

3.14 FLOODPLAINS

Floodplains are the areas bordering streams or ponds that are subject to flooding. Floodplains are protected by local and federal regulations. The regulated floodplain area is defined as the 100-year floodplain, which is the area that will flood in the event of a 100-year storm (a storm severity with the likelihood of occurring, on average, once every 100 years). If any portion of a proposed highway project may encroach upon the 100-year floodplain, more detailed analysis is required to determine the significance of the encroachment and identify alternatives that may reduce or eliminate impacts. This section discusses floodplain impacts related to flooding hazards that may result from the New Pueblo Freeway project. Impacts on wildlife habitat due to floodplain modifications are discussed in **Section 3.12 Fish and Wildlife Habitat**. Impacts to the recreational values of the floodplains are discussed in **Section 3.3 Parks and Recreation**.

Development in floodplains must be carefully managed to prevent losses to public and private property due to flooding. Encroachment (alteration) of the floodplain that reduces flood storage capacity will displace flood waters and may cause flooding upstream or downstream of the encroachment. Obstructions in a stream or river (such as for the placement of a bridge pier) can restrict the channel, cause erosion or scour, and increase flood elevations upstream. For highway projects, this type of obstruction generally occurs at river crossings and is referred to as a transverse encroachment, meaning that the encroachment is perpendicular to the flow of the stream. Transverse encroachment is relatively easy to manage and usually does not result in significant impacts to the floodplain. Longitudinal encroachment refers to the placement of improvements such as new construction, development, or fill within the floodplain, such as for building a road parallel to the edge of a river. This type of encroachment reduces the storage capacity of the floodplain (constricting the area through which water can flow), causes higher peak flows, and potentially creates flooding downstream.

The federal government has developed a national floodplain management program that is administered by the Federal Emergency Management Agency (FEMA) through the National Flood Insurance Program. Delineating the 100-year

floodplain and mapping those boundaries on Flood Insurance Rate Maps (FIRM) is the responsibility of FEMA.

In addition to the FIRM, FEMA prepares a Flood Insurance Study (FIS) describing the modeling and analyses conducted to support the FIRM. The Pueblo Floodplain Manager, like local officials throughout the country, is charged with administering a floodplain management program that regulates development in the 100-year floodplain. Under the National Flood Insurance Program, all construction activities or alterations to existing structures within the 100-year floodplain need a development permit from the local permit official.

Executive Order (EO) 11988, "Floodplain Management" (Federal Register May 24, 1977), directs federal agencies, including FHWA, to "avoid direct or indirect support of floodplain development wherever there is a practicable alternative." Under EO 11988, the evaluation of potential impacts to floodplains and alternatives considered to mitigate adverse impacts are to be disclosed in environmental documentation prepared under the National Environmental Policy Act (NEPA). The FHWA policy (as codified in 23 CFR 650.103) is to avoid longitudinal and significant encroachments on floodplains where practicable. Significant encroachments include development with the potential to impact critical transportation facilities, pose a significant risk, or create a significant adverse impact on the natural values of floodplains (23 CFR 650.105). The Modified I-25 Alternative (Preferred Alternative) was developed to be in compliance with 23 CFR 650.103, which fulfills the requirements of EO 11988. The Modified I-25 Alternative (Preferred Alternative) was designed to avoid or minimize impacts to the floodplain.

3.14.1 Affected Environment

There are two FEMA-regulated floodplains in the vicinity of the project limits: Fountain Creek and the Arkansas River. The 100-year floodplain boundaries have been delineated for both waterways and are shown in **Exhibit 3.14-1**. The Fountain Creek floodplain is located in the North Area (Phase 1) of the proposed highway improvements, adjacent to the east side of the existing I-25 north of SH 96. South of SH 96, Fountain Creek flows southeast away from the project area. I-25 crosses the Arkansas River floodplain at

The current FIS for Fountain Creek within the City of Pueblo was completed in 1986. A number of projects impacting the floodplain have been completed since the publication of the FIS. The following projects and studies have been completed or initiated since 1986:

