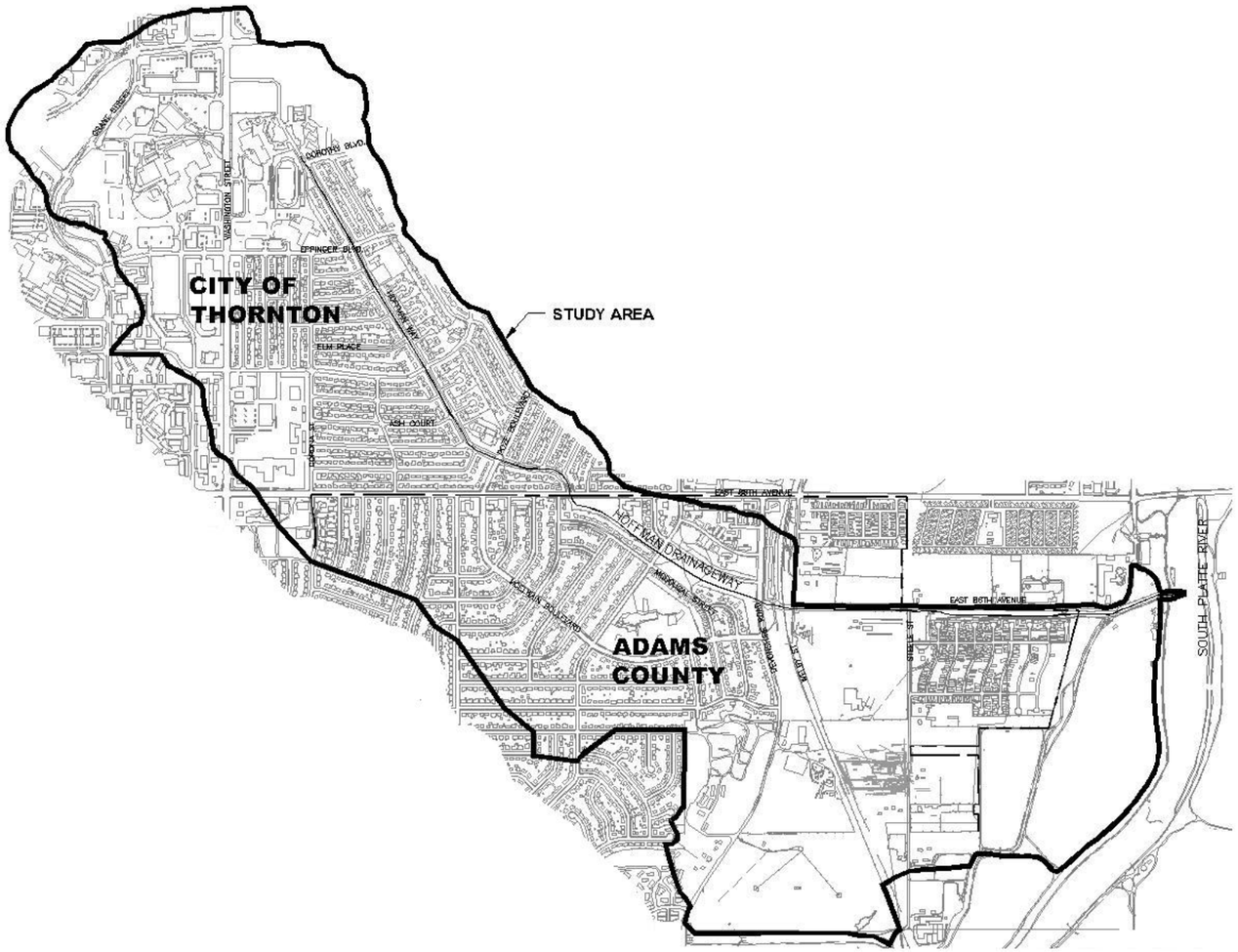
DFHAD Prototype

DIGITAL FLOOD HAZARD AREA DELINEATION

HOFFMAN DRAINAGEWAY



Project Sponsors:

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

ADAMS COUNTY

CITY OF THORNTON

Prepared by:

MOSER & associates ENGINEERING

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October 2007

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October 15, 2007

Mr. Ben Urbonas, P.E.
Urban Drainage & Flood Control District
2480 West 26th Avenue, Suite 156-B
Denver, Colorado 80211

RE: Flood Hazard Area Delineation – Hoffman Drainageway

Dear Mr. Urbonas:

Enclosed is the Flood Hazard Area Delineation (FHAD) Report for the Hoffman Drainageway. This report documents the FHAD study process from initiation through completion of the final floodplain and floodway delineations. A summary of the project history, description of the study area, field inventory of hydraulic structures, summary of hydrologic and hydraulic analysis, HEC-RAS water surface profile computer modeling results for the 10-, 50-, 100-, and 500-year storm events, and determination of the 0.5 foot and 1.0 foot floodways are provided in this report.

The floodplain and floodway information provided herein should assist the Urban Drainage and Flood Control District and other project sponsors in updating the FEMA floodplain boundaries for Hoffman Drainageway to reflect the current watershed conditions and in administration of new and existing development in the areas prone to flooding.

We appreciate the opportunity to prepare this analysis and look forward to working with you on future projects.

Respectfully Submitted,

Moser & Associates Engineering, Inc.

David Delagarza, E.I.
Project Engineer

Teresa Patterson, P.E.
Project Manager

Rick R. Moser, P.E.
Principal-In-Charge

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1.1 AUTHORIZATION

On July 11, 2006 the Urban Drainage and Flood Control District (District), in joint sponsorship with the City of Thornton and Adams County, contracted with Moser & Associates Engineering for the provisions of engineering services for a Major Drainageway Planning and Flood Hazard Area Delineation (FHAD) Study for the Hoffman Drainageway watershed. Specific hydrologic analysis tasks were performed in accordance with Agreement Number 06-04.05.

1.2 PURPOSE AND SCOPE

The scope of this FHAD study is as follows:

1. Gather and assemble information on the existing drainage system including hydraulic structures, channel characteristics, and topographic information
2. Define the water surface profile and flood boundaries for the 10, 50, 100, and 500-year flood events and also for the 0.5 foot and 1.0 foot floodways.
3. Prepare plan and profile drawings of the Hoffman Drainageway showing the limits of the 100-year floodplain and the 10-year and 100-year flood profile.
4. Document the study results in the FHAD Report.

The study area is approximately 1.8 square miles located within the City of Thornton and portions of unincorporated Adams County. The study are boundary is generally defined on the west by Grant Street, the north by East Thornton Parkway, the east by the South Platte River, and the south by Coronado Parkway.

Three addenda have been issued for this contract. Addendum 1 was executed to expand the study area to include land affected by flood flow splits outside of the main Hoffman Drainageway. Addendum 2 was executed to obtain additional survey information near structures and along FHAD cross sections to better define the floodplain delineations for the FHAD. Addendum 3 was executed to perform a more detailed analysis of several localized areas of concern.

1.3 PLANNING PROCESS

In the beginning, the project sponsors expressed two primary goals: determine the actual path of floodwater and propose improvements to safely convey the floodwater to minimize the flooding impacts to the structures in the watershed. The watershed had been studied in the past, but a FEMA detailed study for the entire watershed had not been completed. The project sponsors felt it was important to address the watershed as a whole and prioritize the improvements.

Early in the FHAD process, it was discovered that the Hoffman Drainageway did not contain flood flows within its existing infrastructure which resulted in multiple flood flow splits. Because of this, the watershed study area was expanded to consider additional storm runoff through the split flow areas.

Two public open houses were held on September 11, 2006 and July 19, 2007. A mailing was sent to all property owners within the watershed to attend the first meeting to provide insight into issues in the project area and to offer input for the study. Ten (10) residents and representatives attended the first open house. Postcards were sent to all property owners whose properties are within or adjacent to an existing or new floodplain. Eleven (11) residents and representatives attended the second open house.

The "Hoffman Drainageway Baseline Hydrology Report" was published in September 2006 which summarized the results for existing fully-developed land-use condition hydrologic analysis for the Major Drainageway Study and the FHAD. This report was accepted by the project sponsors and provided the hydrology for the Flood Hazard Area Delineation.

This Flood Hazard Area Delineation Report describes the Study Area, provides results of the hydrologic analysis and documents the findings of the hydraulic analysis for the floodplain and floodway delineations.

1.4 MAPPING AND SURVEYS

The District supplied mapping (2-foot contours) for the original contract study limits as AutoCAD electronic files. Adams County supplied 2-foot contour mapping to supplement the District's mapping for the expanded watershed area.

1.5 DATA COLLECTION

Several sources of data have been collected at this point. These sources include:

- Mapping (2-foot contours) for the study area was supplied by the District as AutoCAD electronic files.
- Supplemental mapping (2-foot contours) was supplied by Adams County as AutoCAD electronic files for the expanded watershed area.
- Hardcopies of Flood Insurance Study backup HEC-2 files were supplied by FEMA for the detailed floodplain study between 88th Avenue and Devonshire Boulevard.
- As-built survey information for the H.C.C. Subdivision on Steele Street.
- City of Thornton GIS shape files (August 2006).
- Adams County storm sewer GIS shape files (August 15, 2006)
- City of Thornton as-built plans for storm sewer and channel improvements along the watershed.
- Hardcopy of Muller Engineering Lower Hoffman Drainageway conceptual Design report date May 14, 1990.
- Hardcopy of Muller Engineering Lower Hoffman Drainageway Preliminary Design Memorandum dated January 30, 2003.

1.6 ACKNOWLEDGEMENTS

The following individuals representing project sponsors have attended the progress meetings and given input to the study.

Ben Urbonas, P.E.	Project Director, Urban Drainage and Flood Control District
Ken MacKenzie, P.E.	Project Manager, Urban Drainage and Flood Control District
Pete Brezall	Project Manager of Infrastructure Engineering, City of Thornton
Besharah Najjar, P.E.	Engineering Manager, Adams County
Jessica Stevens, E.I.	Drainage Engineer, Adams County

The following individuals from Moser & Associates Engineering contributed to this study are listed below.

Rick Moser, P.E.	Principal-In-Charge
Teresa Patterson, P.E.	Project Manager
David Delagarza E.I.	Project Engineer
Lee Draeger, E.I.	Engineer
Robert Mitchell	Technician
Tony Tran	Technician
Amy Tiegen	Technician
Stephanie Titus	Technician
Sage Cabrera	Technician

2.1 PROJECT AREA

The project area consists of the Hoffman Drainageway watershed which is located in the City of Thornton and portions of unincorporated Adams County. The total watershed area is 1,161 acres or 1.81 square miles. The study area boundary is generally defined on the west by Grant Street, the north by East Thornton Parkway, the east by the South Platte River, and the south by Coronado Parkway. Early in the FHAD process, it was discovered that the Hoffman Drainageway did not contain flood flows within its existing infrastructure which resulted in multiple flood flow splits. Because of this, the watershed study area was expanded to consider additional storm runoff through the split flow areas.

The Hoffman Drainageway starts near the intersection of Hoffman Way and Dorothy Boulevard, runs southeast along Hoffman Way to 88th Avenue, continues southeast through a residential area to Devonshire Boulevard, then follows 86th Avenue easterly to the South Platte River. The drainageway crosses 88th Avenue, the Union Pacific Railroad (UPRR), the Colorado Agricultural Ditch, and the Lower Clear Creek Canal (LCCC). See the Study Area map Figure 2-1.

A Project Reuse Watershed number for Hoffman Drainageway has not been defined.

2.2 LAND USE

The watershed is nearly built out, so only the fully-developed land-use condition is considered for this study. The land-use within the watershed can be broken down into the general land-use categories which are summarized below. The watershed imperviousness is 60.2%.

