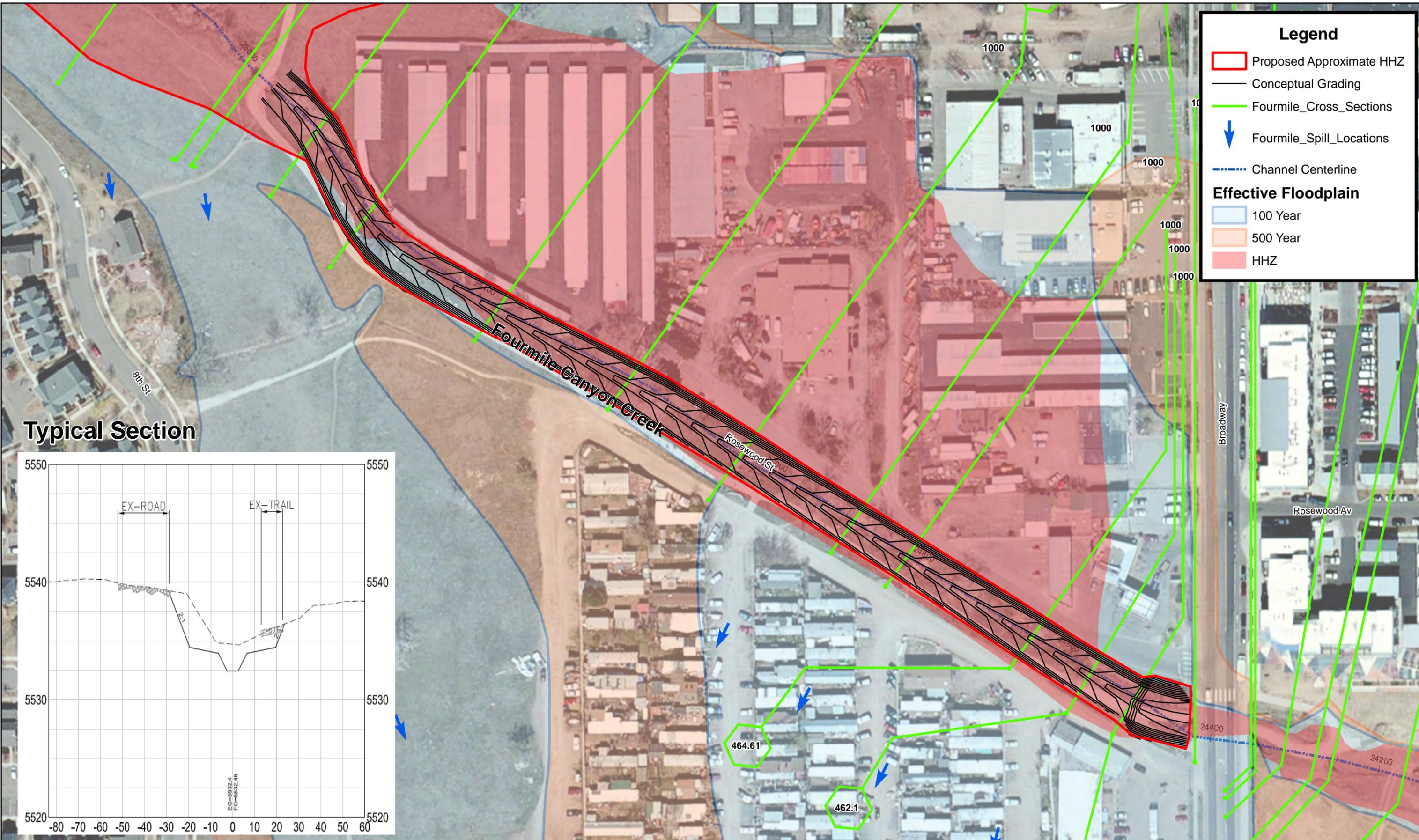
Effective Floodplain

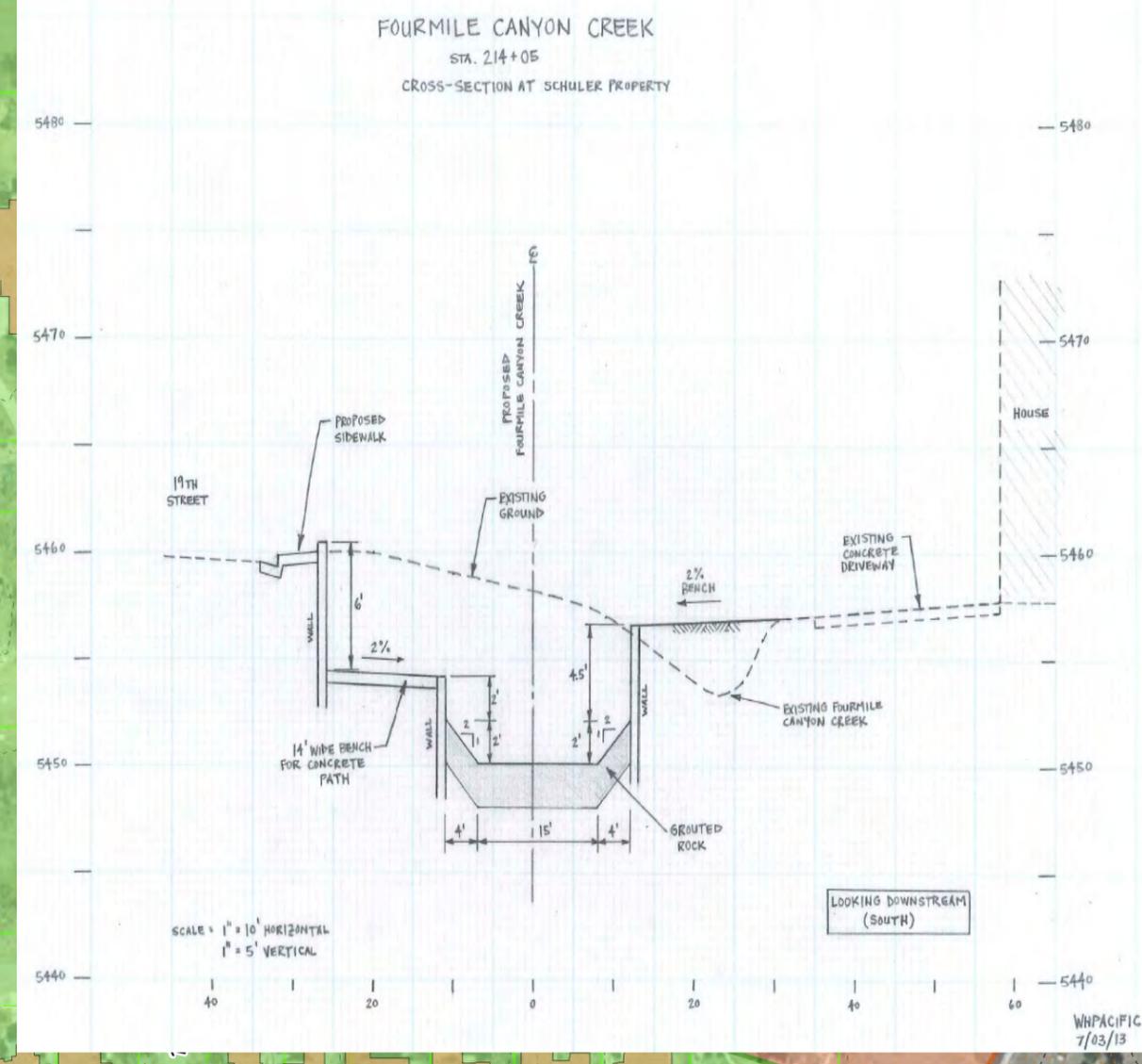
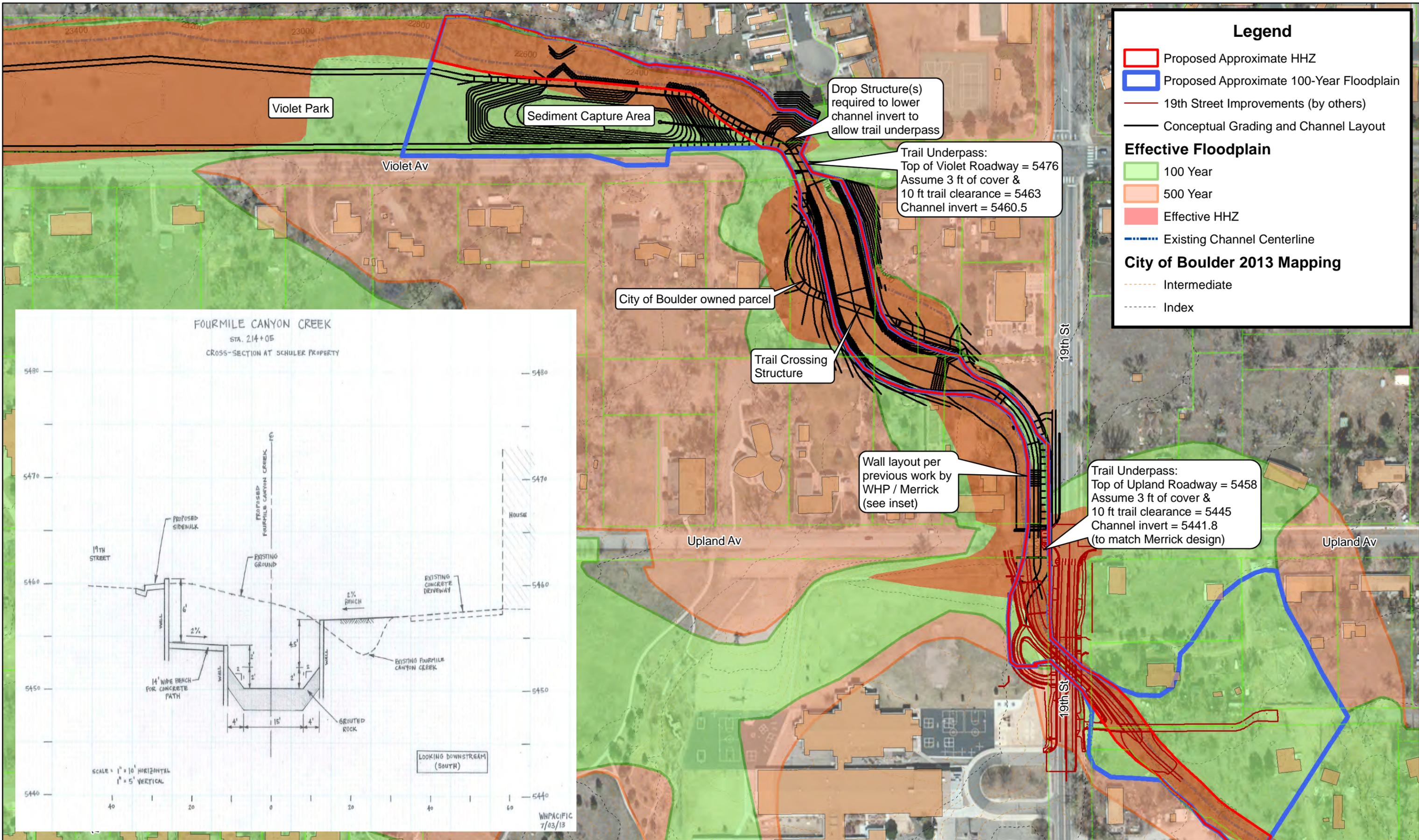
- 100 Year
- 500 Year
- Effective HHZ

City of Boulder 2013 Mapping

- - - - Intermediate
- - - - Index







APPENDIX B

ERO Memorandum

August 20, 2013

To: Kurt Bauer, City of Boulder
Brian Chevalier, McLaughlin Water Engineers

From: Mary L. Powell, ERO Resources Corporation

Re: Review of Fourmile Canyon Creek 19th Street to Violet Avenue Trail and Flood Improvements for Natural Resource “Red Flags”

Background

The City of Boulder (City) is proposing flood control and recreation trail improvements along Fourmile Canyon Creek between 19th Street and Violet Avenue (project area). On August 9, 2013, ERO Resources Corporation (ERO) assessed the project area for the presence of significant natural resources that could make the current project concepts difficult or infeasible to implement (2013 site visit). Potential significant natural resources in the project area include habitat for threatened or endangered species, raptor nests, unique wetlands or other sensitive vegetation communities, and use by regulated wildlife such as the black-tailed prairie dog.