- ❖ The U.S. Army Corps of Engineers (USACE) constructed a levee on the east bank of Fountain Creek from approximately 8th Street to 13th Street and a floodwall on the west bank from 8th Street to 11th Street to protect I-25 and the existing railroad tracks. The levee and floodwall prevent overflow of the creek banks in the area north of 8th Street that was shown in the 1986 FIS. As a result of these projects, FEMA issued a Letter of Map Revision (LOMR) in 1991 reflecting the elimination of overbank flows in this area.
- ❖ The USACE installed rip rap (large, loose rocks) along the banks of Fountain Creek in various locations between 8th Street and SH 47 to protect the highly erodable banks. These projects were intended to stabilize the existing banks and did not result in any map revisions by FEMA.
- ❖ CDOT completed improvements to the US 50/SH 47/I-25 interchange in 1998. This project included extending Dillon Drive from SH 47 to 28th Street, which created an embankment on the west side of the Fountain Creek floodplain between SH 47 and 28th Street. In 1998, FEMA accepted a Conditional Letter of Map Revision (CLOMR) revising the floodplain boundaries.
- ❖ It is widely accepted by FEMA and USACE that significant geomorphic changes have occurred to Fountain Creek in this area since the FIS was published in 1986. In an effort to understand these changes, the USACE prepared the *Fountain Creek Watershed Study, Hydraulics Report* (USACE, 2006). This study consists of updated hydrologic and hydraulic analyses of the Fountain Creek watershed. Generally, hydrologic analyses determine peak flows and hydraulic analyses determine the capability of structures to convey peak flows and identify areas of flooding potential. In 2006, the USACE completed the hydrologic and preliminary hydraulic analyses. Results of the hydrologic analysis show significant decreases in the expected flood flows in Fountain Creek. The regulatory (100-year high) flow for Fountain Creek is currently 64,000 cubic feet per second (cfs); the regulatory flow proposed as a result of the updated hydrologic study is 41,000 cfs. Results of the hydraulic modeling show that the 100-year

floodplain would be contained within the east bank levee in future conditions, provided that ongoing maintenance of the levee occurs during this time. Once the FCWS is complete, FEMA would update the FIRM for the project area. The CDOT Project Team worked with FEMA staff to update the Fountain Creek floodplain information to reflect currently understood conditions.



Fountain Creek Floodplain

3.14.1.2 Arkansas River

The Arkansas River watershed encompasses more than 4,700 square miles and extends from the river's origin in Leadville, Colorado through Kansas, Oklahoma, and Arkansas before terminating at the Mississippi River. I-25 and Santa Fe Avenue cross the 100-year Arkansas River floodplain in the Central Area (Phase 2) of the project just north of Santa Fe Drive.

A significant concern in the project area is flooding caused by spring snowmelt and high-intensity rain events within the Arkansas River watershed. Prior to the construction of the Pueblo Dam in the early 1970s, the Arkansas River flooded every 10 years on average. The most significant of these floods occurred in 1921 when flooding destroyed entire neighborhoods and more than half of the City's businesses. No major flooding has occurred since the completion of Pueblo Dam. Flooding in the project area is also controlled by the backwater created when Fountain Creek is at flood stage.

The current FIS for the Arkansas River within the City of Pueblo was completed in 1986. The Arkansas River through Pueblo is confined between floodwalls, and no significant

development has taken place within the floodplain in the project vicinity since completion of the FIS.

Further details on floodplains in the project area may be found in the *Floodplain Technical Memorandum, New Pueblo Freeway* (CH2M HILL, 2005f).

3.14.2 Environmental Consequences

3.14.2.1 No Action Alternative

Under the No Action Alternative, only minor improvements, repairs, and routine maintenance of I-25 would occur, and there would be no changes to existing floodplains in the project area.

3.14.2.2 Build Alternatives

Where possible, project designers developed the Build Alternatives to avoid or minimize impacts that could raise or widen the base floodplain. Floodplain analyses were prepared to determine the potential impacts of the Existing I-25 Alternative and Modified I-25 Alternative (Preferred Alternative) on flooding conditions for both waterways (CH2M HILL, 2005f). The Build Alternatives would be designed in compliance with EO 11988, which requires federal agencies to avoid direct or indirect support of floodplain development whenever a practicable alternative exists.