TABLE 2-1

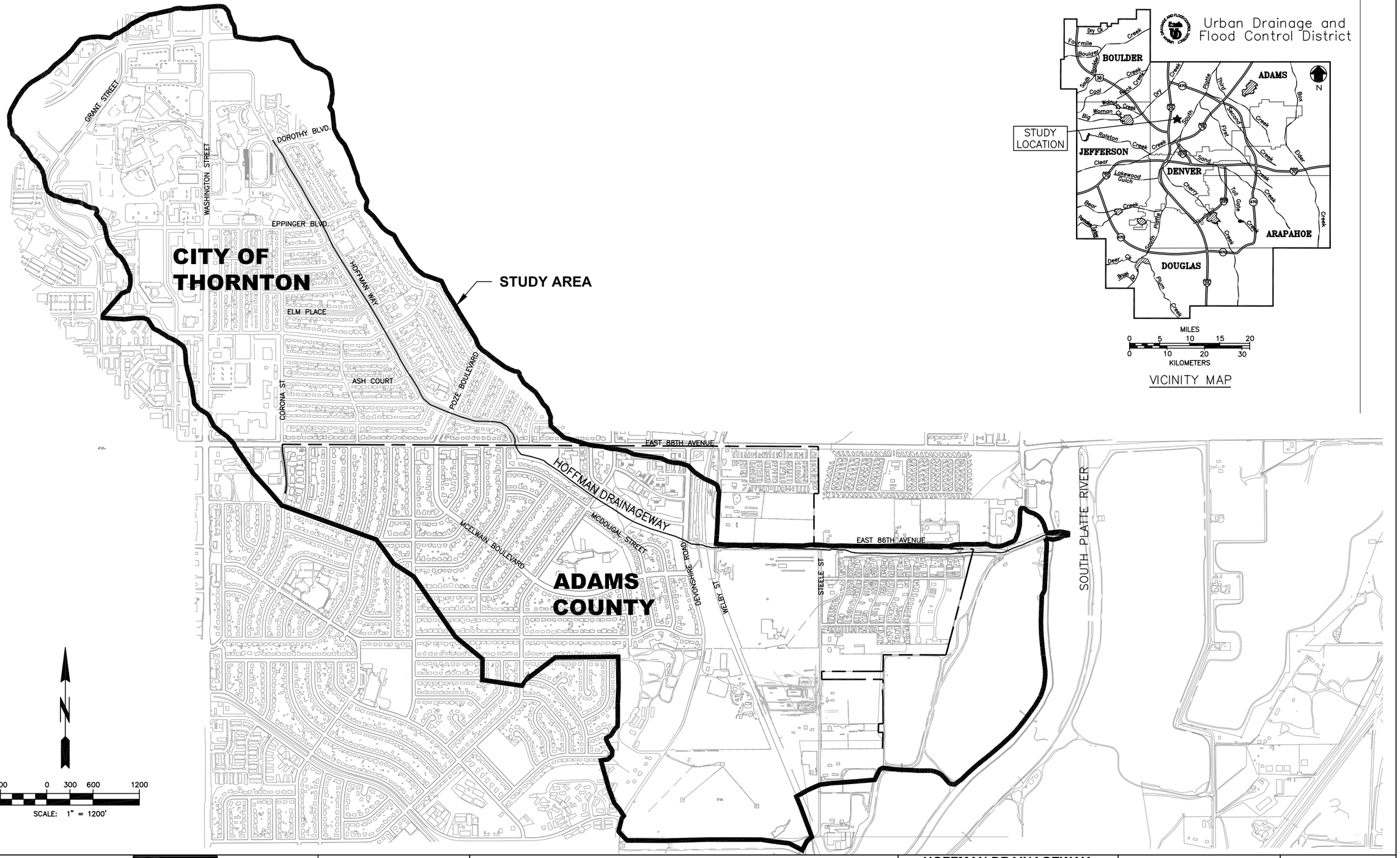
Fully-Developed Land-Use

Imperviousness %	Area	
	(acres)	(sq mi)
30	50	0.08
35	357	0.56
45	36	0.06
50	147	0.23
55	39	0.06
80	385	0.60
90	72	0.11
100	74	0.12

Land-use information was obtained by sampling random areas of similar densities from the base mapping to calculate the imperviousness values. Additional discussions with the project sponsors were used to determine projected densities for the few areas that have yet to be developed. See Figure B-1 in Appendix B for the Imperviousness Map that illustrates the land-use densities.

There are two soil classifications within the project limits, types A and C and are described in Section 3.3.3.

General watershed parameters include:
Highest watershed elevation (approximate) = 5,446
Lowest watershed elevation (approximate) = 5,070
The average slope of the channel = 0.025 ft/ft
Watershed shape (L/W) = 4



VICINITY MAP

MOSER & associates ENGINEERING 720 S. COLORADO BLVD. SUITE 410 S DENVER, CO 80246 PHONE: 303-757-3655 FAX: 303-300-1635	DESIGNED DPD DATE 08/31/07 DRAWN ACT DATE 08/31/07 CHECKED TLP DATE 08/31/07 REVISED ____ DATE ____	CITY OF THORNTON, ADAMS COUNTY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT	HOFFMAN DRAINAGEWAY FLOOD HAZARD AREA DELINEATION

STUDY AREA

FIGURE 2-1

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2.3 OUTFALL DESCRIPTION

During the process of developing this report, a number of split flow conditions were identified. This resulted in seven (7) different reaches being used for the purpose of FHAD planning. Figure 2-2 illustrates the locations of the various reaches.

Hoffman Drainage Mainstem and Irrigation Ditch Split

Hoffman Mainstem represents the central flow of runoff through the watershed and is the primary flowpath for the watershed. It may be divided into three distinct subreaches:

SubReach 1 Along Hoffman Way from the upstream FHAD limit at the intersection of Dorothy Boulevard to 88th Avenue. Hoffman Way is a divided collector roadway with a landscaped median through a residential area. There is a storm sewer system that generally follows the median.

SubReach 2 88th Avenue to Welby Road. The existing drainageway infrastructure is a combination of open channel, pipe, culverts, and bridges. This reach flows through a residential area with a very small section of industrial land directly adjacent to the UPRR.

Hoffman SubReach 1 – Hoffman Way

Hoffman Mainstem SubReach 2 – 88th Avenue to Rainbow

SubReach 3 Welby Road to the South Platte River (SPR). This reach runs through an industrial area. The upper half of this reach is a dilapidated open channel with steep, unstable slopes. The lower half was recently improved down to the SPR. The Lower Clear Creek Canal crosses the Hoffman Mainstem immediately upstream of the improved section. The irrigation structure significantly constricts the drainageway at this location, causing runoff to split into the Irrigation Ditch Split.

Hoffman Mainstem SubReach 3 – Channel Along 86th Avenue

Rainbow, Hope and Railroad Splits

Due to an undersized culvert at Rainbow Drive, stormwater splits from Hoffman Mainstem and flows through an undeveloped property east of Rainbow Drive. Runoff that splits into the Rainbow Split does not return to the Hoffman Mainstem. The Rainbow Split is characterized by open, undeveloped land above Devonshire Boulevard. A shallow channel conveys a small volume of flow through this property to Devonshire Blvd. Flows which exceed the capacity of this channel (approximately 140 cfs) break out of the channel to the south, flow to Hope Court and rejoin the Rainbow Split at McElwain Boulevard.

Below Devonshire Boulevard, the Rainbow Split flows through an undeveloped lot and over the railroad tracks. A small ditch on the west side of the tracks carries up to 150 cfs into the Railroad Split along the railroad tracks. The Railroad Split conveys water to the Lower Clear Creek Canal railroad bridge. The Railroad Split then flows east under this bridge and joins the Industrial Split, discussed below.

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URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

HOFFMAN DRAINAGEWAY FLOOD HAZARD AREA DELINEATION

CONVEYANCE OVERVIEW

FIGURE 2-2

Flows from the Rainbow Split which are not diverted into the Railroad Split pass over the railroad tracks and enter a prestressed concrete plant. Within the plant property, these flows split around the primary building. The flows that split to the south become the Industrial Split, which is discussed below. Flows which split around the north side of the building continue along the Rainbow Split over Steele Street. Below Steele Street, the Rainbow Split flows through the corner of a mobile home park and into sparsely developed horse pastures. The Rainbow Split flows into a series of gravel ponds and discharges into the South Platte River.

Industrial and Industrial South Splits

The Industrial Split begins as flows splits around the south side of the main building of the prestressed concrete plant. The Industrial Split continues south, paralleling the Railroad through an undeveloped parcel. Runoff in the Industrial Split which is not diverted into the Industrial South Split, discussed below, flows around the north side of the commercial property, overtopping a detention pond and Steele Street, and rejoins the Rainbow Split east of Steele Street.

South of the aforementioned undeveloped parcel is a newly developed commercial property (Parrot H.C.C. Subdivision). When the commercial property was constructed, several feet of fill material was added. As a result of the fill material being placed in this location, flows from the Industrial Split are divided again, creating the Industrial South Split. A ditch along the railroad tracks carries flow in the Industrial South Split. Water in this split follows the railroad around the west side and the south side of the commercial property to Steele Street. Flows then overtop Steele Street, flow through sparsely developed land and rejoin the Rainbow Split at the gravel lakes.

With the existing topography, there is no way for flows from the Rainbow Split to rejoin the Hoffman Drainageway. The Rainbow Split overtops the UPRR and splits and rejoins several times before continuing easterly toward the South Platte River.

The mainstem of Hoffman runs along the south side of 86th Avenue in an open channel. At the LCCC, the at-grade crossing with the irrigation ditch is too small to release the larger storm events and during the 100-year storm event, water breaks out of the irrigation structure overtopping 86th Avenue. This results in shallow flooding north of 86th Avenue.

2.4 PREVIOUS STUDIES AND FLOOD HISTORY

According to the Flood Insurance Rate Map (FIRM), there is a Zone A (approximate) floodplain along Hoffman Way. In August 1974 a detailed study of the drainageway between 88th Avenue and Welby Road was completed and a Zone AE floodplain was recognized. Downstream of Welby Road, the FIRM panel notes, "500-year flood contained in [the] channel".

According to the current FIRM, a number of houses along Hoffman Way and in the Hope Court neighborhood are within a 100-year floodplain. Figure 2-3 illustrates the approximate location of the FIRM effective floodplain and how it compares to the FHAD 100-year floodplain.

The residents in the watershed have reported their experiences with flooding. At the public meeting, several of residents in the Hope Court area relayed their stories of flooding. At the same meeting, two members of the mobile home community southeast of the LCCC and 86th Avenue imparted their stories of being flooded multiple times from backwater up the LCCC.

2.5 WETLAND AND RIPARIAN ZONES

No riparian or wetland vegetation has been observed within the study area with the exception of the South Platte River banks at the downstream study limits. However, a thorough investigation should be performed prior to construction.

2.6 FLORA, FAUNA AND THREATENED OR ENDANGERED SPECIES

There are no known threatened flora or fauna within the study area; however a thorough investigation should be performed prior to any construction.

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400 0 200 400 800

SCALE: 1" = 800'

LEGEND

APPROXIMATE LIMITS OF EFFECTIVE FLOODPLAIN

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HOFFMAN DRAINAGEWAY
FLOOD HAZARD AREA DELINEATION

FLOOD INSURANCE RATE MAP LIMITS

FIGURE 2-3

3.1 OVERVIEW

The storm runoff hydrographs and routing for the study were generated using the Environmental Protection Agency's 2006 version of Stormwater Management Model (SWMM) Version 5.0. The physical characteristics for each subwatershed in the SWMM analysis include:

- Drainage area
- Width of the subwatershed
- Subwatershed slope
- Percent imperviousness
- Subarea routing
- Percent routed
- Soil infiltration rates
- Surface retention storage values

The peak flow results from the SWMM model were compared to the results in the FEMA FIS at various locations. The comparison process is discussed in more detail in Section 3.6

In accordance with District policy, existing privately-owned detention basins were not included in the hydrologic models because of the uncertainty associated with their continued existence. There are no known publicly-owned and maintained detention basins in the watershed area.

The drainage network is generally comprised of subwatersheds, design points, and open channels.

The "Hoffman Drainageway Baseline Hydrology Report" was published in September of 2006 and the hydrologic calculations were accepted by the Urban Drainage and Flood Control District on October 11, 2006.