The natural resources and associated regulations described in this report are valid as of the date of this report and may be relied upon for the specific use for which it was prepared by ERO under contract to the City of Boulder. Because of their dynamic natures, site conditions and regulations should be reconfirmed by a qualified consultant before relying on this report for a use other than that for which ERO was contracted.

General Description of Project Area

The project area is generally bounded by Violet Avenue to the north, 19th Street to the east, Upland Avenue to the south, and residential properties to the west (Figure 1). Fourmile Canyon Creek flows from northwest to southeast through the project area.

Fourmile Canyon Creek flows through a residential development. The creek and its floodplain have been encroached upon by the development and the creek appears to have been channelized along most of its length.

Currently, Fourmile Canyon Creek flows through a narrow floodplain terrace in the project area. The channel bottom of the creek is comprised of sand and gravel. Fourmile Canyon Creek is an ephemeral to intermittent stream that conveys large volumes of water following precipitation events. Small base flows may be present during spring runoff. The creek was not flowing and no saturation was visible during the 2013 site visit.

The vegetation in the project area is dominated by a plains cottonwood (*Populus deltoides*) riparian community. In addition to plains cottonwood, the tree overstory

Denver
1842 Clarkson St.
Denver, CO 80218
303.830.1188

Boise
3314 Grace St.
Boise, ID 83703
208.373.7983

Durango
1015 ½ Main Avenue
Durango, CO 81301
970.422.2136

Western Slope
P.O. Box 932
161 South 2nd St.
Hotchkiss, CO 81419
970.872.3020

includes Siberian elm (*Ulmus pumila*), peachleaf willow (*Salix amygdaloides*), crack willow (*Salix fragilis*), and green ash (*Fraxinus pennsylvanica*). The understory is comprised of intermittent introduced upland grasses, particularly smooth brome (*Bromus inermis*).

The Natural Resource Conservation Service (NRCS) has mapped soils in the project area as Nederland very cobbly sandy loam (NRCS 2013). This soil type is derived from cobbly loamy alluvium and is well drained.

Project Area

Fourmile Canyon Creek between 19th Street and Violet Avenue

Residential lots line Violet Avenue, 19th Street, and Upland Avenue. Along these streets, the homes are situated close to the road with maintained yards encroaching on the Fourmile Canyon Creek corridor. The vegetation along the streets is dominated by introduced species such as smooth brome, cheatgrass (*Bromus tectorum*), and crested wheatgrass (*Agropyron desertorum*). These areas are dominated by introduced upland species and, therefore, provide only limited habitat value for small birds and mammals. Along the Fourmile Canyon Creek corridor, several Siberian elms and plains cottonwoods provide the overstory cover. Smooth brome and tall fescue (*Festuca arundinacea*), with very sparse patches of reed canarygrass (*Phalaris arundinacea*), edge the Fourmile Canyon Creek channel.

In general, habitat in the project area is of low value to wildlife; however, three fawns were observed in the dry channel during the 2013 site visit. Wildlife use of the project area is limited by the presence of development and human activity. Deer, fox, and raccoon may move through this area, but are more likely to use the less-developed areas east of 19th Street. The trees along the creek are potential nesting sites for raptors, including owls, and it is likely that small songbirds nest in the trees lining the street. No sensitive plant communities or habitat would support threatened or endangered species in the project area.

Threatened and Endangered Species

During the 2013 site visit, ERO assessed the project area for suitable habitat for federally listed threatened and endangered species protected under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (ESA). The project area does not fall within U.S. Fish and Wildlife Service (Service) habitat or survey guidelines for the majority of the species listed by the Service as potentially occurring in Boulder County (Table 1).

Table 1. Federally threatened, endangered, and candidate species potentially found in Boulder County or potentially affected by projects in Boulder County.

Common Name	Scientific Name	Status*	Habitat	Suitable Habitat Present
Mammals				
Canada lynx	<i>Lynx canadensis</i>	T	Climax boreal forest with a dense understory of thickets and windfalls	No
Preble's meadow jumping mouse	<i>Zapus hudsonius preblei</i>	T	Shrub riparian/wet meadows	No
Birds				
Interior least tern**	<i>Sterna antillarum athalassos</i>	E	Sandy/pebble beaches on lakes, reservoirs, and rivers	No habitat and no depletions anticipated
Mexican spotted owl	<i>Strix occidentalis</i>	T	Closed canopy forests in steep canyons	No
Piping plover**	<i>Charadrius melodus</i>	T	Sandy lakeshore beaches and river sandbars	No habitat and no depletions anticipated
Whooping crane**	<i>Grus americana</i>	E	Mudflats around reservoirs and in agricultural areas	No habitat and no depletions anticipated
Fish				
Greenback cutthroat trout	<i>Oncorhynchus clarki stomias</i>	T	Cold, clear, gravel headwater streams and mountain lakes	No
Pallid sturgeon**	<i>Scaphirhynchus albus</i>	E	Large, turbid, free-flowing rivers with a strong current and gravel or sandy substrate	No habitat and no depletions anticipated
Plants				
Colorado butterfly plant	<i>Gaura neomexicana</i> ssp. <i>coloradensis</i>	T	Subirrigated, alluvial soils on level floodplains and drainage bottoms between 5,000 and 6,000 feet in elevation	No
Ute ladies'-tresses orchid	<i>Spiranthes diluvialis</i>	T	Moist to wet alluvial meadows, floodplains of perennial streams, and around springs and lakes below 6,500 feet in elevation	No

Common Name	Scientific Name	Status*	Habitat	Suitable Habitat Present
Western prairie fringed orchid**	<i>Platanthera praeclara</i>	T	Moist to wet prairies and meadows	No habitat and no depletions anticipated

*T = Federally Threatened Species, E = Federally Endangered Species.

**Water depletions in the South Platte River may affect the species and/or critical habitat in downstream reaches in other counties or states.

Source: Service 2013.

Because of the association of Preble’s meadow jumping mouse (Preble’s), Colorado butterfly plant (CBP), and Ute ladies’-tresses orchid (ULTO) to wetland/riparian habitat along the Colorado Front Range, ERO evaluated the potential for these species to occur in the project area.

Preble’s Meadow Jumping Mouse

Typically, Preble’s occurs below 7,600 feet in elevation, generally in lowlands with medium to high moisture along permanent or intermittent streams and canals. Preble’s occurs in low undergrowth consisting of grasses and forbs, in open wet meadows, riparian corridors near forests, or where tall shrubs and low trees provide adequate cover. Preble’s typically inhabits areas characterized by well-developed plains riparian vegetation with relatively undisturbed grassland and a water source nearby.