North Area (Phase 1)

Proposed development within the Fountain Creek floodplain includes replacement of the US 50B bridge, reconstruction of the I-25/US 50B interchange, and an extension of Dillon Drive from 29th Street to US 50B; therefore, analysis is focused in these areas (Sections 8100 to 6749 on **Exhibit 3.14-2**).

Exhibit 3.14-2 shows the current floodway limit and areas of impact to the 100-year floodplain and labels the cross sections that were used in the Floodplain Analysis Model (CH2M HILL, 2005f). A floodway is defined as the portion of the available flow cross section that, if obstructed, will cause an increase in the water-surface elevations resulting from a 100-year flood of more than the regulated amount (usually 1 foot). Each cross section represents the elevation and width of the floodplain at that given location. As shown in **Exhibit 3.14-2**, there are two longitudinal encroachments of the Fountain Creek floodplain resulting from the extension of Dillon Drive. The new US 50B bridge would have a wider span than the existing bridge, so it would have greater

conveyance capacity. However, there is a slight increase in inundated area at these sections caused by the bridge abutments and Dillon Drive embankment where it encroaches on the floodplain. The overall floodplain width either remains the same or decreases over most cross sections, with the exception of Sections 6950 and 7000 and at the widened US 50B bridge.

Exhibit 3.14-3 shows the change in BFE, floodplain width, and velocity that would result from the encroachment into the floodplain and floodway caused by the Dillon Drive extension under either Build Alternative. In much of the study area, the floodplain is not adversely impacted; however, the embankment created by the Dillon Drive extension would result in an increase in the BFE and floodplain width upstream of the embankment (between Sections 7050 and 6950). Channel velocity would increase below the embankment just upstream of the bridge.

If mitigation measures are not included in the final design, the result could be increased scour and erosion around the bridge piers at the US 50B bridge. Additionally, a small area near the bridge that would be inundated by the 100-year flood is not currently within the 100-year floodplain boundaries. This area comprises a total of 3.35 acres (the area within the limits of construction between Sections 6950 and 7000 and not hatched in blue on **Exhibit 3.14-2**), of which 0.19 acre is privately owned, and 3.16 acres are owned by the City. Any structures developed on this land could be at risk from a 100-year storm event.

South Area (Phase 2)

Because neither the Fountain Creek nor Arkansas River floodplains are present in the South Area (Phase 2), there are no floodplain impacts in the South Area (Phase 2) under either Build Alternative.

Central Area (Phase 2)

Existing I-25 Alternative

Impacts to the Arkansas River floodplain for the Existing I-25 Alternative would be limited to replacement of the existing I-25 bridge in its approximate current location, as shown in **Exhibit 3.14-4**. In the Central Area (Phase 2), the Arkansas River is confined on both banks by the existing floodwalls. Implementation of the Existing I-25 Alternative would not flood any new areas that are not within the existing 100-year floodplain.

EXHIBIT 3.14-2
Areas of Impact to the 100-Year Floodplain in the North Area (Phase 1)

