

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

MEETING DATE: September 15, 2014

AGENDA TITLE: Public hearing and consideration of a recommendation to City Council to adopt the Skunk Creek, Bluebell Creek and King’s Gulch Floodplain Mapping Update

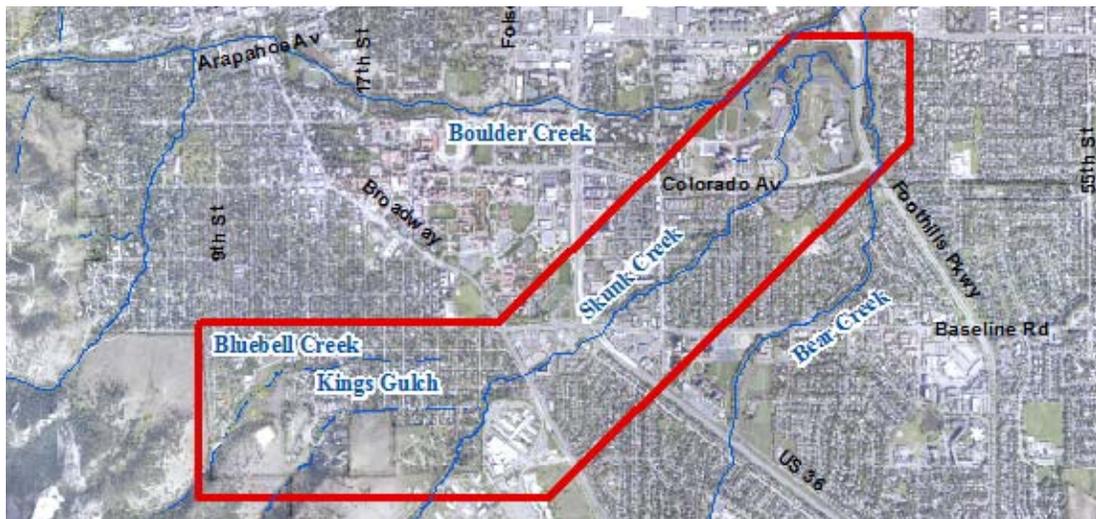
PRESENTER/S:

Jeff Arthur, Director of Public Works for Utilities
Bob Harberg, Principal Engineer - Utilities
Annie Noble, Flood and Greenways Engineering Coordinator
Katie Knapp, Engineering Project Manager

EXECUTIVE SUMMARY

Floodplain mapping provides the basis for flood management by identifying the areas subject to the greatest risk of flooding. This information is essential for determining areas where life safety is threatened and property damage is likely and is the basis for floodplain regulations and the National Flood Insurance Program (NFIP). The city’s floodplain maps need to be periodically updated to reflect changes in the floodplain resulting from land development, flood mitigation improvements, new topographic mapping information and new mapping study technologies.

The Skunk Creek Floodplain Mapping Update includes the King’s Gulch, Skunk and Bluebell Canyon Creek floodplains between the city limits to east of Foothills Parkway where Skunk Creek confluences into Bear Canyon Creek as shown in red below.



Engineering consultants provided hydraulic modeling to update the existing Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) and City of Boulder floodplains, water surface elevations, conveyance and high hazard zones.

The proposed mapping of the Skunk Creek Floodplain would result in a net:

- Increase of 44 structures identified in the 100-year floodplain;
- Decrease of 27 structures identified in the conveyance zone and;
- Decrease of 17 structures identified in the high hazard zone.

STAFF RECOMMENDATION:

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

Motion to recommend that City Council adopt the Skunk Creek floodplain mapping update including potential additional refinements made prior to Council's consideration.

COUNCIL FILTER IMPACTS:

- Economic: Flood insurance is required for properties located in the 100-year floodplain if they are financed by a federally-backed mortgage. Flood insurance rates are set by FEMA based on the flood risk as shown on the flood insurance rate maps. Accurate floodplain mapping helps facilitate accurate flood insurance rates. The average annual rate for flood insurance within the city in 2013 was \$760 (3,830 policies). Flood protection land use regulations also create costs for the property owners in the form of permit fees, increased costs of remodeling and restrictions on development. Flood insurance and land use regulations do, however, provide protection from potentially catastrophic losses due to floods.
- Environmental: Flood events can result in damage or destruction to buildings and corresponding release of man-made contaminants. Flood waters can also cause erosion and damage to areas of the natural environment that are not capable of conveying high-velocity stormwater. The updated mapping will more accurately identify the areas with the greatest flooding risks.
- Social: Floodplain mapping provides the basis for flood management by identifying the areas subject to flooding. This information is essential for determining areas where life safety is threatened and property damage is likely. Land use regulations help reduce risks to people and property in these high flood-risk areas. Accurate mapping of flood risks also helps implement effective flood preparedness and response programs, thereby increasing the safety of people living, working or visiting the City of Boulder.

OTHER IMPACTS:

- Fiscal: Funding for this study is included in the Department of Public Works Utilities Division budget.
- Staff Time: Time for completing the study is included in existing work plans.

BOARD AND COMMISSION FEEDBACK

The Skunk Creek floodplain mapping was presented to the WRAB as an information item on August 18, 2014. The board requested that staff continue to work with the public to inform them about the proposed floodplain mapping and address comments and concerns. It was also requested that information about FEMA's Letter of Map Amendment (LOMA) process be made available on the city's website. Staff is continuing to work with the public and will provide additional notification letters prior to Council consideration of the mapping study. Information about FEMA's LOMA process has also been included on the project website.