ERO evaluated the project area and determined that suitable habitat is not present in the project area and Preble’s would not be affected by work in the project area because:

- Fourmile Canyon Creek is ephemeral and does not provide a consistent water source, which is typically associated with Preble’s.
- The project area is isolated from other known Preble’s populations by urban development. The nearest known Preble’s population is more than 3 miles away on Upper Bear Creek in El Dorado Canyon.
- A trapping survey was performed on Fourmile Canyon Creek within the project area in 1997 and Preble’s was not present.
- Developed land and the backyards of houses surround the project area.

Because of these reasons, it is unlikely that the project area supports a Preble’s population or that Preble’s moves through the corridor. Therefore, any work in the project area would have no effect on individual Preble’s or the continued existence of the species.

Ute Ladies’-Tresses Orchid

ULTO occurs at elevations below 6,500 feet in moist to wet alluvial meadows, floodplains of perennial streams, and around springs and lakes where the soil is seasonally saturated within 18 inches of the surface. Generally, the species occurs where the vegetative cover is relatively open and not overly dense or overgrazed.

ERO determined that the project area is not conducive to the establishment of ULTO and differs from the criteria of the Service's November 1992 *Interim Survey Requirements for *Spiranthes diluvialis** for the following reasons:

- Fourmile Canyon Creek is ephemeral and incised and does not support the type of subirrigated wetlands with which ULTO is typically associated.
- Most of the riparian corridor is heavily shaded by tree canopy and would likely preclude the shade-intolerant orchid.
- Dry uplands, dominated by introduced species, and developed land surround the project area.

Because of these reasons, it is unlikely the project area supports a ULTO population. Therefore, any work in the project area would have no effect on individuals or the continued existence of the species.

Colorado Butterfly Plant

The CBP is a short-lived perennial herb found in moist areas of floodplains. It occurs on subirrigated alluvial soils on level or slightly sloping floodplains and drainage bottoms at elevations from 5,000 to 6,400 feet. Colonies are often found in low depressions or along bends in wide, active, meandering stream channels that are periodically disturbed.

The Service has not established formal survey guidelines for the CBP, but has indicated that areas similar to, and slightly drier than, ULTO habitat should be assessed. ERO determined that CBP habitat does not occur at the project area because of an abrupt transition from channel to uplands and wet and mesic areas are lacking.

Other Sensitive Species and Wildlife

The habitat in the project area is typical for disturbed riparian habitat throughout the City and surrounding areas. Although this type of habitat supports more species of wildlife than habitats such as uplands or urban areas, no unique or particularly sensitive plant communities or wildlife species are present. Migratory birds make the most use of the project area and are protected by the Migratory Bird Treaty Act (MBTA).

Migratory Birds

ERO assessed the project area for potential habitat and the presence of species protected by the MBTA. Migratory birds, as well as their eggs and active nests, are protected under the MBTA. In addition to the MBTA, the Colorado Division of Parks and Wildlife (CPW) recommends establishing buffer areas around active raptor nests in which encroachment should be limited.

Migratory bird habitat typically includes trees and shrubs, but upland grasslands also are used for nesting. ERO did not observe any nests during the 2013 site visit, but the fully leafed-out condition of the trees prevented a thorough survey.

If the proposed project would require removing or disturbing trees and shrubs, a survey for active nests should be conducted prior to the work to ensure that active

migratory bird nests are not present. If an active raptor nest is present, the City should consult with the CPW to develop appropriate mitigation measures to minimize adverse effects.

Other Wildlife

During the 2013 site visit, three fawns were observed in the project area. As with any human development, including multipurpose trails, wildlife species sensitive to human disturbance are likely to decline in abundance or abandon the area, while other wildlife species adapted to urban development are likely to remain in the area. Species likely to decline would include some raptors and possibly coyotes. Species likely to increase would include red fox, raccoon, and great horned owl. Overall, surrounding and continuing development contributes to a decline in the number and diversity of wildlife species nearby and to a change in species composition to favor species that adapt better to human disturbance.

Conclusions

The Fourmile Canyon Creek riparian corridor provides habitat for a variety of wildlife. Riparian corridors are particularly important in urban areas where they are often used as movement corridors for larger mammals such as deer and for nesting by songbirds and raptors. Species that use riparian corridors in developed areas are typically common species tolerant of human encroachment. As a result, although diverse, most plant and wildlife species in urban riparian areas are not unique or uncommon.

Based on a review of background information, the 2013 site visit, and professional experience, ERO determined that significant natural resources that would make the project infeasible are not likely to be present in the project area. There is no suitable habitat for federally listed threatened or endangered species. Although there is suitable nesting substrate, no raptor nests were observed in the project area. It is likely that nests were present but were obscured from view by leaves. Because Fourmile Canyon Creek is ephemeral, there are almost no wetlands in the project area and the lateral extent of riparian trees and shrubs is limited due to encroachment.

The City's proposed project would not affect any unique or significant natural resources, but there would be impacts on regulated resources including Fourmile Canyon Creek and its riparian areas. These impacts would be addressed through the Clean Water Act Section 404 and City of Boulder Wetland permitting processes. In the event an active nest is present, the City would comply with the MBTA.

References

- Natural Resource Conservation Service (NRCS). 2013. Available at:
<http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>. Last accessed:
August 12, 2013.
- U.S. Fish and Wildlife Service (Service). 1992. Endangered and Threatened Wildlife and Plants: Final Rule to List the Plant *Spiranthes diluvialis* (Ute ladies'-tresses) as a Threatened Species. Federal Register 50 CFR Part 17; 57:12. pp. 2048-2054. January 17.

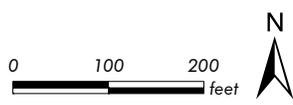
U.S. Fish and Wildlife Service (Service). 2013. Endangered, Threatened, Proposed
And Candidate Species, Colorado Counties. Last accessed: August 12, 2013.