3.2 DESIGN RAINFALL

The 5-minute incremental rainfall depths for the 2-, 5-, 10-, 25-, 50-, and 100-year storm events were gathered from table 9.5 in the Adams County Development Standards and Regulations. The EPA SWMM model then distributed the rainfall depths over a 2-hour storm duration. The incremental rainfall depths used are shown in Table 3-1.

TABLE 3-1

Incremental Rainfall Depths (inches)

Time (min)	Return Period (Year)						
	2	5	10	25	50	100	500
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.02	0.03	0.03	0.03	0.03	0.03	0.03
10	0.04	0.05	0.06	0.07	0.08	0.08	0.10
15	0.08	0.12	0.14	0.10	0.12	0.12	0.15
20	0.16	0.22	0.25	0.16	0.19	0.22	0.26
25	0.25	0.36	0.42	0.30	0.35	0.38	0.46
30	0.14	0.18	0.20	0.50	0.59	0.68	0.82
35	0.06	0.08	0.09	0.24	0.28	0.38	0.46
40	0.05	0.06	0.07	0.16	0.19	0.22	0.26
45	0.03	0.05	0.06	0.10	0.12	0.17	0.20
50	0.03	0.05	0.05	0.10	0.12	0.14	0.16
55	0.03	0.04	0.05	0.06	0.08	0.11	0.13
60	0.03	0.04	0.05	0.06	0.08	0.11	0.13
65	0.03	0.04	0.05	0.06	0.08	0.11	0.13
70	0.02	0.04	0.05	0.05	0.06	0.05	0.07
75	0.02	0.03	0.05	0.05	0.06	0.05	0.07
80	0.02	0.03	0.04	0.04	0.04	0.03	0.04
85	0.02	0.03	0.03	0.04	0.04	0.03	0.04
90	0.02	0.03	0.03	0.03	0.03	0.03	0.04
95	0.02	0.03	0.03	0.03	0.03	0.03	0.04
100	0.02	0.02	0.03	0.03	0.03	0.03	0.04
105	0.02	0.02	0.03	0.03	0.03	0.03	0.04
110	0.02	0.02	0.03	0.03	0.03	0.03	0.04
115	0.01	0.02	0.03	0.03	0.03	0.03	0.04
120	0.01	0.02	0.02	0.03	0.03	0.03	0.04
1-Hour Point Rainfall (inches)	1.00	1.42	1.68	2.01	2.35	2.71	3.35

3.3 SUBWATERSHED CHARACTERISTICS

A total of 27 subwatersheds were delineated in the Hoffman Drainageway study area. The subwatershed identification and locations are displayed in Figure B-2 in Appendix B. The physical characteristics of each subwatershed are described in Table B-1, Subwatershed Characteristics, located in Appendix B.

The 2-foot contour mapping, provided by the District, supplemented with the 2-foot contour mapping from the City of Thornton and Adams County, were used to identify subwatershed boundaries, flow paths, and slopes for each subwatershed. The subwatersheds range in size from 5.3 acres to 107.6 acres with an average drainage area size of 42.5 acres.

Due to the fact that the watershed is almost completely developed, the watershed imperviousness was determined only for fully developed conditions using zoning for guidance in undeveloped areas. Aerial mapping and site visits were used to identify levels of existing imperviousness. City of Thornton and Adams County zoning was used to identify areas where approved future development will have a significant effect on the watershed imperviousness.

Eight (8) different categories of imperviousness were identified and range from 30 percent to 100 percent. The watershed imperviousness is shown on Figure B-1 in Appendix B.

Two (2) soil types identified by the Soil Conservation Service (SCS) were found in the Hoffman Drainageway study area. The majority of the basin is classified as hydrological soil classification Type C Soil. Type A soils are found in the upper area of the basin and near the gravel lakes, and in the southwest portion of the study area. For Types C soils, the initial infiltration rate is 3.0 inches per hour (iph), the final infiltration rate is 0.5 iph, and the infiltration decay constant is 0.0018 (1/sec). For Type A soils, the initial infiltration rate is 5 iph, the final infiltration rate is 1 iph and the decay constant is 0.007 (1/sec). These values are in accordance with District criteria as referenced in the Runoff Chapter of the Urban Storm Drainage Criteria Manual (USDCM, 2001). The distribution of the soil types can be seen on Figure B-3 in Appendix B.

3.4 HYDROGRAPH ROUTING

The routing elements within this model are storm sewer pipes, streets, and open channels. In locations where storm sewer pipes were modeled, a parallel open channel routing element was modeled to carry excess flows from the pipes. Appendix B provides the physical attributes (width, length, slope, side slope, and Manning's "n") assigned to each conveyance element used in the EPA SWMM model. Where available, cross sections for each routing element were developed using as-built information from channel and storm sewer construction.

In Appendix B Figure B-4, the EPA SWMM Routing Map, and Figure B-5, the EPA SWMM Routing Schematic, illustrate the location and connectivity of the drainage system elements. The Routing Map and schematic show where the subwatersheds connect into the drainage system and the specific design points defined at these locations. In addition, the routing elements illustrate where the runoff is connected to the next downstream design point.

Runoff from subwatershed 35 is collected in a storm sewer which is routed out of the Hoffman Drainageway watershed. Flows which exceed the capacity of the storm sewer are tributary to Hoffman Drainageway. The storm sewer is modeled in routing element 355 which connects to outfall 351. Flows which exceed the capacity of the storm sewer are modeled in routing element 356.

Mannings "n" values were verified in the field. Pictures illustrating the Manning's "n" values for a sample of the conveyance elements are included in Appendix B.

3.5 RESULTS OF ANALYSIS

Using the physical subwatershed hydrologic parameters and rainfall information, along with the drainage system conveyance characteristics, peak flow rates were determined. Table B-2 in Appendix B provides peak flow rate information at each of the elements along the drainageway for the 2-, 5-, 10-, 25-, 50-, and 100-year event storms.

A summarized input file from the EPA SWMM model is included in Appendix B. Peak flow profiles for Hoffman Mainstem and the Rainbow Split may be found in Charts B-1 and B-2 both located in Appendix B.

Hydrographs for the 100-year event storm are shown on Chart B-3 in Appendix B at five (5) different locations along Hoffman Drainageway.

3.6 COMPARISON WITH PREVIOUS STUDIES

The flows from the EPA SW MM model were compared with those supplied by FEMA as part of the FIS study. Upon examining the HEC-2 model that was provided as support for the FIS, it became apparent that there was a discrepancy between the flows in the model and those published in the FIS. For the purposes of this study, the HEC-2 model will be used for comparison, as it appears to have more reasonable flows.

The current model was calibrated to the FEMA HEC-2 model by systematically varying the subbasin width characteristic within EPA SWMM. The EPA SWMM model was compared to the HEC-2 model at two locations: East 88th Avenue and Devonshire Road. The results of the calibration are shown below.

TABLE 3-2

Comparison of 100-Year Peak Flow to Other Studies

Location	FIS	FEMA HEC-2	Moser – Calibrated [b]
88th Avenue	680 (0.8 sq.mi.)	1000[a]	1069 (0.8 sq.mi.)
Devonshire Boulevard	1240 (1.2 sq.mi.)	1220[a]	1079 (0.9 sq.mi.)

[a] Tributary area unknown

[b] Calibration occurred before watershed area was expande

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4.1 EVALUATION OF EXISTING FACILITIES

Existing drainage facilities within the project area consist of roadways, natural channels, improved channels, overland flow paths, storm sewers, bridges and culvert crossings.

HEC-RAS was used for the floodplain analysis of all drainage facilities. The cross sections used by HEC-RAS were developed using Autodesk Land Development Desktop and were cut from digital terrain model data supplied by the District for all cross sections above 88th Avenue, and 2-foot contour data for cross sections located below 88th Avenue. The additional survey performed by Woolpert Inc. in March of 2007 was used to further refine selected cross sections and to determine structure elevations near the edge of the floodplain. An as-built survey for the H.C.C. Subdivision provided by Ed Jennings, PE was used to refine the cross sections in the area south of the concrete plant, between the railroad tracks and Steele Street.

All bridges and culverts were analyzed using HEC-RAS. The flow through the culvert between Rainbow and Devonshire was also analyzed using HY-8 to further refine its flow capacity. The flow through the Lower Clear Creek Canal intersection structure was analyzed using HEC-RAS with topographical information obtained from the Woolpert survey. Detailed HEC-RAS output for this project may be located in Appendix C.

For flows in Hoffman Way above 88th Avenue, the surface flows were determined by using SWMM to model the capacity of the underground storm sewer and route excess flows to the surface. The pipe sizes and inverts for the Hoffman Way storm sewer were obtained from as-built information provided by the City of Thornton, where available.

Manning's "n" values were determined through field observation. Pictures illustrating the Manning's "n" values for a sample of the conveyance elements are included in Appendix B.

A number of different splits flow conditions were identified in the watershed. For each split flow, a new reach was created and named. HEC-RAS was used to identify the locations of the splits and to determine the peak flows in each split. A schematic showing each split and its associated peak flow is shown in Figure 4-1.

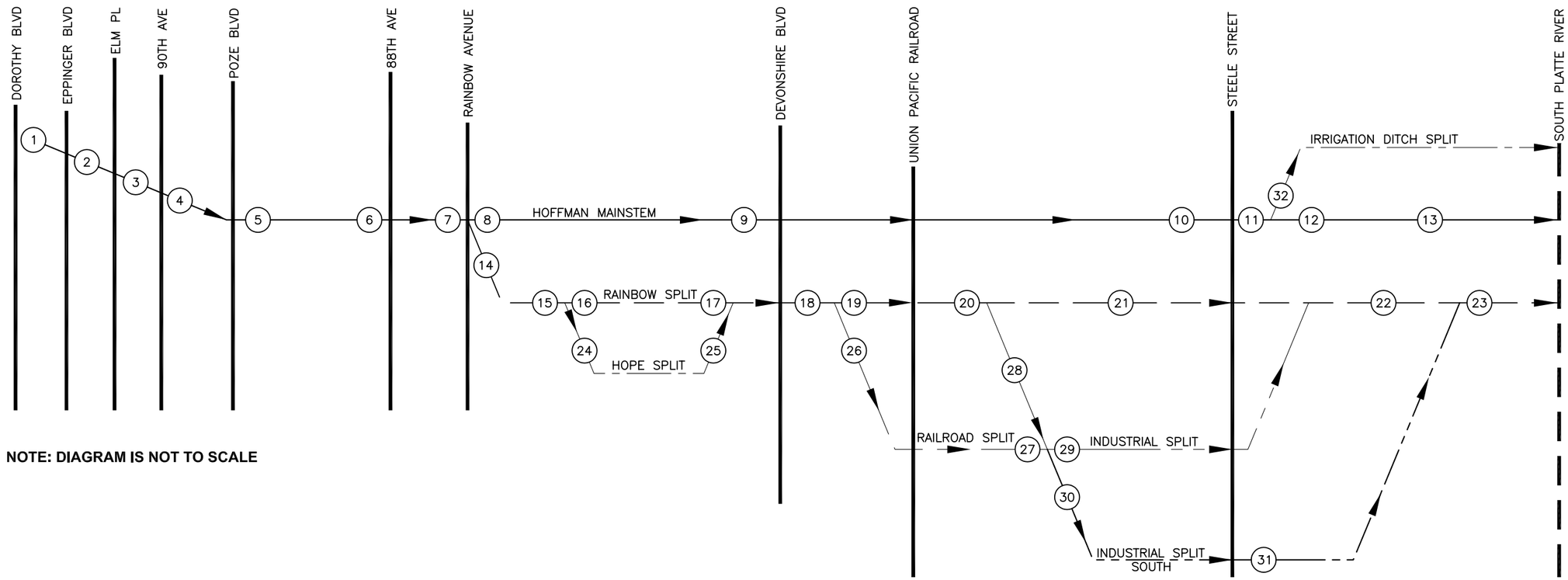
Two floodways were defined for Hoffman Drainageway based on a half-foot and one-foot rise in energy grade elevations. The floodways were defined in a manner to keep structures out of the floodway delineation where possible. In locations where the flow is channelized in the 100-year event and no structures are in the floodplain, the floodway was set equal to the floodplain. The Floodplain and Floodway Data Table can be found in Appendix E.