After WRAB considers the mapping update, it will be provided to the Planning Board as an informational item and then presented to City Council for their consideration.

PUBLIC FEEDBACK

Public notification post cards about the mapping update have been sent to all property owners in the study area and a project web site has been developed to provide information (<https://bouldercolorado.gov/water/skunk-creek-floodplain-mapping-update>).

An open house was held on August 18, 2018 immediately prior to the WRAB meeting to inform the public about the mapping update and hear comments and concerns about the study. Staff has also met with residents in person and responded to phone calls and emails. In general, most of the comments and questions have been about impacts to specific properties and requests for more detailed information such as proposed base flood water elevations. There were also concerns about the high hazard zone delineations and the distribution of the Bluebell Canyon Creek split flow paths downstream of 15th St. In response to the public feedback, the high hazard zone delineations have been re-evaluated and refined. The flow distribution at 15th Street has also been reviewed. At this time, changes have not been made in this area, but staff is working with the engineering consultant to re-evaluate the flow distribution and revisions may be forthcoming. A summary of the public feedback is provided in **Attachment A**.

BACKGROUND

The risk of flash flooding is an important issue for the City of Boulder primarily due to its location at the mouth of Boulder Canyon and other canyon creeks. Approximately 13 percent of the city is located within the 100-year floodplains of Boulder Creek and its 14 tributaries. Additional information about the city's floodplain management program, floodplain regulations and flood insurance can be found at: [Floodplain Management Overview](#).

The city delineates four flood zones:

500-year floodplain: The 500-year floodplain delineates the flood limits resulting from a storm that has a 0.2 percent chance of occurring in any given year.

100-year floodplain: The 100-year floodplain delineates the flood limits resulting from a storm that has a one percent chance of occurring in any given year (26 percent chance over a 30-year mortgage).

Conveyance zone: The conveyance zone is defined as the areas in the floodplain that are reserved for the main passage of the entire 100-year flood flow when the 100-year floodplain is artificially narrowed until a maximum six-inch increase in flood water depth is created. This zone is delineated to allow development to occur up to the narrowed floodplain and still provide passage of 100-year storm flows.

High hazard zone: The high hazard zone defines the area of the floodplain where water depth and velocity pose a threat to life and safety. This area is delineated for areas in the floodplain where water depths are four feet or greater or where the water velocity multiplied by water depth equals or exceeds the number four.

Skunk Creek, Bluebell Canyon Creek, and Kings Gulch were first studied in 1987 by the consulting firm Greenhorne & O'Mara and the resulting Flood Hazard Area Delineation (FHAD) report included the delineation of the 100-year floodplain along these creeks. The Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM) approved for these creeks were originally based on the 1987 FHAD and included a federally-regulated one foot rise floodway. Since that time, both the City of Boulder and the State of Colorado have adopted a ½ foot rise floodway, which the City refers to as the Conveyance Zone.

In 1989, Love and Associates delineated the High Hazard Zone and City of Boulder Conveyance Zone (½ foot rise floodway). The delineations were based on the hydraulic models used in the 1987 FHAD.

On May 6, 1991, FEMA issued a Letter of Map Revision (LOMR) for Skunk Creek to incorporate the results of a channel improvement project. The limit of the LOMR was in the University of Colorado's Research Park, downstream of Colorado Avenue to just upstream of the confluence of Boulder Creek.

Several road-crossing structures for Skunk Creek have been improved since the regulatory floodplain was adopted in 1991. Culverts at Broadway and at 27th Way, crossings at Anderson Ditch and the cemetery maintenance road, and the low water crossing upstream of 27th Way were not included in the 1991 regulatory model, but were incorporated into the current mapping study.

The City initially contracted with Belt Collins to develop the updated floodplain maps but they closed their Boulder office in 2013. ICON Engineering provided a peer review of Belt Collin's 2011 initial study and was selected to complete the project.

In 2013, the city acquired state-of-the-art Light Detection and Ranging (LiDAR) technology to produce high-resolution topographic mapping. The new LiDAR mapping was compared to the 2003 topographic base mapping and areas showing substantial differences were updated in the hydraulic models.

ANALYSIS

This mapping study updates the hydraulic models and flood hazard mapping for the 100-year floodplain, Conveyance and High Hazard Zones for the entire reach of Skunk Creek, including the King's Gulch, and Bluebell Canyon Creek tributaries.

A 2-dimensional hydraulic model was developed for the creek system to determine primary flow paths and split flow areas. Information from the 2-dimensional model was used as a "roadmap" to develop the conventional 1-dimensional hydraulic model used for the analysis.

The existing 100-year floodplain for Skunk Creek, King's Gulch and Bluebell Canyon Creek is primarily along the creek corridors and roadway areas with some spillage into surrounding properties. The proposed 100-year floodplain is more extensive than the existing mapping in most areas and bears resemblance to the September 2013 flood extents. The September 2013 flood extents were not used to delineate the floodplains but were used to check assumptions on flow paths. For Skunk Creek, King's Gulch and Bluebell Canyon Creek, the September 2013 flood extents are similar to the proposed floodplain mapping.