Fourmile Canyon Creek

 Project area

Figure 1
Vicinity Map



Prepared for: City of Boulder
File: 1000-14 Figure 1 Fourmile.mxd [dlH]
August 14, 2013



APPENDIX C

UDFCD Evaluation of Sediment Basin Alternatives

MEMORANDUM

To: David Skuodas / UDFCD
Christie Coleman / City of Boulder

From: Jim Wulliman / Muller Engineering Company
Derek Johns / Muller Engineering Company

Date: September 19, 2012

Project #: 12-033.01

Re: Evaluation of Fourmile Canyon Creek Sediment Basin Alternatives



Muller Engineering Company, Inc.
Consulting Engineers

777 S. Wadsworth Blvd. #4-100
Lakewood, Colorado 80226
303/988-4969 FAX
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Introduction

This memorandum documents an evaluation of alternatives to create a sediment basin along Fourmile Canyon Creek upstream of Broadway Street. Four potential locations/configurations for a sediment basin were examined. Conceptual layouts of the four alternatives were drawn and the alternatives were compared in terms of basin volume and surface area, sediment trap efficiency, probable construction cost, utility impacts, and property issues.

Alternatives

Appendix A includes a key map indicating the locations of the four alternative sediment basins and drawings showing each alternative configuration, described briefly as follows.

Alternative 1. Alternative 1 is located immediately upstream of the trailer park at Rosewood Street and is proposed as an off-line basin south of the creek. The basin would be constructed just south of the existing concrete trail and north of the new Rosewood residential development, currently in the planning stages. The conceptual layout of this basin shows an inlet and outlet conduit sized for the 2-year peak flow (58 cfs). Flows greater than the 2-year event would generally bypass the sediment basin (some flow in excess of the 2-year event would pass through the basin due to higher headwater at the inlet conduit). The basin would normally be empty, but would fill to a depth of approximately three feet or more during storms and drain over a period up to about 40 hours. Emergency flows would pass over a low point in the concrete trail and enter Fourmile Canyon Creek. The basin would be provided with a hard-lined forebay and combined micropool/water quality outlet structure.

Alternative 2. Alternative 2 is also located immediately upstream of the trailer park at Rosewood Street, but is proposed as an on-line basin, allowing all the creek flows to pass through it. The basin would be constructed as a wider section of the creek with a reduced slope and a nominally three foot high downstream sill. The existing concrete trail would be relocated to the south, closer to the new Rosewood residential development, to allow more room for the sediment basin. The conceptual layout of this basin shows a drop structure at the upstream end and the sill at the downstream end. The basin would normally be empty, but would fill to a depth of approximately three feet or more during storms and drain over a period up to about 40 hours. Emergency flows would pass over the downstream sill. The basin would be provided with a hard-lined forebay and combined micropool/water quality outlet structure.

Alternative 3. Alternative 3 is located upstream of Alternatives 1 and 2 east of 8th Street and north of an existing irrigation ditch. Alternative 3 is proposed as an off-line basin and is

essentially a much larger version of Alternative 1. The basin would be constructed just south of the existing concrete trail and north and east of an existing residential development. Like Alternative 1, the conceptual layout of this basin shows an inlet and outlet conduit sized for the 2-year peak flow (58 cfs). Flows greater than the 2-year event would generally bypass the sediment basin (some flow in excess of the 2-year event would pass through the basin due to higher headwater at the inlet conduit). The basin would normally be empty, but would fill to a depth of approximately three feet or more during storms and drain over a period up to about 40 hours. Emergency flows would pass over a low point in the concrete trail and enter Fourmile Canyon Creek. The basin would be provided with a hard-lined forebay and combined micropool/water quality outlet structure.

Alternative 4. Alternative 4 is located furthest upstream of the four alternatives within Boulder Open Space property. Alternative 4 is proposed as an on-line basin, allowing all the creek flows to pass through it. The basin would be constructed with a six-foot drop structure leading into it and a four-foot drop at the downstream end, directing flows back into the creek. The basin bottom would be excavated to a point approximately three feet below the crest of the downstream drop structure. The basin would normally be empty, but would fill to a depth of approximately three feet or more during storms and drain over a period up to about 40 hours. Emergency flows would pass over the downstream drop. The basin would be provided with a hard-lined forebay and combined micropool/water quality outlet structure.

Floodplain Considerations

Each of the four alternative configurations for the proposed Fourmile Canyon Creek sediment basin is located within the 100-year floodplain according to the Phase A report for the Fourmile Canyon Creek and Wonderland Creek Master Plan. This report was prepared in 2006 by Love and Associates for UDFCD and the City of Boulder. The report shows several spills from the Fourmile Canyon Creek floodplain south to the Wonderland Creek floodplain in the vicinity of the proposed sediment basin and generally recommends maintaining these spills, neither significantly increasing nor decreasing them. The report also shows structures in the Fourmile Canyon Creek floodplain and in the spill zones in the vicinity of Alternatives, 1, 2, and 3.

Because each of the alternatives is located within the floodplain and since structures are in the floodplain and the predicted spills are so sensitive, any sediment basin alternative would need to undergo detailed hydraulic modeling and design analysis to ensure that any floodplain impacts are either avoided or minimized and addressed. Of the alternatives, the design of Alternative 3 may be the most challenging from a floodplain impact perspective, since it is located right at one of the major spill points.

Appendix B includes a figure from the Phase A report of the master plan that shows the Fourmile Canyon Creek floodplain and spill points. The four alternative sediment basin locations have been sketched on this figure.

Sediment Trap Efficiency

A study of sedimentation in Fourmile Canyon Creek was documented in a report entitled *Sediment Analysis Report – Four Mile Canyon Creek Downstream of 30th Street* prepared by Moser & Associates in October, 2008 for UDFCD and the City of Boulder. The report provided calculations that indicated that a sediment basin surface area of 1400 SF would be necessary to capture 95% of inflowing sands and gravels during an 80th percentile event. The report also

provided a rough estimate of sediment load from the upstream watershed of 100 tons per square mile per year.