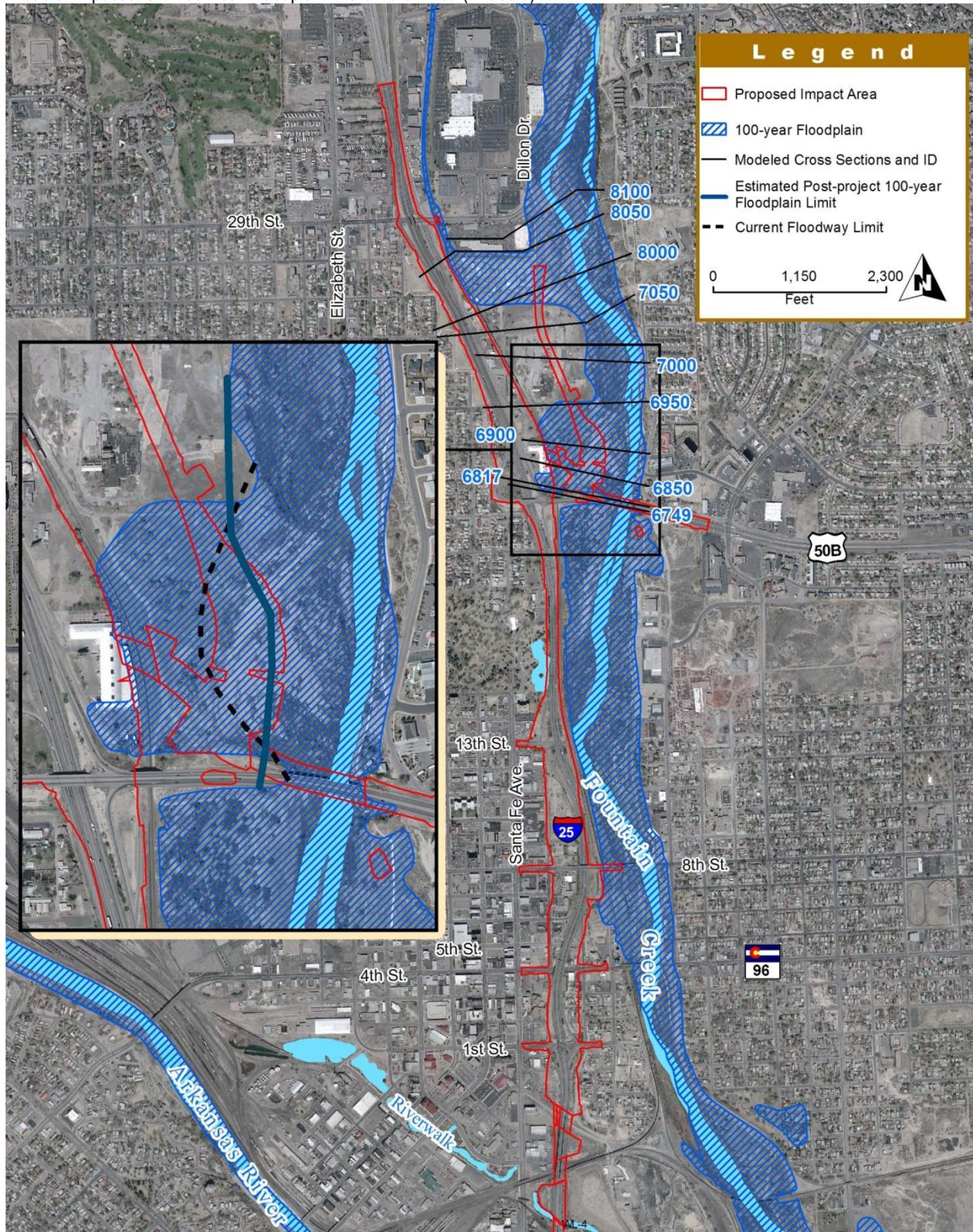


EXHIBIT 3.14-3

Fountain Creek Floodplain Analysis: Modeled Changes to Base Flood Elevation, Floodplain Width, and Velocity From Build Alternatives

Section ¹	Increase in Base Flood Elevation (feet)	Increase in Floodplain Width (feet)	Existing Velocity (increase in velocity) measured in feet per second
8100	0.0	3	10.2 (0.0)
8050	0.1	-88	10.5 (-0.1)
8000	0.0	-15	8.9 (+0.2)
7050	0.3	1	7.9 (-0.6)
7000	1.3	110	14.3 (-1.1)
6950	1.9	192	8.5 (-0.8)
6900	-1.8	-858	12.7 (+7.7)
6850	-4.8	-1018	13.3 (+9.3)
6817	-2.2	116	16.1 (-1.3)
6749	-1.8	118	11.6 (-1.5)

Source: CH2M HILL, 2005f.

¹ Section numbers were assigned in the Floodplain Analysis Model.

The existing I-25 bridge has one set of piers between the floodwalls. The proposed bridge would also have a single set of piers, but located inside the floodwalls. The similar configuration of the new bridge would result in minimal impact to the Arkansas River floodplain and floodway, which have the same boundaries in this area. In the area where the new piers would be placed, Floodplain Analysis Model results showed a 0.1-foot decrease in BFE, a 3-foot reduction in floodplain width, and between 0.3 and 0.4 feet per second (ft/s) increase in velocity (CH2M HILL, 2005f), which would be an improvement to the existing floodplain.