The existing Conveyance and High Hazard Zone mapping for Bluebell Canyon Creek and King's Gulch did not include a significant neighborhood area that has a history of flooding east of 15th Street. The proposed mapping extends the Conveyance and High Hazard Zones through this residential area to their confluence with Skunk Creek along Broadway. The proposed mapping also extends the Conveyance and High Hazard Zones for Skunk Creek north of Broadway to include more roadways, split flows and other areas not previously mapped.

The revised mapping indicates that the flood risk impacts more structures in the Skunk Creek Drainage Basin than was shown in the previous mapping. A majority of the structures newly identified as being at risk are located within the bounds of 15th Street to the east, Broadway to the west, Baseline to the north and King Avenue to the south. This area experienced significant damage during the September 2013 flood.

Attachments B through D present figures showing a comparison between existing and proposed floodplain mapping. A summary of how these changes impact existing structures is included in **Attachment E**.

NEXT STEPS:

Following input from the WRAB, the floodplain mapping study will be finalized and then considered by City Council. If City Council approves the map revisions, the city will submit a request to FEMA for review. During the FEMA review and approval process it is recommended that the new mapping be used for regulatory purposes by regulating to the more restrictive of the existing and proposed mapping. This would mean that development within the newly identified flood zones would be subject to the city floodplain regulations. In order to comply with FEMA requirements, development

within the areas that are being removed from the floodplain would still be subject to the city's floodplain regulations until FEMA officially adopts the new floodplain mapping. Following formal adoption by FEMA, the city would regulate solely based on the new mapping.

ATTACHMENTS

- A. Public Comments
- B. Existing and Proposed 100-Year Floodplain
- C. Existing and Proposed Conveyance Zone
- D. Existing and Proposed High Hazard Zone
- E. Summary of Impacts to Existing Structures



Skunk Creek, Bluebell Canyon Creek and King's Gulch Remapping Study Public Comment Summary

Open House Date: Aug. 18, 2014

Open House Meeting Location: Municipal Building Lobby

Number of attendees that signed-in: 23

Staff in Attendance:

Robert Harberg

Katie Knapp

Kristin Dean

Laurel Olsen-Horen

Douglas Sullivan

Public Comments:

1. **Location:** 2042 Baseline

Commenter: Property owner (Ben Chancellor; Christina Jurgens)

Comment: Did not see flooding in September 2013 and do not feel that the high hazard designation is warranted; question split values for Mariposa vs. Columbine

Response: The high hazard zone delineations have been refined based on a review of adjacent grades. Adjacent to the structure at 2042 baseline, the delineation was revised such that the structure sits just outside of the high hazard zone. Split flow values for Mariposa and Columbine are being re-evaluated using 2D modeling to see if the September flood event can be more closely replicated in the modeling. It should be noted that the September 2013 flooding reflected a lower intensity and longer duration storm compared to the regulatory 100-year design storm that is a significantly higher intensity but shorter duration storm. This difference in storms can result in significant differences between the regulatory 100-year floodplain mapping and what was experienced in the September flood event.

2. **Location:** Area south of Baseline Road between 20th and Broadway

Commenter: Several property owners

Comment: Flooding in September 2013 was confined to streets; no flow behind homes; water did not appear to be originating from Bluebell Canyon Creek proper.

Response: Split flow values for Mariposa and Columbine are being re-evaluated using 2D modeling to see if the September flood event can be more closely replicated in the modeling. It should be noted that the September 2013 flooding reflected a lower intensity and longer duration storm compared to the regulatory 100-year design storm that is a significantly higher intensity but shorter duration storm. This difference in storms can result

ATTACHMENT A: PUBLIC COMMENT SUMMARY

in significant differences between the regulatory 100-year floodplain mapping and what was experienced in the September flood event.

3. **Location:** 22nd and Mariposa Avenue
Commenter: Several property owners
Comment: Flows traveling east on Mariposa turned north on 22nd Street and continued to Columbine Avenue; this is not shown as 100-year flooding.
Response: This flow path has been added to the documentation of the September flood event. The portion of 22nd Street between Mariposa and Columbine is shown as shallow flooding (Zone X) for the proposed floodplain. The proposed floodplain mapping in this area is being re-evaluated.
4. **Location:** 19th and Mariposa Avenue
Commenter: Property owner
Comment: structure at south east corner is shown in the 100-year floodplain but did not experience damage during the September 2013 event; please review assumptions here.
Response: Split flow values for Mariposa and Columbine are being re-evaluated using 2D modeling to see if the September flood event can be more closely replicated in the modeling. It should be noted that the September 2013 flooding reflected a lower intensity and longer duration storm compared to the regulatory 100-year design storm that is a significantly higher intensity but shorter duration storm. This difference in storms can result in significant differences between the regulatory 100-year floodplain mapping and what was experienced in the September flood event.
5. **Location:** 955 Quinn Street
Commenter: Property owner (Lee Payne)
Comment: Structure does not show as impacted on floodplain maps (tree cover issue?); how was floodplain delineated at corner of Denton Avenue and Quinn Street.
Response: Due to the large amount of tree cover, the structure was inadvertently excluded from the proposed floodplain map exhibit. The maps have been corrected to show the principal structure located outside of the proposed 100-year floodplain.
6. **Location:** 3130 Aurora
Commenter: Property Owner
Comment: It seems like the HHZ could be the result of a small depression that we may not want to include in the mapping.
Response:
7. **Location:** 1700 Bluebell
Commenter: Property Owner (Bill Mooz)
Comment: Structure is shown as in proposed floodplain but was not impacted by September 2013 event; wants to know why actual data was disregarded.