Upon review of the trap efficiency equation used in the sediment analysis report, it was found that the equation is based on ideal settling conditions. An alternate equation for trap efficiency is presented in an EPA document entitled *Methodology for Analysis of Detention Basins for Control of Urban Runoff Quality*, dated September, 1986. This equation, shown below, includes a parameter, n, that reflects the degree of turbulence or short-circuiting, which tends to reduce removal efficiency.

$$\text{Trap Efficiency } R = 1 - (1 + 1/n \cdot v_s / (Q/A))^{-n}$$

where Q/A = rate of applied flow divided by surface area of basin (overflow rate)

v_s = settling velocity of particles

n = turbulence or short circuiting parameter

The document suggests these values for n.

n=1	Very poor performance
n=3	Good performance
n=5	Very good performance
n>100	Ideal performance

For the purposes of this evaluation, n=1 was used for online sediment basins and n=2 was used for off-line basins. Trap efficiency was calculated for coarse (0.7 mm) sand (same as 2008 study) and was also checked for medium (0.354 mm) sand and very fine (0.177 mm) sand. Curves of trap efficiency based on a 2-year runoff event (58 cfs based on the 2008 study) and these sediment sizes are shown in Appendix C.

Based on the sediment loading rate of 100 tons per square mile identified in the 2008 report, a watershed area of approximately 8 square miles, and an assumed sediment unit weight of 100 pounds per CF, the annual sediment load in Fourmile Canyon Creek is approximately 593 CY per year. Since the sediment yield estimate in the 2008 report was made before the fire, there is a chance that this load could be exceeded.

Trap efficiency estimates for each of the four alternatives and information on surface area and volume of the basins are shown in the table on the next page. For the two off-line alternatives, it was assumed that 70 percent of the inflowing sediment load would enter the basins through the 2-year inflow conduit and 30 percent would bypass during larger events. The summary table shows that the smallest amount of sediment trapped would be associated with Alternative 1 and progressively more would be captured in Alternatives 3, 2, and 4, respectively.

Opinion of Probable Costs

Concept-level opinions of probable construction costs were developed for each sediment basin alternative. A breakdown of these costs, including a 20% contingency allowance, is provided in Appendix D. The probable costs are summarized in the table on the next page.

Table 1. Fourmile Canyon Creek Sediment Basin Alternative Comparison

Alternative	1	2	3	4
Type	Offline	Online	Offline	Online
n	2	1	2	1
Surface Area, SF	1885	6152	20956	12318
Basin Volume, CY	81	363	1703	925
Sediment Size	Very Fine Sand	Very Fine Sand	Very Fine Sand	Very Fine Sand
Trap Efficiency	74%	86%	95%	92%
Annual Sediment Load, CY	593	593	593	593
Annual Sediment Load Entering Basin, %	70%	100%	70%	100%
Annual Sediment Load Entering Basin, CY	415	593	415	593
Annual Sediment Trapped, CY	307	510	394	545
Annual Sediment Bypassed, CY	286	83	199	47
Effective Trap Efficiency	52%	86%	67%	92%
Volume of Annual Sediment Trapped as Percent of Basin Volume	380%	140%	23%	59%
Concept-level Opinion of Probable Cost	\$275,790	\$365,250	\$454,860	\$435,360
Cost per CY of Annual Sediment Load Trapped	\$898	\$717	\$1,154	\$799

Utility Impacts

Appendix E shows existing water (in blue) and sewer (in yellow) utilities in the vicinity of the sediment basin alternatives. Existing water and sewer lines in the area are in closest proximity to Alternative 3. The approximate locations of water and sewer lines are shown on the drawing of Alternative 3 in Appendix A. The sewer line, since it crosses under Fourmile Canyon Creek, is likely to be low enough not to be impacted by the construction of the Alternative 3 sediment basin. However, it is possible that the proposed configuration could conflict with or reduce cover over the water line.

Property Issues

Appendix E also indicates City of Boulder limits in the vicinity of the proposed sediment basins. The limits are shown on the sediment basin concept drawings in Appendix A. A portion of Alternative 1, 2, and 3 lie outside of City limits within Boulder County jurisdiction. It needs to be determined how significant this inter-jurisdictional issue is.

The portion of Alternative 3 that is in City property lies within a drainage and floodplain tract associated with the residential development located along 7th and 8th Streets. Alternative 4 lies wholly within the City, but on land managed by Boulder Open Space. One of the next steps in the evaluating the feasibility of the four sediment basin locations is to assess the property issues associated with each alternative.