Modified I-25 Alternative (Preferred Alternative)

The Modified I-25 Alternative (Preferred Alternative) includes construction of new bridges across the Arkansas River, new access ramps to I-25, an extension of Stanton Avenue, and realignment of Santa Fe Avenue to make use of the existing I-25 bridge. The new I-25 bridge would be located east of the existing bridge and would result in a new transverse encroachment on the floodplain and floodway, as shown in **Exhibit 3.14-5**. The downstream portion of the new crossing is located outside of the area confined by the

floodwalls, creating a longer bridge span and adding piers within the floodplain. The south abutment of the new bridge is proposed to be located within the Arkansas River floodplain. In this area, Floodplain Analysis Model results showed no change to the BFE. The overall floodplain width would increase by 2 feet just north of and at the bridge location; however, the floodplain width drops by approximately 129 feet just downstream, where the velocities are predicted to increase by 0.1 ft/s (CH2M HILL, 2005f).

As described previously, two conditions exist for flooding on this portion of the Arkansas River. Encroachments on the floodplain are mostly confined to the portion of the river that is controlled by backwater from Fountain Creek; however, velocity in this area is low (less than 2 ft/s), and the impacts of encroachments are minimal. Implementation of the Modified I-25 Alternative (Preferred Alternative) would not flood any new areas that are not within the existing 100-year floodplain. Limited scour of new bridge piers is expected because velocities are so low.

EXHIBIT 3.14-4

Areas of Impact to the 100-year Floodplain in the Central Area (Phase 2) under the Existing I-25 Alternative