ATTACHMENT A: PUBLIC COMMENT SUMMARY

Response: The September 2013 flooding reflected a lower intensity and longer duration storm compared to the regulatory 100-year design storm that is a significantly higher intensity but shorter duration storm. This difference in storms can result in significant differences between the regulatory 100-year floodplain mapping and what was experienced in the September flood event. Split flow values for Mariposa and Columbine are being re-evaluated using 2D modeling to see if the September flood event can be more closely replicated in the modeling.

8. **Location:** 1849 Mariposa Ave,

Commenter: Property Owner (Steve Brown, Guen Simons)

Comment: Water from Bluebell creek did not flow to Mariposa. It flowed down the Bluebell drainage but primarily to the north along 19th Street and down Columbine.

Response: Split flow values for Mariposa and Columbine are being re-evaluated using 2D modeling to see if the September flood event can be more closely replicated in the modeling. It should be noted that the September 2013 flooding reflected a lower intensity and longer duration storm compared to the regulatory 100-year design storm that is a significantly higher intensity but shorter duration storm. This difference in storms can result in significant differences between the regulatory 100-year floodplain mapping and what was experienced in the September flood event.

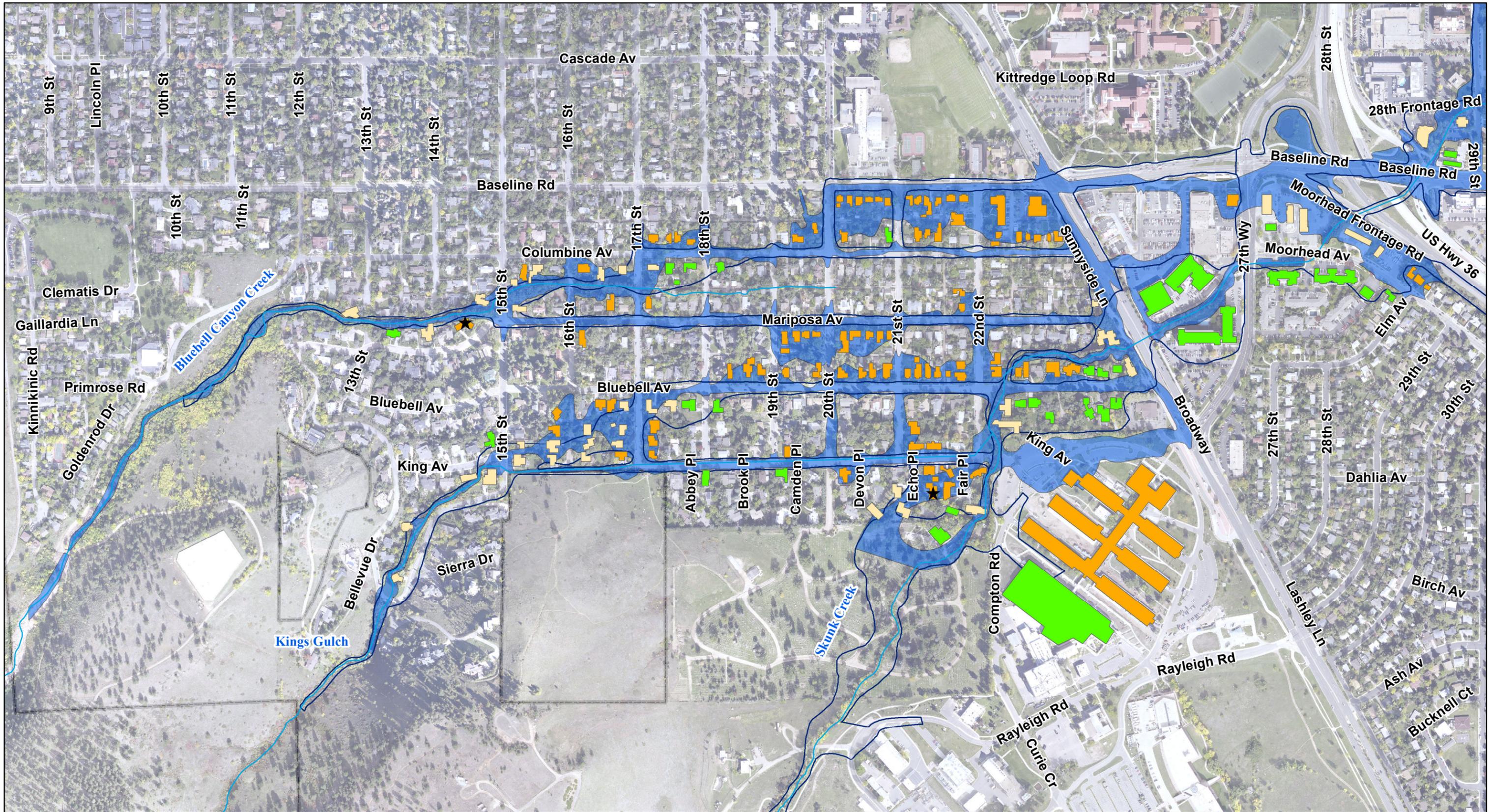
9. **Location:** 2100 Baseline

Commenter: Property Owner (Jamie Karpohl)

Comment: a) There were no eastbound flows observed on Columbine west of 20th Street. b) The flooding at 20th and Columbine originated from the Anderson ditch on the north side of Columbine. This water flowed through properties to the north-east and down the Columbine North alley towards 21st. At 21st the flows split - continuing down the alley and heading north towards Baseline. c) During the flood, there was no flow observed coming down Columbine west of 20th. The only flows observed in Columbine were from Anderson ditch on the north side of the street. When I visited the location of Bluebell Canyon Creek at 15th St. on the morning of September 14th, I observed all of the flow heading down Mariposa. I did not observe any man-made diversions at this location.