4.2 FLOOD HAZARDS

The results of the Flood Hazard Area Delineation are located in Appendix D. The FHAD revealed that there are a number of houses and structures (garages, sheds, etc.) located within the 100-year floodplain.

- One (1) house is located within the 100-year floodplain on Hoffman Way on the northwest corner of Hoffman Way and Ash Court.
- Four (4) houses and two (2) structures are located within the 100-year floodplain on the northwest corner of 88th Avenue and Hoffman Way.
- Two (2) houses and one (1) structure are located within the 100-year floodplain on the west corner of Rainbow Avenue and Vine Court.
- Approximately 13 houses and 13 structures are located within the 100-year floodplain along Hope Court between McDougal Street and McElwain Boulevard.
- Two (2) houses and one (1) structure are located within the floodplain on the southwest corner of McElwain Boulevard and Devonshire Boulevard.
- A large portion of the concrete plant on the southwest corner of 86th Avenue and Steele Street is located within the 100-year floodplain.
- Downstream of the concrete plant, approximately 29 structures, including buildings, mobile homes, livestock shelters, and sheds, are located in the floodplain on both sides of Steele Street.

The culvert between Rainbow Avenue and Devonshire Boulevard can only convey approximately 187 cfs of runoff. Excess flows overtop Rainbow Avenue, continue overland along the Rainbow Split and do not return to the Hoffman Drainageway. In addition, a 185-acre basin which drains to McElwain Boulevard is also tributary to the Rainbow Split, compounding the problems in this area. The Rainbow Split is a major source of flooding. More than 50 houses and other structures are in the floodplain as a result of this split.



NOTE: DIAGRAM IS NOT TO SCALE

FLOW CHANGE LOCATIONS

PEAK FLOWS (cfs)

ID	REACH	SECTION	10-YEAR		50-YEAR		100-YEAR		500-YEAR	
			Storm Sewer	Street	Storm Sewer	Street	Storm Sewer	Street	Storm Sewer	Street
1	MAINSTEM	12800	87	0	87	54	87	91	87	147
2	MAINSTEM	11675	111	0	166	22	165	65	165	140
3	MAINSTEM	10400	240	29	240	255	240	380	240	580
4	MAINSTEM	9650	256	106	256	410	256	581	256	848
5	MAINSTEM	8600	248	140	248	486	248	676	248	972
6	MAINSTEM	7660	119	275	119	634	119	830	119	1134
7	MAINSTEM	7450	398		770		972		1283	
8	MAINSTEM	7400	187		187		187		187	
9	MAINSTEM	4942	192		207		215		228	
10	MAINSTEM	3321	199		222		235		253	
11	MAINSTEM	4942	192		207		215		228	
12	MAINSTEM	4942	192		207		215		228	
13	MAINSTEM	1450	231		290		324		372	
14	RAINBOW	27708	215		585		803		1119	
15	RAINBOW	27708	215		585		803		1119	
16	RAINBOW	27103	140		140		140		140	

PEAK FLOWS (cfs)

ID	REACH	SECTION	10-YEAR	50-YEAR	100-YEAR	500-YEAR
17	RAINBOW	26546	215	585	803	1119
18	RAINBOW	26095	283	720	980	1359
19	RAINBOW	26095	283	720	980	1359
20	RAINBOW	26095	283	720	980	1359
21	RAINBOW	24761	237	468	593	780
22	RAINBOW	23713	279	678	919	1268
23	RAINBOW	23141	298	757	1043	1435
24	HOPE	27103	60	430	648	964
25	HOPE	26546	215	585	803	1119
26	RAILROAD	26824	150	150	150	150
27	RAILROAD	26824	150	150	150	150
28	INDUSTRIAL	41575	46	252	387	579
29	INDUSTRIAL	40942	42	210	326	488
30	INDUSTRIAL SOUTH	32171	4	42	61	91
31	INDUSTRIAL SOUTH	31250	8	52	76	111
32	IRRIGATION DITCH	86	0	36	86	96

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FAX: 303-300-1635

DESIGNED DPD DATE 08/31/07
DRAWN ACT DATE 08/31/07
CHECKED TLP DATE 08/31/07
REVISED DATE

CITY OF THORNTON, ADAMS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

HOFFMAN DRAINAGEWAY
FLOOD HAZARD AREA
DELINEATION

CONVEYANCE SCHEMATIC

FIGURE 4-1

NAME: Z:\UDFCD PLANNING\Hoffman\CAD-Hoffman\dwg\FHAD\Fig 4-1 FHAD CONVEYENCE.dwg
PLOT DATE: Oct 11, 2007 1:31pm

The channel is undersized at the Lower Clear Creek Canal at grade crossing. This causes flows to split out of Hoffman Drainageway at this location and sheet flow overland to the northeast. This is the reason for the shallow flooding region on the north side of 86th Avenue, between Steele Street and the South Platte River.

HEC-RAS analysis indicates that a number of structures do not contain the various storm events. The results of the analysis are shown in Table 4-1

TABLE 4-1

Structure Hydraulic Analysis
(Structures Exceeding the Allowable Overtopping Criteria)

Structure	Station	Return Event			
		10-Year	50-Year	100-Year	500-Year
88th Avenue Pipe	76+00	X	X	X	X
Rainbow Avenue Culvert	64+00	X	X	X	X
Old Welby Road Culvert	48+70				
Railroad Bridge	47+50				
Welby Road Culvert	46+25				
Steele Street	32+60		X	X	X
LCCC Crossing	30+00		X	X	X
Maintenance Road	8+25				
Maintenance Road	2+75				
Pedestrian Trail	2+00	N/A - Overtopped by S. Platte River Backwater			

X = Storm Event Peak Flow Exceeds the allowable overtopping criteria
Additional details in Appendix D

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SECTION 5 – REFERENCES

1. “Urban Storm Drainage Criteria Manual”, Urban Drainage and Flood Control District, 2001.

2. “User Manual, EPA SWMM Version 5.0”, U.S. Environmental Protection Agency, 2005.

3. “Lower Hoffman Drainageway Conceptual Design”, Muller Engineering Company, May 14, 1990

4. “Lower Hoffman Drainageway Preliminary Design Memorandum”, January 30, 2003

5. “Flood Insurance Rate Maps, Adam s County, Co lorado and Incorporated Areas”, Federal Emergency Management Agency, August 16 1995

6. “FEMA Flood Insurance Study”, Federal Emergency Management Agency, August 1995.

7. “As-built” drawings for Hoffman Way storm sewer, City of Thornton

8. H.C.C Subdivision As-Built Survey, R.W. Bayer & Associates, Inc., October 2006.

9. 1974 FEMA HEC-2 Model Output Back-up Data

10. “Hoffman Drainageway Baseline Hydrology Report,” Moser and Associates , September 2006.

11. “Flood Hazard Area Delineation , S outh Platte River, Adam s C ounty, Colorado.,” Camp, Dresser and McKee, April 2005.

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APPENDIX A – Meeting Minutes

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PROGRESS MEETING FOR HOFFMAN DRAINAGEWAY PLANNING & FHAD STUDY MEETING MINUTES

Date: August 1, 2006
Location: Urban Drainage and Flood Control District Board Room
Distributions: Attendees

Attendees:

Name	Organization	Email
Ben Urbonas	UDFCD	burbonas@udfcd.org
Ken MacKenzie	UDFCD	kam@udfcd.org
Pete Brezall	City of Thornton	pete.brezall@cityofthornton.net
Gene Potter	City of Thornton	gene.potter@cityofthornton.net
Matthew Pacheco	LCCDC&CADC	matthew.pacheco@cityofthornton.net
Besharah Najjar	Adams County	bnajjar@co.adams.co.us
Jessica Murphy	Adams County	jmurphy@co.adams.co.us
Rick Moser	Moser & Associates	moser@moser-eng.com
Teresa Patterson	Moser & Associates	patterson@moser-eng.com
David Delagarza	Moser & Associates	delagarza@moser-eng.com

I. Purpose

The purpose of this meeting was to kickoff the project study, to obtain input from the project sponsors and interested parties, and to describe information collected to date.

II. Schedule

The notice to proceed was on July 17th, 2006. The Alternatives Analysis & FHAD are scheduled to be complete on December 1, 2006. The conceptual design report is scheduled to be complete on June 1, 2007.

DESCRIPTION	DATE
Notice to Proceed	July 17, 2006
Baseline Hydrology Report	September 1, 2006
Draft Alternatives Report	September 29, 2006
Draft FHAD Report	September 29, 2006
Final Alternatives Report	December 1, 2006
Final FHAD Report	December 1, 2006
Draft Conceptual Design Report	March 30, 2007
Final Conceptual Design Report	June 1, 2007

III. Information Gathered and Existing Reports

Ben Urbonas has provided mapping for the majority of the Watershed to Moser and Associates. There are several areas along the fringe of the watershed boundary that were not included in the mapping. The City of Thornton will provide GIS mapping to cover these areas and supplement the mapping provided by the District. The GIS mapping should include 2-foot contours (1998) as well as aerial photography (2004).

Moser & Associates has obtained FEMA data for Hoffman (Northfield Creek).

The City of Thornton provided a storm sewer map of the watershed at the meeting.

IV. Additional Information Needed

The City of Thornton will provide Moser and Associates GIS mapping of the watershed as discussed above.

Drainage Reports and any as-built drawings still need to be obtained for the Hoffman Street Storm Sewer.

V. Study Watershed

Ben Urbonas gave Moser and Associates direction to only model the future land use condition, as the watershed is almost fully developed. There are only three relatively small locations in the watershed that are expected to be developed in the future:

- The undeveloped area at the north end of the watershed will be developed commercial. Thornton has a requirement of a 20 percent landscaping and therefore an 80% impervious value will be used for future development.
- The undeveloped lot between Devonshire Street and Rainbow Street will be assumed to be developed as high-density residential housing.
- The existing “Urban Farmer Nursery” will be assumed to be developed commercial (80% imperviousness.)

The “High Point” development is a 6 to 7 acre area in the northwest corner of the watershed that will be re-routed out of the watershed with future development; however for the purposes of this study it will be included in the watershed delineation.

The existing Union Pacific Railroad Line is planned to become a commuter rail line with the RTD FasTracks project. This project will also include a station at 88th Ave & Welby Rd. RTD will be invited to become involved in this project.

The hydrology for this project will be completed entirely in SWMM. The SWMM model will be calibrated to match FEMA flows at 88th Ave and Devonshire.

There may be an area between the Hoffman watershed and the Niver Creek watershed to the southwest that has not been identified as tributary to either watershed. Moser & Associates will compare the boundary of the Niver Creek watershed (from the Niver Creek OSP) to the Hoffman watershed boundary and account for any discrepancy.

VI. Problem Areas

There are a number of homes in the effective floodplain.

Overtopping has occurred in larger events at Hoffman Way and 88th Ave approximately 2 times in the last 20 to 30 years.

There may be a split flow near Devonshire causing some of the runoff to inundate the railroad tracks or divert into the Niver creek watershed.

The Lower Clear Creek Canal currently intercepts the low flows in Hoffman Gulch. This is not preferred by the canal company and has led to some minor flooding along the canal.

The portion of the drainageway along 86th Avenue is unsafe for vehicles and very tight as far as ROW is concerned. In addition, 86th Avenue will likely be widened to 3 lanes in the future.

Elm Place is a large contributing basin to the Hoffman drainageway and significant flooding has occurred there in the past, however, Flood Hazard Area Delineation and development of alternatives to improve pipe the conveyance for Elm Place are not included in the scope of this study.

There are a number of utilities that will need to be considered during the alternatives analysis. Utility maps will be obtained from the companies early in the alternatives analysis phase. It has been observed that there are exposed utilities in the drainageway that need to be addressed.