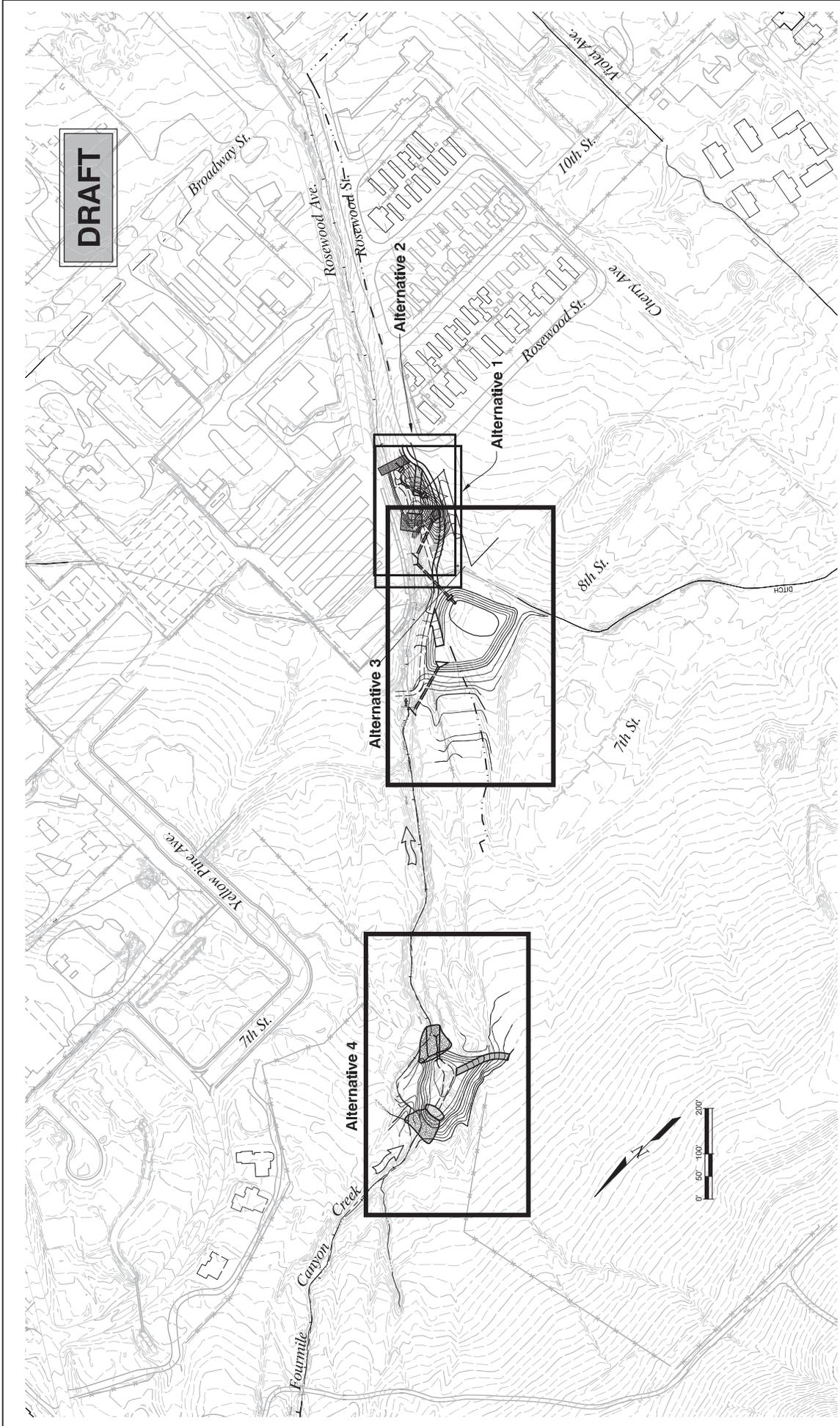
Conclusions

Property issues aside, the evaluation indicates that the preferred sediment basin configuration is Alternative 4, followed by Alternative 2. Alternative 1 is very small and has limited sediment trapping potential. Alternative 3 faces design challenges associated with being located at a floodplain spill point.

Alternative 4 has the greatest estimated overall trap efficiency and, compared to Alternative 2, has more capacity to store accumulated sediment, reducing the required frequency of cleaning. Alternative 4 is located in an open area furthest away from existing buildings and trails. Alternative 4 could be laid out to preserve the riparian vegetation associated with the existing creek and the facility itself could be designed to appear fairly natural. Alternative 4 requires coordination with the property owner, Boulder Open Space and Mountain Parks, to see if the sediment basin would be an acceptable use of the land.

Alternative 2 seems to be the second best choice for a sediment basin location. It would provide the second greatest sediment trapping efficiency, but is smaller and more constrained than Alternative 4, may present more challenges in avoiding floodplain impacts, and disturbs the mainstem reach of the creek more than Alternative 4. Alternative 2 has less sediment storage capacity than Alternative 4 and would need to be maintained more often. On the other hand, Alternative 2 has a lower opinion of probable cost than Alternative 4. Alternative 2 requires coordination with Boulder County to make sure that a sediment basin can be built in an area split between City and County jurisdiction.

DRAFT



DATE: SEPT. 13, 2012
 DRAWING NO.:
 SHEET NO.: 1 OF 5

**Sediment Basin
 Key Map**

**FOURMILE CANYON CREEK
 UPSTREAM OF BROADWAY**



CITY OF
 BOULDER



PREPARED FOR:
 URBAN DRAINAGE AND
 FLOOD CONTROL
 DISTRICT

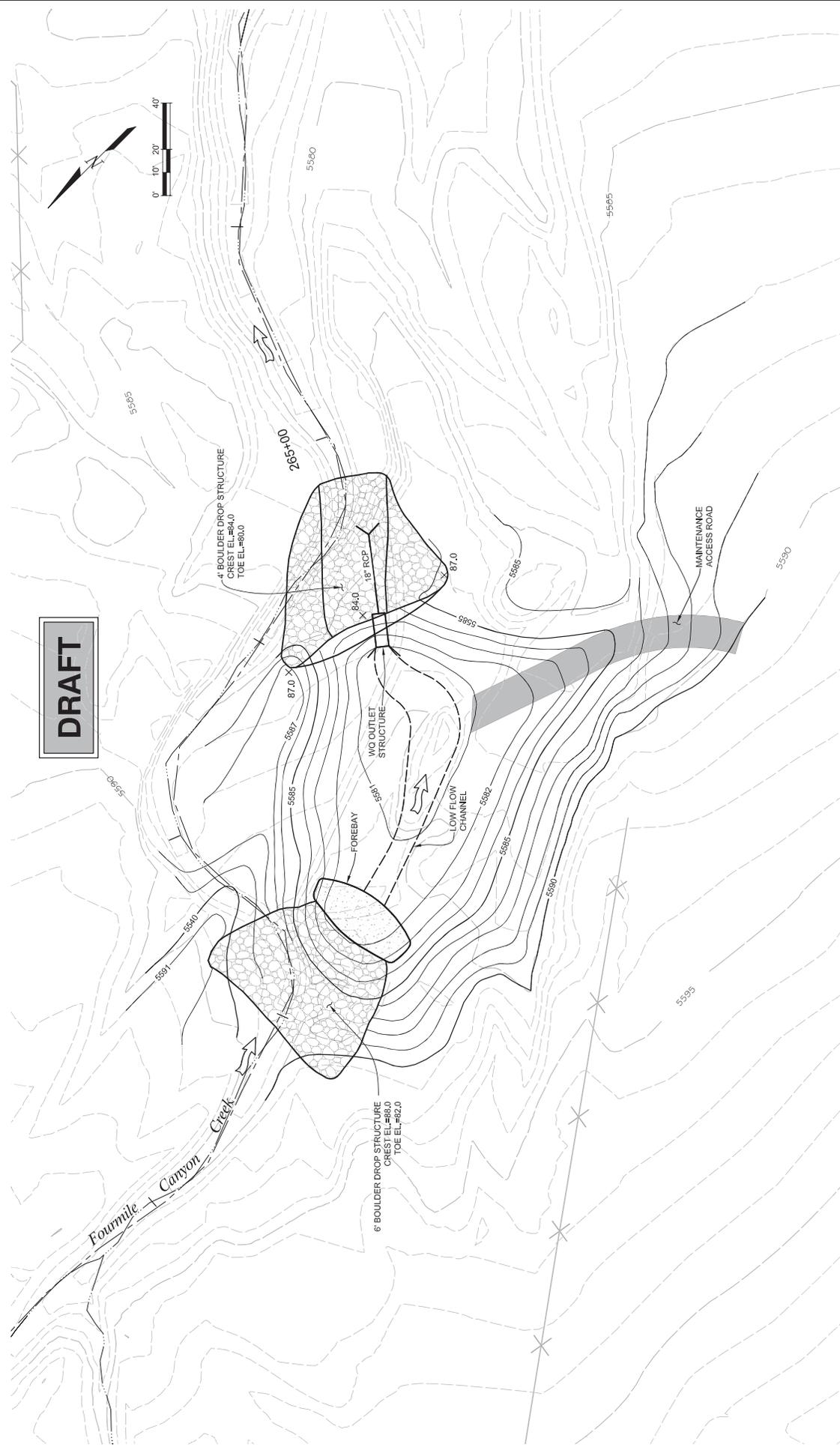
DESIGN:
MULLER ENGINEERING CO., INC.
 CONSULTING ENGINEERS
 777 S. WADSWORTH BLVD. STE. 4-100
 LAKEWOOD, COLORADO 80226
 (303) 964-4959