Response: a) The city has received conflicting information about the flooding observed along Columbine between 19th and 20th Streets. At this time the flood extent documentation shows this area as having flows that came north from Mariposa along 19th Street and then continuing east on Columbine. The documentation of the September 2013 flood extents will continue to be refined as additional information is received.

b) Split flow values for Mariposa and Columbine are being re-evaluated using 2D modeling to see if the September flood event can be more closely replicated in the modeling. It should be noted that the September 2013 flooding reflected a lower intensity and longer duration storm compared to the regulatory 100-year design storm that is a significantly higher intensity but shorter duration storm. This difference in storms can result in significant differences between the regulatory 100-year floodplain mapping and what was experienced in the September flood event.



Legend

	Proposed Skunk Creek 100 Year Floodplain		Buildings Newly Affected by 100 Year Floodplain (110)		Creek
	FEMA Effective 100 Year Floodplain		Buildings Remaining in the 100 Year Floodplain (117)		City Limits
	Revised Boulder Creek 100 Year Floodplain		Buildings No Longer Affected by 100 Year Floodplain (61)		LOMR

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Skunk Creek

Proposed 100 Year Floodplain
Compared to FEMA Effective
Map 1 of 2

CITY OF BOULDER
Utilities Division
Rev. 9/8/2014



Legend

	Proposed Skunk Creek 100 Year Floodplain		Buildings Newly Affected by 100 Year Floodplain (110)		Creek
	FEMA Effective 100 Year Floodplain		Buildings Remaining in the 100 Year Floodplain (117)		City Limits
	Revised Boulder Creek 100 Year Floodplain		Buildings No Longer Affected by 100 Year Floodplain (61)		LOMR

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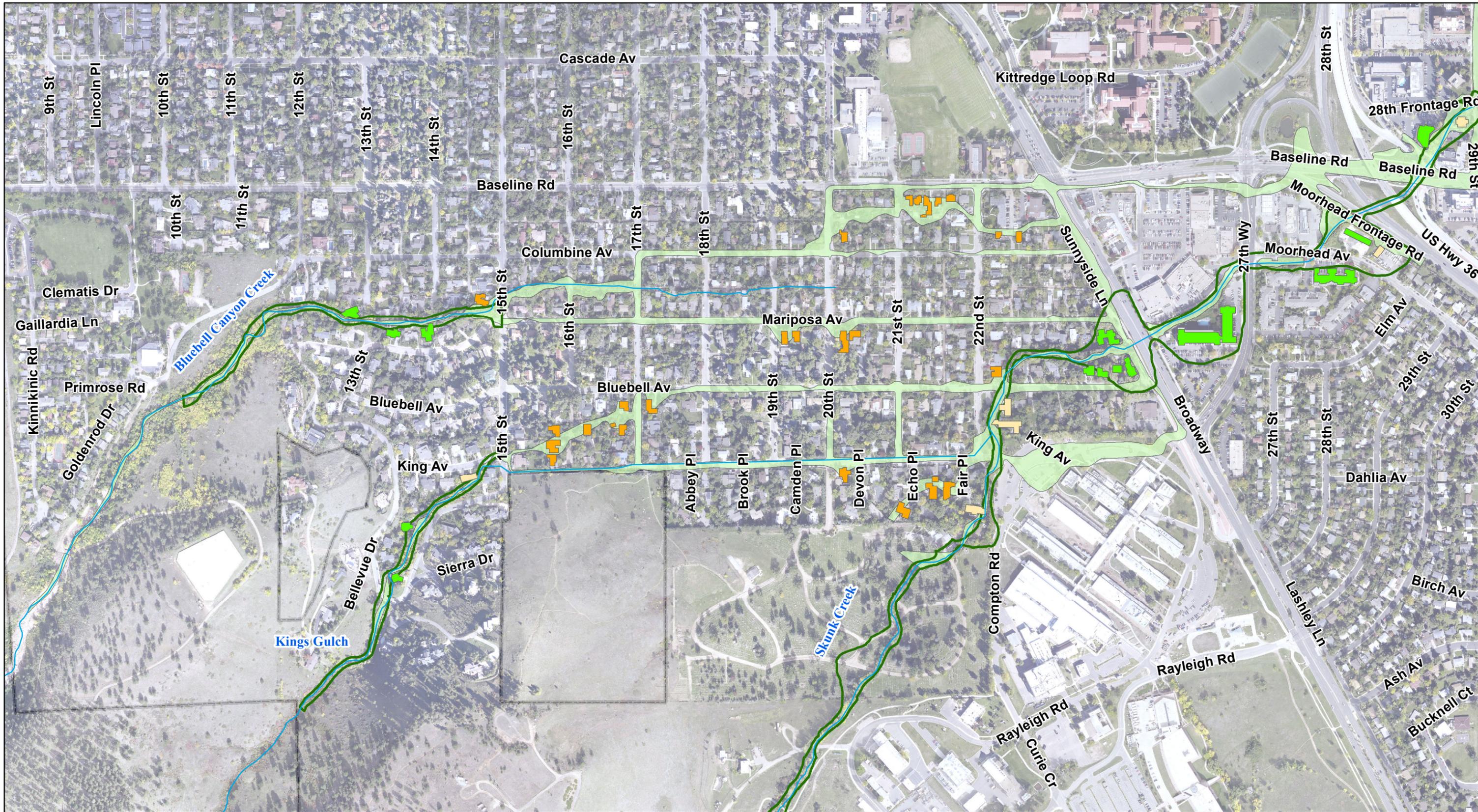
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Skunk Creek