The design flows for the Lower Clear Creek Canal and the Colorado Agricultural Ditch are 150 cfs and 80 cfs respectively.

VII. Public Involvement

A website will be maintained by Moser and Associates on the District's server. This website will explain the purpose of the project, the limits of the study, the progress of the work, and provide an avenue for public comment.

A public meeting will be held to address concerns of the homeowners and business owners in the area. The meeting will "Open House" style, with several short presentations. The meeting is tentatively scheduled for Thursday September 14th from 6pm to 8pm. Pete Brezall and Gene Potter indicated that they would look into the availability of the Thornton Civic Center meeting area for this meeting. (Pete has notified after the progress meeting that September 14th is not available and the public meeting was scheduled at Thornton Civic Center for September 11, 2006)

A postcard will be mailed to all homeowners and business owners in the study limits informing them of the project, the website and the public meeting. Jessica Murphy indicated that she would provide names and addresses for the mailing to Ken MacKenzie. Teresa will provide the limits of the watershed to Jessica.

VIII. Next Meeting

The next progress meeting is scheduled for August 22nd at 1:30 pm at the Urban Drainage and Flood Control District's office.

IX. Action Items

- Moser & Associates will contact the City or Thornton to obtain GIS mapping.
- Pete Brezall will provide as-builts of the new CBC near the lower end of the study reach to Moser & Associates
- Jessica will provide address list to Ken MacKenzie for public meeting by August 9th.
- Moser & Associates will provide a floodplain boundary to Jessica.
- Moser & Associates will provide a brief description of the study area location to Ken Mackenzie
- Besharah will provide documentation on the 90' existing drainage easement along 86th Avenue. He will also try to provide documentation on the court ruling requiring the pipe between Rainbow Street and Devonshire Street.

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PUBLIC MEETING FOR HOFFMAN DRAINAGEWAY PLANNING & FHAD STUDY MEETING SUMMARY

Date: September 11, 2006
Location: Thornton Civic Center Training Room

Attendees:

Name	Organization	Email
Ken MacKenzie	UDFCD	kam@udfcd.org
Besharah Najjar	Adams County	bnajjar@co.adams.co.us
Pete Brezall	City of Thornton	pete.brezall@cityofthornton.net
Rick Moser	Moser & Associates	moser@moser-eng.com
Teresa Patterson	Moser & Associates	patterson@moser-eng.com
David Delagarza	Moser & Associates	delagarza@moser-eng.com

Public Participants are shown on an attached sheet.

I. Purpose

The purpose of this meeting was to inform the public of the scope and objectives of the study and to gather input from the public about problems in the area.

II. Comments

The following is a summary of comments received from the public at the meeting.

- Stormwater backs up at Rainbow and Devonshire and floods houses and yards on Hope Ct. One of the residents noted that the last time a major flood occurred was in July 2004.
- The pipe inlet between Rainbow and Devonshire clogs with debris.
- Flooding occurs between 88th Avenue and Rainbow Drive with some regularity
- 88th Avenue floods and overtops with heavy rains
- The existing Drainageway is a breeding ground for mosquitoes
- During heavy rains the water along the Lower Clear Creek Canal backs up from the intersection with Hoffman Gulch causing flooding of the residences south of 86th Avenue. The ditch company (a representative from the City) will occasionally open the gate at Lower Clear Creek Canal to alleviate the flooding. Several residents voiced that keeping the gate open all of the time would prevent future flooding.
- There are 2 sanitary sewer lines exposed along 86th Avenue between Welby and Steele Street. A representative from EnCon (pre-cast concrete plant) voiced concerns about flooding on the plant boundary and the exposed utilities in the Hoffman ditch.

WE NEED YOUR HELP TO DEVELOP A MAJOR DRAINAGEWAY PLANNING AND FLOOD HAZARD AREA DELINEATION STUDY FOR THE HOFFMAN DRAINAGEWAY!

The project sponsors listed below are in the process of updating a major drainageway master plan for the Hoffman Drainageway.

The area we are studying is roughly bounded on the west by I-25, on the north by Thornton Pkwy, on the south by 86th Avenue, and on the east by the South Platte River.

We invite you to attend a public meeting that will take place on **September 11, 2006** to tell us what flood-related problems you have observed and to provide your input to develop a master plan that best addresses community needs while staying within the resources that may be available to solve them.

Where: Thornton Civic Center
Training Room, First Floor
9500 Civic Center Drive,
Thornton, CO 80229

When: September 11, 2006 from 6:00 to 8:00 PM

Project Sponsors:

- Urban Drainage and Flood Control District
- Adams County
- City of Thornton

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PROGRESS MEETING FOR HOFFMAN DRAINAGEWAY PLANNING & FHAD STUDY MEETING MINUTES

Date: September 19, 2006
Location: Urban Drainage and Flood Control District Board Room
Distributions: Concerns Map, Structure Profile, Alternative Screening Matrix, and Alternatives Descriptions

Attendees:

Name	Organization	Email
Ben Urbonas	UDFCD	burbonas@udfcd.org
Ken MacKenzie	UDFCD	kam@udfcd.org
Pete Brezall	City of Thornton	pete.brezall@cityofthornton.net
Besharah Najjar	Adams County	bnajjar@co.adams.co.us
Teresa Patterson	Moser & Associates	patterson@moser-eng.com
David Delagarza	Moser & Associates	delagarza@moser-eng.com

I. Feedback from Public Meeting

Teresa discussed the feedback revealed at the public meeting held on September 11.

II. Draft Hydrology Report

A brief discussion was held about the draft hydrology report, which was published on September 4th.

III. FHAD

David presented the preliminary cross sections for use in modeling FHAD flows. The discussion acknowledged that the cross sections upstream of 88th Avenue should be placed to account for crown issues at intersection and also have cross sections between them. At 88th Avenue, there should be a cross section upstream of 88th, along 88th at the crown, and then one downstream of 88th.

A discussion was held about how to handle split flows from Hoffman. The flow split begins at Rainbow and therefore a second set of cross sections for the flow split are set up downstream of Rainbow. It is anticipated that the flow overtops Devonshire and the railroad and heads east through the HydroConduit property. It is also anticipated that not all of the flow overtops the railroad, causing another flow split at the railroad.

Ben stated that any water that splits from the main channel needs to be modeled regardless of where it is going. Due to the large area and length of the split flows, this work will require an addendum. Teresa will get a scope and cost estimate for the addendum to Ben as soon as possible.

IV. Alternatives

Teresa presented a preliminary alternatives analysis matrix. A brief discussion was held regarding the viability of the various alternatives considered. It was agreed that the McElwain Blvd basin should be added to the alternatives analysis.

V. Schedule

The project is currently on schedule; however the change of scope will require additional time. The schedule will be adjusted accordingly in the addendum.

VI. Next Meeting

The next progress meeting has been scheduled for Monday, October 16th at 1:30 pm at UDFCD.

MOSER & associates ENGINEERING

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PROGRESS MEETING FOR HOFFMAN DRAINAGEWAY PLANNING & FHAD STUDY MEETING MINUTES

Date: October 16, 2006
Location: Urban Drainage and Flood Control District Board Room
Distributions: Subwatershed Boundaries, Imperviousness Map, Soils Map, EPA SWMM Routing, Preliminary FHAD Map

Attendees:

Name	Organization	Email
Ben Urbonas	UDFCD	burbonas@udfcd.org
Ken MacKenzie	UDFCD	kam@udfcd.org
Pete Brezall	City of Thornton	pete.brezall@cityofthornton.net
Besharah Najjar	Adams County	bnajjar@co.adams.co.us
Jessica Stevens	Adams County	Jstevens@co.adams.co.us
Rick Moser	Moser & Associates	moser@moser-eng.com
Teresa Patterson	Moser & Associates	patterson@moser-eng.com
David Delagarza	Moser & Associates	delagarza@moser-eng.com

I. Purpose

The purpose of the meeting was to present an update of the project progress. The meeting included discussions about the expanded watershed boundary due to the flood flow splits, land-use for these areas, and how the modeling should account for the additional contributing flows. The preliminary 100-year floodplain delineation upstream of Rainbow Avenue was also discussed.

II. Expanded Watershed Hydrology

Teresa presented the additional subbasins that were modeled to define the split flow conditions from Hoffman Drainageway. Ben stated that the flow spilt at the railroad should be modeled in a manner that the floodplain west of the railroad will account for the split flow and the floodplain east of the railroad will assume that all of the water overtops the railroad instead of splitting.

The future land use of the area between Devonshire and the railroad was questioned. The distributed exhibit shows 80% impervious. Jessica is going to check with the County's planning department to see what it's future plans were and inquire if the trailer home area south of 86th Avenue will remain zoned as designated.

III. FHAD

David presented the preliminary flood hazard area delineation results for the area above Rainbow Drive. While some houses appear to have been removed from the FIRM delineation, a number of houses have been added around 88th Avenue and Hoffman Way as well as at the intersection with Rainbow Drive.

IV. Alternatives

Teresa discussed the flooding issues along Hoffman Way and at Rainbow Avenue and strategies to address capacity concerns. She also presented that the detention upstream of Devonshire would need to be approximately 50 ac-ft to accommodate existing channel capacities downstream of Devonshire Blvd.

V. Other Items

Ed Jennings, the engineer for the developer of the property south of HydroConduit property, met with Teresa concerning changes to the topography on his client's property. The development of the lot changed the topography and will most likely affect the floodplain delineation that we are doing. It was agreed that if updated mapping is supplied to Moser within 1 month that the topography for the FHAD will be updated to reflect this change.

VI. Schedule

An extension of the schedule was requested to offer more time to develop the FHAD and the Alternatives. The draft FHAD and Alternatives Reports deadline has been moved to December 1.

VII. Upcoming Meetings

The next progress meeting has been scheduled for **Tuesday, November 14th at 1:30 pm** at UDFCD.

The next public meeting will be held in late January to early February during the sponsor's Alternatives Report review period to take the public's comments into consideration for the Selected Plan. Pete will check on available dates at the Thornton City Hall.

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PROGRESS MEETING FOR HOFFMAN DRAINAGEWAY PLANNING & FHAD STUDY MEETING MINUTES

Date: November 14, 2006
Location: Urban Drainage and Flood Control District Confrence Room
Distributions: Alternative 1 Plan (Hoffman and McElwain Detention),
Alternative 2 Plan (Hoffman Dentention),
Alternative 3 Plan (100-year Conveyance, Open Channel),
Alternative 4 Plan (100-year Conveyance, Conduits),
Alternative 5 Plan (Non-Structural Methods),
Watershed Overview, and Estimate of Probable Cost

Attendees:

Name	Organization	Email
Ben Urbonas	UDFCD	burbonas@udfcd.org
Ken MacKenzie	UDFCD	kam@udfcd.org
Pete Brezall	City of Thornton	pete.brezall@cityofthornton.net
Besharah Najjar	Adams County	bnajjar@co.adams.co.us
Jessica Stevens	Adams County	Jstevens@co.adams.co.us
Teresa Patterson	Moser & Associates	patterson@moser-eng.com
David Delagarza	Moser & Associates	delagarza@moser-eng.com

I. Purpose

The purpose of the meeting was to present an update of the project progress. The meeting included discussions about the preliminary 100-year floodplain delineation and preliminary alternatives.

II. FHAD

David discussed the preliminary FHAD for the basin. While some structures were removed from the floodplain, a significant number of structures were added to the floodplain or are adjacent to the floodplain boundary. Ben requested that all structures that are near the floodplain boundary be surveyed to determine their first floor elevation. This survey will also include enough information to tie in the Jenning's property as-built survey into the study mapping.

III. Alternatives Assessment

Teresa discussed the various alternatives and the associated cost estimates. The alternatives presented include options for incorporating detention along the mainstem of Hoffman Drainageway and also downstream of the McElwain neighborhood. Other alternatives consider conveyance infrastructure with various configurations of open channels and conduits. The fifth alternative considers non-structural methods that may include purchasing residential homes in the floodplain.