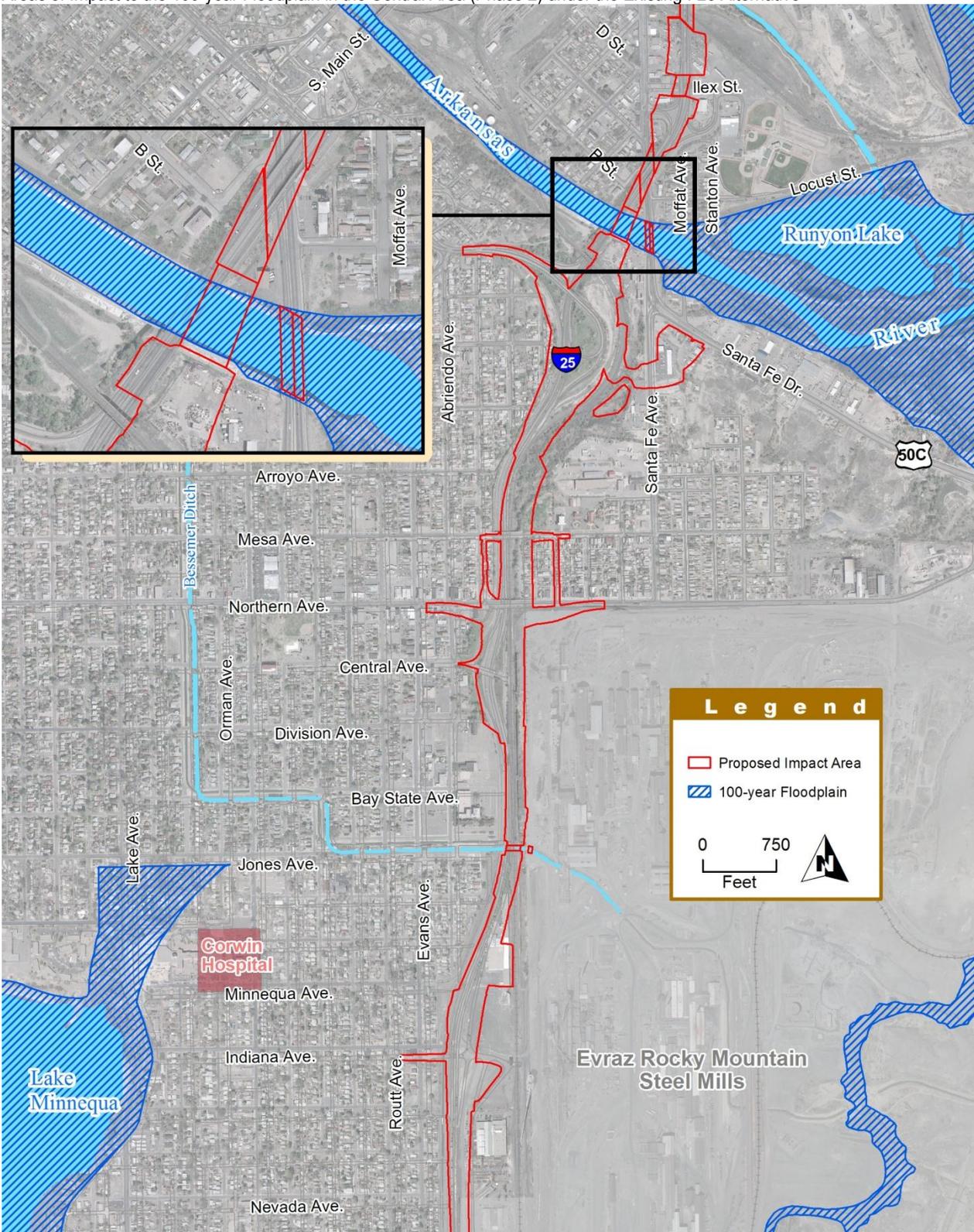
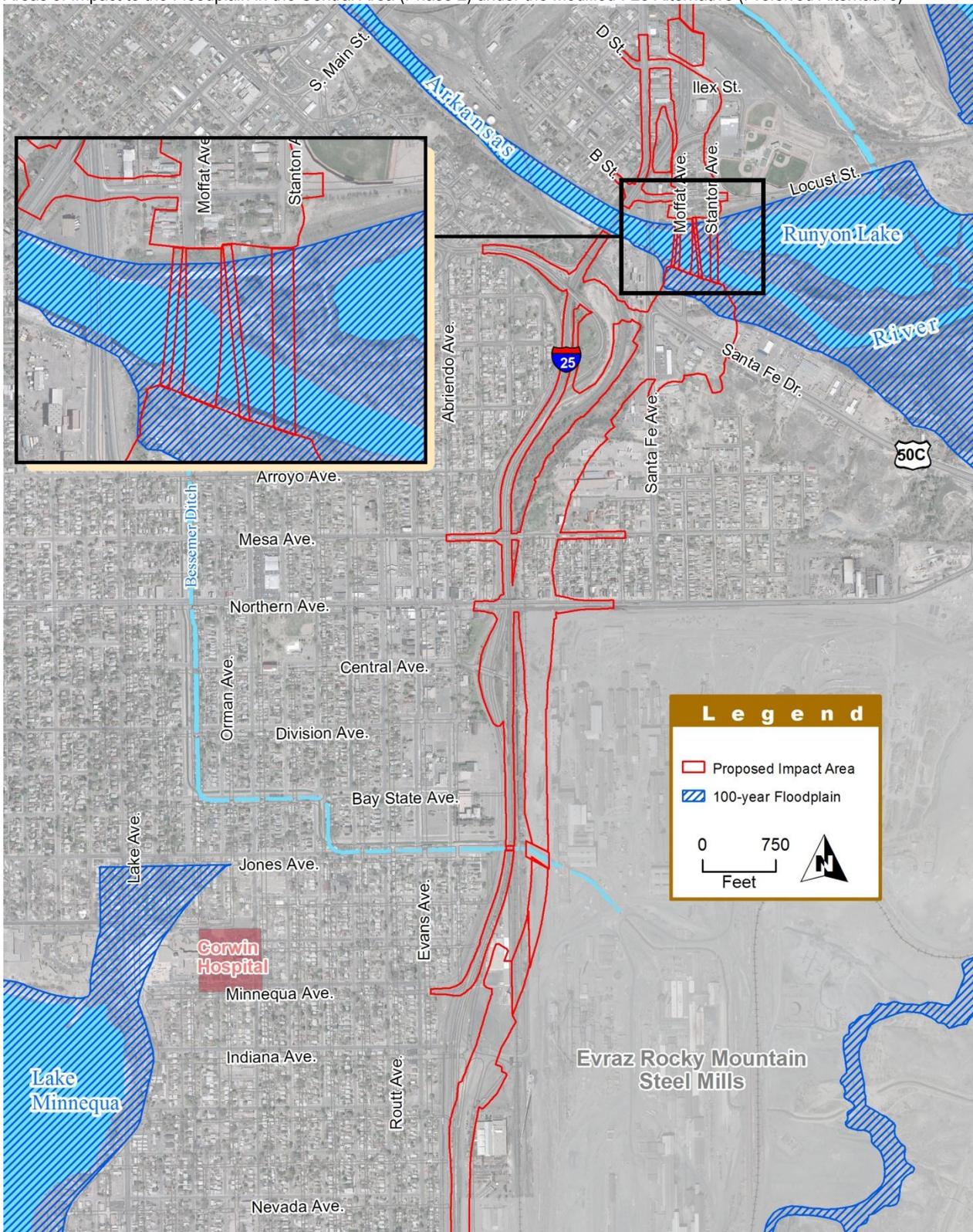