Proposed 100 Year Floodplain Compared to FEMA Effective

Map 2 of 2

CITY OF BOULDER
Utilities Division
Rev. 9/8/2014



Legend

	Proposed Skunk Creek Conveyance Zone		Buildings Newly Affected by Conveyance Zone (28)		Creek
	Effective Other Creeks Conveyance Zone		Buildings Remaining in the Conveyance Zone (27)		City Limits
	Revised Boulder Creek Conveyance Zone		Buildings No Longer Affected by Conveyance Zone (55)		

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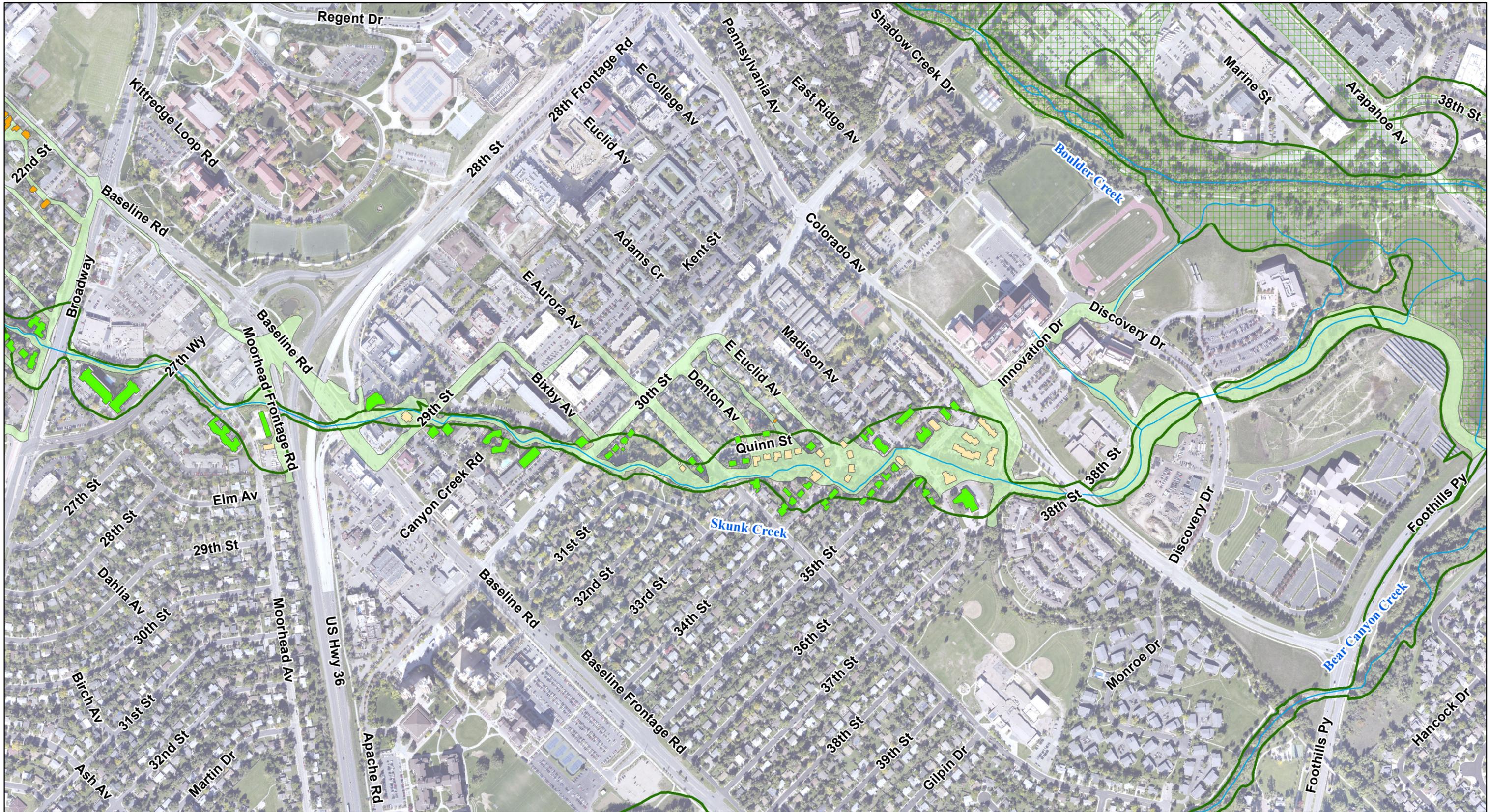
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Skunk Creek