DRAWN:
 CHECK:

APPRO: MEC PROJECT NO. 12033501

NO.	DATE	REVISIONS

DRAFT



DATE	SEPT. 13, 2012
	DRAWING NO.
SHEET NO.	3 OF 5
Sediment Basin Alternative 4	
FOURMILE CANYON CREEK UPSTREAM OF BROADWAY	
 CITY OF BOULDER	
 URBAN DRAINAGE AND FLOOD CONTROL DISTRICT	
DESIGN	MULLER ENGINEERING CO., INC. CONSULTING ENGINEERS 777 S. WADSWORTH BLVD. STE. 4-100 LAKEWOOD, COLORADO 80226 (303) 964-4959
DRAWN	
CHECK	
APPR	MEC PROJECT No. 1203301
REVISIONS	
NO.	DATE

APPENDIX D

CEA Per Review Committee Comments

CEAPER REVIEW COMMITTEE MEETING – MONDAY, APRIL 11TH 2016

Attendees

Valerie Matheson	Ryan Martin	Jennifer Pinsonneault
Mike Sweeny	Chris Meschuck	Edward Stafford
Annie Noble	Doug Godfrey	Ward Bauscher
Christin Shepherd	Gerrit Slatter	Don Damico

CEAPER Review Question #1

Does Staff agree with the impact assessment?

- Is the analysis complete and accurate?
- Are there issues not identified in the CEAP?
- Are there follow-up questions or issues that need to be addressed?

Answers to Question #1 and Responses

Did we recognize other critical facilities? Make sure they are all captured.

Additional critical facilities have been identified and added to the list on page 2 of the CEAP document. These additional critical facilities include Shining Mountain Waldorf and New Horizons Cooperative Preschool.

It is not accurate to say “safe access”, as we cannot completely guarantee safe access during a major storm event. Refine wording to say either improved or safer access.

The wording ‘safe access’ within the document has been revised to ‘safer access’. The presentation will also be worded as ‘safer access’.

Option 2A has more impacts in the riparian area. Add language about impacts to wildlife.

A paragraph was added to page 20, in the preferred alternative section that describes construction and post-construction impacts to wildlife and habitat for the multi-use path options.

The wording: “Once in place, the proposed multi-use path alignment will have some disturbance impacts to wildlife along the stream corridor” was also added to the impact assessment checklist question response (A.1 and A.2).

Page 10 - why does FM7 not have a BCR? Include more narrative about this.

Previous CEAP’s do not include a BCA and staff has removed the BCR analysis from this CEAP. BCA typically relies on property damage, where the benefits of this CEAP’s recommendations extend beyond protection of property to life safety, flood emergency response and safer access to critical facilities. Document text has been updated accordingly

FM7 Costs do not entirely make sense with the 2011 MDP. Please explain.

The alternative section describing FM7 has been updated to include variations in cost from the 2011 MDP and the alternative outlined in this CEAP document.

Make sure it is clear why the major detention options were removed.

This comment was made in reference to the presentation itself. When we present to WRAB, GAC, and City Council there will be more information about the flood mitigation options and why we removed them in the presentation itself.

Table 1 on page 13; add critical facilities and vehicular access?

Table 1: Summary of Major Issues for Flood Mitigation Alternative has been updated with CIP Prioritization Guiding Principles & Greenways Objectives including safer access to critical facilities, habitat impacts, and coordination with greenways objectives.

Are there any business impacts? What about impacts north of creek west of Broadway?

There are no business impacts or impacts to the north of the creek west of Broadway.

CEAPer Review Question #2

Does staff agree with the preferred alternative as identified by the project manager?

- Are the trade-offs of the preferred alternative acceptable?
- Are there potential conflicts with other CIP projects?
- Are there potential regulatory issues that need to be resolved prior to final design and construction?

Answers to Question #2 and Responses

Yes. Coordination with CIP projects will be critical for this project including OSMP, Parks, Transportation, and GoBoulder.

CEAPer Review Question #3

Are there community issues or public process considerations that should be addressed?

Terminology – use multi-use path instead of bikeway, trail, etc.

Goes to GAC for decision on May 17th, 2016.

CEAPer Review Question #4

Is the CEAP ready for board review?

As amended, yes.

Additional Comments

There is a social trail from foothills community to path; can we include it in this CEAP?

This social trail is across private property (Boulder Housing Partners) and is shown in OSMP's North Trail Study as a non-OSMP Managed Multi-Use Trail heading west and connecting with an OSMP Multi-Use Trail. You can see a map of the North TSA here: https://www-static.bouldercolorado.gov/docs/NorthTSA_Basemap-1-201508061519.pdf

At 19th & Upland, the house is close to the trail. Are we coordinating with the property owner?

The project manager has been in contact with this property owner and is trying to work out a way for him to still have development and still get an easement.

Show a larger channel for HHZ containment, which contains the flow, but then where the flows go has not been resolved.

In Appendix A, ICON Figure 22 illustrates High Hazard containment west of Broadway.

Other Additions and Revisions to Document

- *Multi-Use path costs have been updated (see table 4)*
- *Jeff Haley, Parks & Recreation, edited text to Sediment Capture at Violet Park (page 21)*
- *Don Damico, OSMP, edited text to Sediment Capture West of Broadway on OSMP Property (page 21)*
- *Don Damico, OSMP, requested that coordination with OSMP be mentioned in section 6.0. Text has been added accordingly.*