It was requested that the open channel alternative along Hoffman Way north of 88th Avenue be reinvestigated for other configurations besides the deep channel with vertical sides. Moser will also add an option for a concrete-lined channel east of Welby Road along 86th Avenue.

IV. Schedule

The schedule will be extended to accommodate acquiring the additional survey for the FHAD. Once Moser obtains the survey results, the next progress meeting will be scheduled.

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PROGRESS MEETING FOR HOFFMAN DRAINAGEWAY PLANNING & FHAD STUDY MEETING MINUTES

Date: April 24, 2007
Location: Urban Drainage and Flood Control District Conference Room
Distributions: Floodplain Exhibit, Alternative Plans, and Estimate of Probable Cost

Attendees:

Name	Organization	Email
Ben Urbonas	UDFCD	burbonas@udfcd.org
Ken MacKenzie	UDFCD	kam@udfcd.org
Pete Brezall	City of Thornton	pete.brezall@cityofthornton.net
Besharah Najjar	Adams County	bnajjar@co.adams.co.us
Jessica Stevens	Adams County	Jstevens@co.adams.co.us
Teresa Patterson	Moser & Associates	patterson@moser-eng.com
David Delagarza	Moser & Associates	delagarza@moser-eng.com

I. Purpose

The purpose of the meeting was to present the results of the field survey and its affect on the FHAD and alternatives evaluation.

II. FHAD Progress

Moser received the additional survey of elevations around the residential homes in March and has incorporated this information into the FHAD modeling. David discussed the results and how the floodplain was being modified. Spot elevations from the survey at the corner of the houses near the border of the floodplain were examined to fine tune the location of the 100-year floodplain around the houses.

The survey also tied the Jenning's property as-built on Steele Street into the project mapping. The as-built shows that fill was placed in the flow path which changes the floodplain in this area. The floodplain was revised in this area to reflect this.

III. Alternatives Assessment

Teresa recapped the alternatives that are being evaluated. She presented alternatives that would narrow the floodplain along Hoffman north of 88th Avenue, removing four houses from the floodplain. Teresa will look at additional alternatives at this location to see if there is a more cost effective solution.

Jessica told us that the parcel in the northwest corner of Devonshire Blvd. and McElwain Blvd. may be an area that we could use for improvements. The owner has contacted the County several times to see if would like to purchase the property. Teresa will investigate if it is feasible to discharge the proposed McElwain improvements through this land instead of east of Devonshire.

IV. Other

It was decided that instead of holding another public meeting, the sponsors would contact those property owners affected by the updated floodplain.

V. Schedule

Moser will get the website updated soon. The draft FHAD and draft Alternatives Evaluation Reports will be submitted by the end of May. Moser will try to submit the FHAD report sooner.

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PROGRESS MEETING FOR HOFFMAN DRAINAGEWAY PLANNING & FHAD STUDY MEETING MINUTES

Date: July 11, 2007
Location: Urban Drainage and Flood Control District Conference Room
Distributions: none

Attendees:

Name	Organization	Email
Ben Urbonas	UDFCD	burbonas@udfcd.org
Ken MacKenzie	UDFCD	kam@udfcd.org
Pete Brezall	City of Thornton	pete.brezall@cityofthornton.net
Chris Crowley	City of Thornton	chris.crowley@cityofthornton.net
Marques Granderson	City of Thornton	marques.granderson@cityofthornton.net
Matthew Pacheco	LCC Ditch Co.	matthew.pacheco@cityofthornton.net
Besharah Najjar	Adams County	bnajjar@co.adams.co.us
Jessica Stevens	Adams County	Jestevens@co.adams.co.us
Teresa Patterson	Moser & Associates	patterson@moser-eng.com
David Delagarza	Moser & Associates	delagarza@moser-eng.com

I. Purpose

The purpose of the meeting was to discuss the Project Sponsors' review comments on the Phase A – Development of Alternate Plans report.

II. Phase A Report Review Comments

Ken and Besharah supplied Moser with copies of the report with their review comments; Jessica provided a CD that contained a scan of her comments; and Pete distributed a hard copy of an email that had review comments from City of Thornton and also sent an email with additional City of Thornton comments.

Lower Clear Creek Canal (LCCC) – The figure illustrating the conceptual configuration for separating the Hoffman Channel from the LCCC ditch flows was discussed. Matt stated that the ditch company supported the general idea of the configuration as illustrated in the report, but that they would like to see a waste gate and emergency overflow provided. Moser will add a note to the figure stating that a waste gate and an emergency overflow shall be provided. Moser will also revise the figure to show a rectangular ditch section instead of a trapezoidal section.

88th Avenue & Cross Culvert – We discussed the flooding at issues at the intersection of Hoffman Way and 88th Avenue. Chris Crowley pointed out that the crown of 88th Avenue is much higher than the gutters and asked if lowering in the crown would help alleviate the flooding in that area. The cause of the flooding is water breaking out of the Hoffman Way street section to the houses which are lower than the curb line. Lowering the crown of 88th has little effect on the flooding upstream.

We also discussed that the culvert under 88th Avenue is a 60" CMP in poor condition and that 88th Avenue is overtopped frequently, including the 10-year event.

It was noted that there are multiple detention facilities in the upper end of the watershed. It was discussed whether accounting for them in the hydrology would affect the peak flows enough to show a benefit and whether their storage could be guaranteed for perpetuity. It is the District's policy that planning studies only recognize facilities under the maintenance and control of the local government to ensure its existence. Moser will experiment with flows near 88th to determine the threshold at which flooding occurs for the one new house within the floodplain boundary.

McElwain Blvd. – The alternatives illustrate discharging the proposed storm sewer east of Devonshire. Adams County requested that for Alternatives 2-4, the outfall flows north to the Hoffman culvert under Devonshire, eliminating one culvert crossing.

86th Avenue Concrete Channel option – Moser will add a discussion in the report that the concrete-lined channel shall be designed in accordance with USDCM Major Drainageway chapter. The report will also note that chain-link fence will be required around the perimeter of the channel and shall be equipped with a complete underdrain system and shall be constructed of reinforced steel.

III. Thornton Water Treatment Plant

The 2007 FHAD (draft currently being reviewed) shows the area north of 86th Avenue and east of the LCCC in a shallow flooding area. The Thornton Water Treatment Plant (WTP) lies within this boundary. City of Thornton is concerned about the flood insurance implications and asked that Moser take a more detailed look at that area. Thornton supplied the as-builts for the WTP grading plan and a CD of additional survey shots in the area. Moser will assess the capacity of the ditch west of the WTP to determine if it has adequate capacity to divert the shallow flood flows around the plant. If additional information is needed, Moser will contact Thornton. Moser will also supply an addendum to Ken for this additional work.

IV. Community Meeting

A community meeting has been scheduled for Thursday, July 19th at the Thornton Civic Center. Residents that could potentially be affected by the FHAD floodplain update were invited to attend this public meeting. Moser will prepare exhibits showing the old and new floodplain lines and the structures affected and an exhibit of the Recommended Plan. Jessica is going to put together some information about obtaining flood insurance.

MOSER & associates ENGINEERING

720 S. Colorado Boulevard, Suite 410 S
Denver, Colorado 80246
phone (303) 757-3655
fax (303) 300-1635

PUBLIC MEETING FOR HOFFMAN DRAINAGEWAY PLANNING & FHAD STUDY MEETING SUMMARY

Date: July 19, 2007
Location: Thornton Civic Center Training Room

Attendees:

Name	Organization	Email
Ken MacKenzie	UDFCD	kam@udfcd.org
Jessica Stevens	Adams County	Jestevens@co.adams.co.us
Pete Brezall	City of Thornton	pete.brezall@cityofthornton.net
Marques Granderson	City of Thornton	marques.granderson@cityofthornton.net
Teresa Patterson	Moser & Associates	patterson@moser-eng.com
David Delagarza	Moser & Associates	delagarza@moser-eng.com

Public Participants are shown on an attached sheet.

I. Purpose

The purpose of this meeting was to inform the public of the preliminary results of the Flood Hazard Area Delineation (FHAD) study, present the recommended improvements developed in the Alternatives Analysis phase of the project to address the problem areas, and to gather input from the public concerning the floodplain changes and the drainage improvements.

II. Major Discussion Points

- Ken introduced the team members and briefly described the scope and purpose of the study.
- Ken stated that this study will not, by itself, determine what improvements, if any will be constructed, rather, it will be used as a guide to determine where improvements are needed, how they will be effective, and give the project sponsors a tool to budget for construction of the improvements.
- Ken discussed what it means for a structure or property to be in the floodplain and the flood insurance implications.
- Teresa and David with Moser presented the floodplain results from the preliminary FHAD mapping in detail and compared the results from this FHAD study to the current FEMA Flood Insurance Rate Maps.
- Teresa presented the preliminary design alternatives being considered and discussed and how the improvements would modify drainage patterns and the floodplain.
- The public participants were invited to look at the floodplain and recommended improvement exhibits up close and ask the sponsors and Moser representatives questions.

YOU MAY BE AFFECTED BY CHANGES TO THE FLOOD HAZARD AREA DELINEATION OF THE HOFFMAN DRAINAGEWAY

The project sponsors listed below are in the process of a major drainageway master planning study and flood hazard area delineation for the Hoffman Drainageway.

The area we are studying is roughly bounded on the west by I-25, on the north by Thornton Pkwy, on the south by 86th Avenue, and on the east by the South Platte River.

We invite you to attend a public meeting that will take place on **July 19, 2007** to find out how the changes to the Hoffman Drainageway floodplain delineation may affect you and what plans are being formulated as part of the master plan to mitigate the flood hazards we have identified.

FOR INFORMATION OR TO CONTACT A PROJECT SPONSER, GO TO:
http://projects.udfcd.org/hoffman/html/contacts.html

Where: Thornton Civic Center
Training Room, First Floor
9500 Civic Center Drive,
Thornton, CO 80229

When: July 19, 2007 from 6:00 to 8:00 PM

Project Sponsors:

- Urban Drainage and Flood Control District
- Adams County
- City of Thornton

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APPENDIX B –Hydrologic Analysis