Proposed Conveyance Zone Compared to FEMA Effective

Map 1 of 2


 CITY OF BOULDER
 Utilities Division
 Rev. 9/8/2014



Legend

-  Proposed Skunk Creek Conveyance Zone
-  Buildings Newly Affected by Conveyance Zone (28)
-  Creek
-  Effective Other Creeks Conveyance Zone
-  Buildings Remaining in the Conveyance Zone (27)
-  City Limits
-  Revised Boulder Creek Conveyance Zone
-  Buildings No Longer Affected by Conveyance Zone (55)




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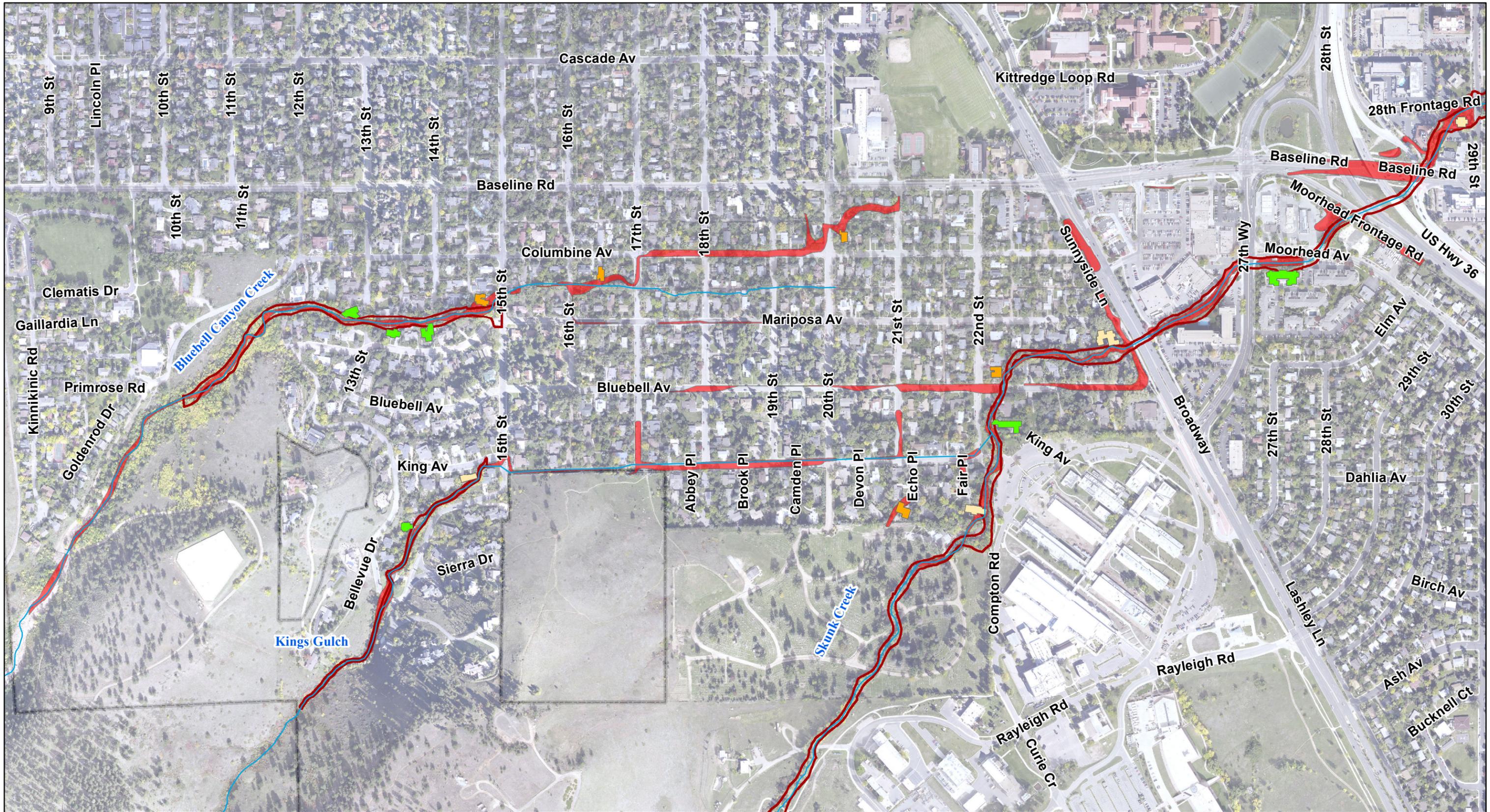
Skunk Creek

Proposed Conveyance Zone
Compared to FEMA Effective

Map 2 of 2

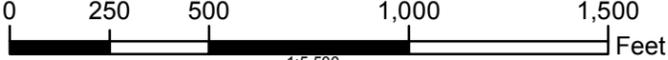


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Rev: 9/8/2014



Legend

-  Proposed Skunk Creek High Hazard Zone
-  Effective Other Creeks High Hazard Zone
-  Revised Boulder Creek High Hazard Zone
-  Buildings Newly Affected by High Hazard Zone (6)
-  Buildings Remaining in the High Hazard Zone (7)
-  Buildings No Longer Affected by High Hazard Zone (23)
-  Creek
-  City Limits