EXHIBIT 3.14-5

Areas of Impact to the Floodplain in the Central Area (Phase 2) under the Modified I-25 Alternative (Preferred Alternative)



3.14.3 Mitigation

Unless otherwise specified, the following mitigations apply to both the Existing I-25 Alternative and the Modified I-25 Alternative (Preferred Alternative).

Mitigation measures outlined in this section are based on impacts identified using the currently approved data. As noted previously, FEMA is planning a major update to the FIS, which will likely result in a narrower floodplain boundary than is currently represented on the FIRM.

- ❖ Further floodplain analysis will be required during final design, both as a result of project design refinement and model revisions by FEMA. Depending on the results of the floodplain analyses using the revised modeling and the final design configuration of I-25, CDOT will likely need to apply for FIRM revisions through FEMA. If there are significant impacts to the floodplains or expected encroachments on the floodways, a CLOMR application will need to be submitted and approved prior to construction. The CLOMR is FEMA's comment on a proposed project that would impact a floodplain. If no significant impacts to the floodplains or floodway encroachments are expected, FEMA may allow the project to proceed without a CLOMR.
- ❖ In either case, a LOMR application will be required if there is any substantial encroachment on the floodplain. The LOMR is FEMA's modification to an effective FIRM. It would be prepared using as-built data from improvements and would detail the effects of the improvements upon the floodplain(s). A CLOMR or LOMR may be required if there is encroachment on the Fountain Creek or Arkansas River floodplains.

Should there be encroachment on the Fountain Creek or Arkansas River floodplains, the following mitigation measures would be implemented.

- ❖ The small additional area in the North Area (Phase 1) within the Fountain Creek floodplain that is currently shown to be inundated during the 100-year flood event (see **Exhibit 3.14-2**) will be managed to reduce impacts. Approximately 0.2 acre of private property may be acquired by CDOT, and the estimated 3.2 acres of City property will be managed in perpetuity as part of the Fountain Creek recreation area. The City has agreed in its March 2010 Memorandum of Understanding with CDOT that no structures will be permitted in this area (see **Appendix F**).
- ❖ In the North Area (Phase 1), streambed and bank stabilization measures will be included in the final project for the area surrounding the US 50B bridge that is currently shown to be subjected to increased flow velocity as a result of the proposed development under either Build Alternative. Examples of such mitigation include channel bed stabilization with rip rap or construction of grade control structures, rip rap lining or slope paving of banks, and guide banks to reduce velocity near fill slopes. This work may require that CDOT obtain a Section 404 permit from the USACE under Section 404 of the Clean Water Act prior to construction. Specific mitigation measures will be developed during design when expected flow conditions are more accurately defined (that is, after the completion of the FCWS).
- ❖ Per the analysis, impacts to the Arkansas River floodplain and floodway are expected to be minimal, and required mitigation measures will be limited to erosion protection for bridge structures. New bridge structures will have foundations designed to limit scour, and proposed abutments within the floodplain will be protected from erosion. Measures that may be used to protect the bridges include rip rap armoring of banks and slope paving.
- ❖ The design of any selected alternative will comply with EO 11988, "Floodplain Management." In addition, State of Colorado drainage design standards will be applied to achieve results that will not increase or significantly change the flood elevations and/or limits.