Supporting Documents

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EPA SWMM Input File

```
[TITLE]

[OPTIONS]
 FLOW_UNITS           CFS
 INFILTRATION         HORTON
 FLOW_ROUTING         KINWAVE
 START_DATE           08/10/2006
 START_TIME           00:00:00
 REPORT_START_DATE    08/10/2006
 REPORT_START_TIME    00:00:00
 END_DATE             08/10/2006
 END_TIME             10:00:00
 SWEEP_START          01/01
 SWEEP_END            12/31
 DRY_DAYS             0
 REPORT_STEP          00:05:00
 WET_STEP             00:15:00
 DRY_STEP             01:00:00
 ROUTING_STEP         0:00:10
 ALLOW_PONDING        NO
 INERTIAL_DAMPING     PARTIAL
 VARIABLE_STEP        0.75
 LENGTHENING_STEP     0
 MIN_SURFAREA         0
 NORMAL_FLOW_LIMITED  NO
 SKIP_STEADY_STATE    NO
 IGNORE_RAINFALL      NO

[RAINGAGES]
;;               Rain      Recd.  Snow   Data       Source           Station    Rain
;;Name           Type      Freq.  Catch  Source     Name             ID         Units
;;-------------------------------------------------------------------------------------
  Adams          VOLUME    0:05   1.0    FILE       "Z:\UDFCD
PLANNING\Hoffman\data\SWMM\adams_raingauge.txt" 500YR      IN

[SUBCATCHMENTS]
;;                                                 Total    Pcnt.            Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width   Slope    Length   Pack
;;-------------------------------------------------------------------------------------------------
  10             Adams            100              5.31     80       109     2.12     0
  11             Adams            110              67.69    62       516     1.47     0
  12             Adams            120              8.78     80       96      1.33     0
  13             Adams            130              15.6     60       452     1.8      0
  14             Adams            140              43.24    39       234     1.01     0
  15             Adams            150              18.71    46       182     3.08     0
  16             Adams            160              13.3     60       500     0.5      0
  20             Adams            200              19.77    35       307     3.08     0
  21             Adams            210              71.61    40       612     2.91     0
  22             Adams            220              35.28    35       745     3.64     0
  23             Adams            230              39.81    36       784     4.2      0
  24             Adams            240              31.89    40       536     3.44     0
  25             Adams            250              54.87    72       1030    7.72     0
  30             Adams            300              26.63    89       611     3.92     0
  31             Adams            310              22.63    77       238     2.49     0
  32             Adams            320              47.55    57       388     2.93     0
  33             Adams            330              64.39    50       1147    5.72     0
  34             Adams            340              31.81    57       374     3.95     0
  35             Adams            350              42.24    75       578     3.82     0
  40             Adams            400              33.5     93.8     220     0.58     0
  41             Adams            410              32.8     80       921     1.65     0
  42             Adams            420              42.1     80       444     1.31     0
  43             Adams            430              73.8     42       571     2.39     0
  44             Adams            440              54.2     35       617     2.09     0
  45             Adams            450              57.9     44       450     2.11     0
  50             Adams            500              46.5     80       307     2.28     0
  51             Adams            510              65.3     80       503     2.89     0
  52             Adams            520              19.1     66       411     9.34     0

[SUBAREAS]
;;Subcatchment     N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------------------------------------------------------------------------------------
  10               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  11               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  12               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50
  13               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  14               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  15               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  16               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  20               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  21               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  22               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  23               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  24               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  25               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  30               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  31               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50
  32               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50
  33               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  34               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50
  35               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50
  40               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50
  41               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50
  42               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50
  43               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  44               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  45               0.02       0.25       0.08       0.18       0          PERVIOUS   33
  50               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50
  51               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50
  52               0.02       0.25       0.08       0.18       0          IMPERVIOUS 50

[INFILTRATION]
;;Subcatchment     MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------------------------------------------------------------------
  10               3.0        0.5        6.48       7          0
  11               3.0        0.5        6.48       7          0
  12               3.0        0.5        6.48       7          0
  13               3.0        0.5        6.48       7          0
  14               3.0        0.5        6.48       7          0
  15               3.0        0.5        6.48       7          0
  16               3.0        0.5        4          7          0
  20               3.0        0.5        6.48       7          0
  21               3.0        0.5        6.48       7          0
  22               3.0        0.5        6.48       7          0
  23               3.0        0.5        6.48       7          0
  24               3.2        0.5        6.17       7          0
  25               4.1        0.8        4.30       7          0
  30               3.0        0.5        6.48       7          0
  31               3.0        0.5        6.48       7          0
  32               3.0        0.5        6.48       7          0
  33               3.8        0.7        4.88       7          0
  34               4.3        0.8        3.91       7          0
  35               4.4        0.8        3.74       7          0
  40               4.68       .92        3.14       7          0
  41               3.17       .54        6.15       7          0
  42               3.0        .5         6.48       7          0
  43               3.0        0.5        6.48       7          0
  44               3.0        .5         6.48       7          0
  45               3.0        0.5        6.48       7          0
  50               3.94       .74        4.61       7          0
  51               3.65       .66        5.2        7          0
  52               3.0        0.5        6.48       7          0

[JUNCTIONS]
;;               Invert     Max.       Init.      Surcharge  Ponded
;;Name           Elev.      Depth      Depth      Depth      Area
;;-------------------------------------------------------------------------
  110              5091.53    0          0          0          0
  120              5125       0          0          0          0
  130              5150.41    0          0          0          0
;Below 88th
```

```
 245              CIRCULAR     3.5        0          0          0          1
 245s             IRREGULAR    HoffmanTyp 0          0          0          1
 255              CIRCULAR     2.75       0          0          0          1
 255s             IRREGULAR    HoffmanTyp 0          0          0          1
 305              IRREGULAR    48street   0          0          0          1
 315              IRREGULAR    48street   0          0          0          1
 325              IRREGULAR    48street   0          0          0          1
 335              IRREGULAR    48street   0          0          0          1
 345              IRREGULAR    48street   0          0          0          1
 355              CIRCULAR     4.5        0          0          0          1
 356              IRREGULAR    48street   0          0          0          1
 415              DUMMY        0          0          0          0          1
 425              TRAPEZOIDAL  3          100        10         10         1
 435              TRAPEZOIDAL  2          100        100        100        1
 436              TRAPEZOIDAL  3          2          1          1          1
 445              IRREGULAR    48street   0          0          0          1
 455              IRREGULAR    48street   0          0          0          1
 515              TRAPEZOIDAL  10         2          1          1          1
 526              TRAPEZOIDAL  10         2          1          1          1
 525              DUMMY        0          0          0          0          1
 437              TRAPEZOIDAL  2          100        100        100        1

[TRANSECTS]
;;-----------------------------------------------------------------------------------------

;48' Street
 NC .014     0.014    0.014
 X1 48street          10       .375     52.625   0.0      0.0      0.0      0.0      0.0
 GR 2.5      -20      .5       .375     0        .5       0.166667 2.5      0.647    26.5
 GR 0.16666667 50.5     0        52.5     .5       52.625   .5       53       2.5      73

 NC 0.014    0.014    0.014
 X1 HoffmanTyp        17       0.0      88       0.0      0.0      0.0      0.0      0.0
 GR 4        -20      2        .375     1.5      .5       1.41666667 2.5      0.937    26.5
 GR .770     28.5     1.270    28.625   1.270    29.0     1.770    44       1.270    59.0
 GR 1.270    59.375   .770     59.5     0.937    61.5     1.416667 85.5     1.5      87.5
 GR 2.0      87.625   4        108

[REPORT]
 INPUT     NO
 CONTROLS  NO

[TAGS]
```

```
  150             5190       0          0          0          0
  160             5155       0          0          0          0
  300             5268       0          0          0          0
  310             5301       0          0          0          0
  320             5267.2     0          0          0          0
  330             5308       0          0          0          0
  340             5354.3     0          0          0          0
  410             5108       0          0          0          0
  420             5116       0          0          0          0
  431             5132       0          0          0          0
  440             5194       0          0          0          0
  450             5224       0          0          0          0
  510             5122       0          0          0          0

[OUTFALLS]
;;                Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;--------------------------------------------------------
  100             5071.0     FREE                        NO
  351             5362.8     FREE                        NO
  400             5080       FREE                        NO
  500             5118       FREE                        NO

[DIVIDERS]
;;                Invert     Diverted         Divider
;;Name           Elev.      Link             Type       Parameters
;;-------------------------------------------------------------------
  140             5169.88    145o             CUTOFF     181        0          0          0          0
;Hoffman Way at 88th
  200             5191       205s             OVERFLOW   0          0          0          0
;Hoffman Way at Poze Blvd.
  210             5200       215s             OVERFLOW   0          0          0          0
;Hoffman Way at 9th Ave
;Sta. 20+65
  220             5212.95    225s             OVERFLOW   0          0          0          0
;Hoffman Way at Elm Pl.
;Sta. 28+26
  230             5235.65    235s             OVERFLOW   0          0          0          0
;Hoffman Way at Eppinger Blvd.
;Sta 40+75
  240             5269.71    245s             OVERFLOW   0          0          0          0
;Hoffman Way at Dorthy Pl.
;Sta. 51+48
  250             5303.94    255s             OVERFLOW   0          0          0          0
  350             5372.8     356              OVERFLOW   0          0          0          0
  430             5148       435              CUTOFF     0          0          0          0          0
  520             5133       526              CUTOFF     1000       0          0          0          0

[CONDUITS]
;;                Inlet            Outlet                    Manning    Inlet      Outlet     Init.
Maximum
;;Name           Node             Node             Length    N          Height     Height     Flow
Flow
;;--------------------------------------------------------------------------------------------------
--------------
  115             110              100              1320      .04        0          0          0
0
  125             120              110              1700      .04        0          0          0
0
  135             130              120              1850      .05        0          0          0
0
  145             140              130              1400      .02        0          0          0
0
  145o            140              430              1400      .045       6.5        11.59      0
0
  155             150              140              1100      .04        0          0          0
0
  165             160              430              400       0.01       0          0          0
0
  205             200              150              150       0.025      0          0          0
0
  205s            200              150              150       .02        7          6          0
0
  215             210              200              1000      .014       0          0          0
0
  215s            210              200              1000      .02        10         7          0
0
  225             220              210              1350      .014       0          0          0
0
  225s            220              210              1350      .02        9.75       10         0
0
  235             230              220              743       .014       0          2          0
0
  235s            230              220              743       .02        9.95       9.75       0
0
  245             240              230              1216      .014       0          1.4        0
0
  245s            240              230              1216      .02        6.99       9.95       0
0
  255             250              240              1272      .014       0          0.2        0
0
  255s            250              240              1272      .02        6.96       6.99       0
0
  305             300              220              2000      .02        0          0          0
0
  315             310              300              2000      .02        0          0          0
0
  325             320              230              1500      .02        0          0          0
0
  335             330              320              2000      .02        0          0          0
0
  345             340              330              2000      .02        0          0          0
0
  355             350              351              1000      .014       0          0          0
0
  356             350              330              2500      .02        0          0          0
0
  415             410              400              850       0.04       0          0          0
0
  425             420              410              2100      0.04       0          0          0
0
  435             430              431              1350      0.035      0          0          0
0
  436             430              520              400       .04        0          0          0
0
  445             440              430              3800      0.02       0          0          0
0
  455             450              440              3000      0.02       0          0          0
0
  515             510              500              600       0.045      0          0          0
0
  526             520              510              1800      0.045      0          0          0
0
  525             520              431              400       0.04       0          0          0
0
  437             431              420              1350      0.04       0          0          0
0

[XSECTIONS]
;;Link            Type         Geom1      Geom2      Geom3      Geom4      Barrels
;;-------------------------------------------------------------------------------
  115             TRAPEZOIDAL  8          6          3          3          1
  125             TRAPEZOIDAL  8          6          3          3          1
  135             TRAPEZOIDAL  8          6          4          4          1
  145             CIRCULAR     5          0          0          0          2
  145o            TRAPEZOIDAL  5          20         10         10         1
  155             TRAPEZOIDAL  10         5          4          4          1
  165             DUMMY        0          0          0          0          1
  205             CIRCULAR     5          0          0          0          1
  205s            IRREGULAR    HoffmanTyp 0          0          0          1
  215             CIRCULAR     5          0          0          0          1
  215s            IRREGULAR    HoffmanTyp 0          0          0          1
  225             CIRCULAR     5          0          0          0          1
  225s            IRREGULAR    HoffmanTyp 0          0          0          1
  235             CIRCULAR     4          0          0          0          1
  235s            IRREGULAR    HoffmanTyp 0          0          0          1
```

EPA SWMM Output File (100-Year)

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.011)
--------------------------------------------------------------


****************
Analysis Options
****************
Flow Units ............... CFS
Infiltration Method ...... HORTON
Flow Routing Method ...... KINWAVE
Starting Date ............ AUG-10-2006 00:00:00
Ending Date .............. AUG-10-2006 10:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Wet Time Step ............ 00:15:00
Dry Time Step ............ 01:00:00
Routing Time Step ........ 10.00 sec


*********************
Rainfall File Summary
*********************
Station    First       Last        Recording   Periods    Periods    Periods
ID         Date        Date        Frequency   w/Rain     Missing    Malfunc.
-------------------------------------------------------------------------------
100YR      AUG-10-2006 AUG-10-2006     5 min       25          0          0


*************************        Volume         Depth
Runoff Quantity Continuity     acre-feet        inches
*************************     ---------       -------
Total Precipitation ......       282.441         3.120
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........        98.244         1.085
Surface Runoff ...........       180.639         1.995
Final Surface Storage ....         5.180         0.057
Continuity Error (%) .....        -0.574


*************************        Volume        Volume
Flow Routing Continuity        acre-feet      Mgallons
*************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......       180.654        58.869
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........       181.932        59.285
Surface Flooding .........         0.000         0.000
Evaporation Loss .........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.297         0.097
Continuity Error (%) .....        -0.872