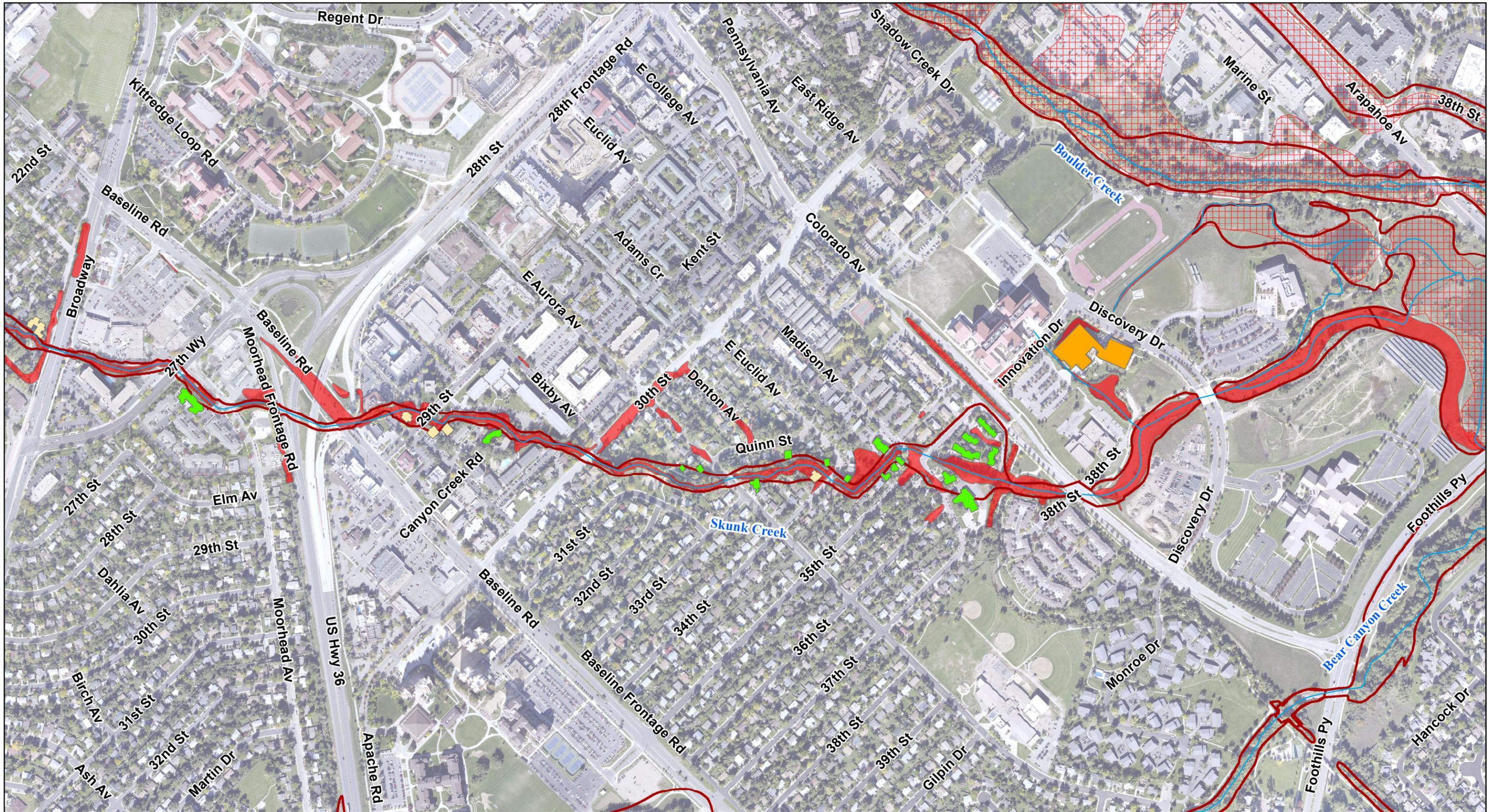
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Skunk Creek

Proposed High Hazard Zone Compared to FEMA Effective

Map 1 of 2



Legend

- Proposed Skunk Creek High Hazard Zone
- Effective Creeks High Hazard Zone
- Revised Boulder Creek High Hazard Zone
- Buildings Newly Affected by High Hazard Zone (6)
- Buildings Remaining in the High Hazard Zone (7)
- Buildings No Longer Affected by High Hazard Zone (23)
- Creek
- City Limits

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Skunk Creek

Proposed High Hazard Zone
Compared to FEMA Effective
Map 2 of 2

CITY OF BOULDER
Utilities Division
Rev: 9/8/2014

Attachment E

Skunk Creek, Bluebell Canyon Creek and Kings Gulch Floodplain Mapping Revisions

The tables below present a summary of how the proposed floodplain mapping revisions impact existing structures.

Summary of Proposed Changes

Skunk Creek			
Number of Structures	100-Year Floodplain	Conveyance Zone	High Hazard Zone
Existing Floodplain	178	82	30
Proposed Floodplain	222	55	13
Change			
No Longer Affected	61	55	23
Newly Affected	110*	28	6
No Change	117**	27	7

**There are (3) LOMRs which previously excluded structures from the 100-year floodplain that are newly affected by the proposed 100-year floodplain extents*

***There are (5) LOMRs which previously excluded structures from the 100-year floodplain that are no longer affected by the proposed 100-year floodplain extents (117(no change structures) + 110(newly affected structures) – (5)LOMRs = 222 structures in proposed floodplain)*