**************************
Subcatchment Runoff Summary
**************************

-------------------------------------------------------------------------------------------
                    Total      Total      Total      Total      Total       Peak     Runoff
                   Precip      Runon      Evap      Infil     Runoff     Runoff     Coeff
Subcatchment           in         in        in         in         in        CFS
-------------------------------------------------------------------------------------------
10                  3.120      0.000      0.000      0.452      2.629     16.468     0.843
11                  3.120      0.000      0.000      1.155      1.918     94.185     0.615
12                  3.120      0.000      0.000      0.409      2.641     22.513     0.847
13                  3.120      0.000      0.000      0.853      2.244     41.922     0.719
14                  3.120      0.000      0.000      1.931      1.157     35.846     0.371
15                  3.120      0.000      0.000      1.402      1.695     30.689     0.543
16                  3.120      0.000      0.000      1.019      2.074     30.317     0.665
20                  3.120      0.000      0.000      1.529      1.579     32.761     0.506
21                  3.120      0.000      0.000      1.606      1.494    100.857     0.479
22                  3.120      0.000      0.000      1.409      1.702     67.848     0.545
23                  3.120      0.000      0.000      1.385      1.725     78.071     0.553
24                  3.120      0.000      0.000      1.393      1.713     60.125     0.549
25                  3.120      0.000      0.000      0.807      2.285    177.930     0.732
30                  3.120      0.000      0.000      0.240      2.843    113.909     0.911
31                  3.120      0.000      0.000      0.459      2.604     66.447     0.834
32                  3.120      0.000      0.000      0.990      2.094    110.271     0.671
33                  3.120      0.000      0.000      1.325      1.777    152.588     0.570
34                  3.120      0.000      0.000      1.185      1.901     87.192     0.609
35                  3.120      0.000      0.000      0.662      2.408    145.590     0.772
40                  3.120      0.000      0.000      0.180      2.766     51.641     0.887
41                  3.120      0.000      0.000      0.361      2.711    134.047     0.869
42                  3.120      0.000      0.000      0.412      2.636    105.127     0.845
43                  3.120      0.000      0.000      1.618      1.478     98.053     0.474
44                  3.120      0.000      0.000      1.694      1.410     73.236     0.452
45                  3.120      0.000      0.000      1.584      1.510     76.696     0.484
50                  3.120      0.000      0.000      0.524      2.515    102.024     0.806
51                  3.120      0.000      0.000      0.476      2.574    169.789     0.825
52                  3.120      0.000      0.000      0.577      2.515     88.161     0.806
-------------------------------------------------------------------------------------------
System              3.120      0.000      0.000      1.085      1.995   2314.061     0.640
```

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Max Vol. Ponded acre-in	Total Minutes Flooded
110	JUNCTION	0.89	3.08	5094.61	0 00:50	0	0
120	JUNCTION	0.83	2.70	5127.70	0 00:48	0	0
130	JUNCTION	0.83	2.73	5153.14	0 00:40	0	0
150	JUNCTION	6.17	7.40	5197.40	0 00:46	0	0
160	JUNCTION	0.00	0.00	5155.00	0 00:00	0	0
300	JUNCTION	0.21	0.75	5268.75	0 00:42	0	0
310	JUNCTION	0.19	0.62	5301.62	0 00:40	0	0
320	JUNCTION	0.27	0.97	5268.17	0 00:41	0	0
330	JUNCTION	0.21	0.85	5308.85	0 00:40	0	0
340	JUNCTION	0.16	0.64	5354.94	0 00:40	0	0
410	JUNCTION	0.38	2.31	5110.31	0 01:10	0	0
420	JUNCTION	0.37	2.38	5118.38	0 01:02	0	0
431	JUNCTION	0.20	1.28	5133.28	0 00:56	0	0
440	JUNCTION	0.27	0.77	5194.77	0 00:47	0	0
450	JUNCTION	0.23	0.69	5224.69	0 00:40	0	0
510	JUNCTION	1.06	5.16	5127.16	0 00:40	0	0
100	OUTFALL	0.89	3.07	5074.07	0 00:52	0	0
351	OUTFALL	0.42	3.04	5365.84	0 00:40	0	0
400	OUTFALL	0.00	0.00	5080.00	0 00:00	0	0
500	OUTFALL	1.06	5.13	5123.13	0 00:42	0	0
140	DIVIDER	6.78	9.50	5179.38	0 00:48	0	0
200	DIVIDER	7.17	8.40	5199.40	0 00:46	0	0
210	DIVIDER	10.12	11.32	5211.32	0 00:45	0	0
220	DIVIDER	9.85	11.06	5224.01	0 00:43	0	0
230	DIVIDER	10.01	10.89	5246.54	0 00:42	0	0
240	DIVIDER	7.02	7.62	5277.33	0 00:41	0	0
250	DIVIDER	6.99	7.60	5311.54	0 00:35	0	0
350	DIVIDER	0.42	3.04	5375.84	0 00:40	0	0
430	DIVIDER	11.89	14.56	5162.56	0 00:51	0	0
520	DIVIDER	0.00	0.00	5133.00	0 00:00	0	0

****
Node Flow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Maximum Flooding Overflow CFS	Time of Max Occurrence days hr:min
110	JUNCTION	94.19	326.05	0 00:50	0.00	
120	JUNCTION	22.51	236.76	0 00:47	0.00	
130	JUNCTION	41.92	222.77	0 00:40	0.00	
150	JUNCTION	30.69	974.80	0 00:46	0.00	
160	JUNCTION	30.32	30.32	0 00:40	0.00	
300	JUNCTION	113.91	167.30	0 00:42	0.00	
310	JUNCTION	66.45	66.45	0 00:40	0.00	
320	JUNCTION	110.27	327.40	0 00:41	0.00	
330	JUNCTION	152.59	223.52	0 00:40	0.00	
340	JUNCTION	87.19	87.19	0 00:40	0.00	
410	JUNCTION	134.05	1060.72	0 01:10	0.00	
420	JUNCTION	105.13	1069.11	0 01:02	0.00	
431	JUNCTION	0.00	1026.16	0 00:56	0.00	
440	JUNCTION	73.24	125.14	0 00:47	0.00	
450	JUNCTION	76.70	76.70	0 00:40	0.00	
510	JUNCTION	169.79	169.79	0 00:40	0.00	
100	OUTFALL	16.47	338.27	0 00:52	0.00	
351	OUTFALL	0.00	145.47	0 00:40	0.00	
400	OUTFALL	51.64	1109.41	0 01:10	0.00	
500	OUTFALL	102.02	269.58	0 00:42	0.00	
140	DIVIDER	35.85	1006.61	0 00:48	0.00	
200	DIVIDER	32.76	948.41	0 00:46	0.00	
210	DIVIDER	100.86	924.93	0 00:45	0.00	
220	DIVIDER	67.85	840.42	0 00:43	0.00	
230	DIVIDER	78.07	621.40	0 00:42	0.00	
240	DIVIDER	60.13	233.14	0 00:40	0.00	
250	DIVIDER	177.93	177.93	0 00:35	0.00	
350	DIVIDER	145.59	145.59	0 00:40	0.00	
430	DIVIDER	98.05	1024.05	0 00:51	0.00	
520	DIVIDER	88.16	88.16	0 00:35	0.00	

****
Outfall Loading Summary
****

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS
100	98.33	63.44	338.27
351	97.64	10.48	145.47
400	98.33	120.75	1109.41
500	98.33	29.22	269.58
System	98.16	223.89	1656.43

****
Link Flow Summary
****

Link	Type	Maximum Flow CFS	Time of Max Occurrence days	hr:min	Maximum Velocity ft/sec	Max/ Full Flow	Max/ Full Depth	Total Minutes Surcharged
115	CONDUIT	325.09	0	00:52	6.97	0.11	0.38	0
125	CONDUIT	235.71	0	00:51	7.00	0.07	0.31	0
135	CONDUIT	215.79	0	00:48	4.79	0.08	0.34	0
145	CONDUIT	181.52	0	02:11	10.01	0.45	0.47	0
145o	CONDUIT	807.11	0	00:51	5.56	0.31	0.59	0
155	CONDUIT	971.58	0	00:48	9.26	0.14	0.45	0
165	DUMMY	30.32	0	00:40				
205	CONDUIT	119.42	0	00:38	6.58	1.08	0.95	114
205s	CHANNEL	828.94	0	00:46	13.56	0.15	0.43	0
215	CONDUIT	247.86	0	01:44	13.72	1.08	0.95	73
215s	CHANNEL	675.21	0	00:46	26.59	0.13	0.41	0
225	CONDUIT	255.81	0	01:08	14.23	1.08	0.95	64
225s	CHANNEL	580.11	0	00:45	24.01	0.12	0.40	0
235	CONDUIT	240.44	0	00:46	20.80	1.08	0.95	53
235s	CHANNEL	380.33	0	00:43	32.91	0.04	0.29	0
245	CONDUIT	165.42	0	00:57	18.68	1.08	0.95	24
245s	CHANNEL	65.22	0	00:43	30.01	0.01	0.18	0
255	CONDUIT	86.83	0	01:08	15.87	1.08	0.95	39
255s	CHANNEL	90.53	0	00:41	26.06	0.01	0.20	0
305	CHANNEL	165.37	0	00:44	8.53	0.05	0.30	0
315	CHANNEL	62.89	0	00:46	5.27	0.02	0.24	0
325	CHANNEL	326.05	0	00:43	10.00	0.10	0.39	0
335	CHANNEL	221.20	0	00:42	8.68	0.07	0.34	0
345	CHANNEL	85.19	0	00:42	6.59	0.03	0.25	0
355	CONDUIT	145.47	0	00:40	12.87	0.80	0.67	0
356	CHANNEL	0.00	0	00:00	0.00	0.00	0.00	0
415	DUMMY	1060.72	0	01:10				
425	CONDUIT	1011.48	0	01:10	3.67	0.63	0.76	0
435	CONDUIT	991.67	0	00:56	3.95	0.32	0.59	0
436	CONDUIT	0.00	0	00:00	0.00	0.00	0.00	0
445	CHANNEL	119.57	0	00:56	5.91	0.05	0.30	0
455	CHANNEL	67.69	0	00:50	4.53	0.03	0.27	0
515	CONDUIT	167.78	0	00:42	4.60	0.21	0.51	0
526	CONDUIT	0.00	0	00:00	0.00	0.00	0.00	0
525	DUMMY	88.16	0	00:35				
437	CONDUIT	992.50	0	01:02	3.59	0.36	0.63	0

****
Highest Flow Instability Indexes
****
Link 155 (1)
Link 235 (1)
Link 315 (1)
Link 215 (1)
Link 125 (1)

****
Routing Time Step Summary
****
Minimum Time Step : 10.00 sec
Average Time Step : 10.00 sec
Maximum Time Step : 10.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.10

Analysis begun on: Thu Oct 11 13:42:07 2007
Analysis ended on: Thu Oct 11 13:42:07 2007
Total elapsed time: < 1 sec

Table B-1
Subwatershed Characteristics

Basin ID	Area (ac.)	Width (ft)	Slope (%)	Impervious (%)	Subarea Routing	Percent Routed	Infiltration		
							Initial (in/hr)	Final (in/hr)	Decay Coefficient (1/sec)
10	5.31	109	2.12	80	PERVIOUS	33	3.00	0.50	6.48
11	67.69	516	1.47	62	PERVIOUS	33	3.00	0.50	6.48
12	8.78	96	1.33	80	IMPERVIOUS	50	3.00	0.50	6.48
13	15.37	253	2.26	64	PERVIOUS	33	3.00	0.50	6.48
14	43.24	234	1.01	39	PERVIOUS	33	3.00	0.50	6.48
15	18.71	182	3.08	46	PERVIOUS	33	3.00	0.50	6.48
20	19.77	307	3.08	35	PERVIOUS	33	3.00	0.50	6.48
21	71.61	612	2.91	40	PERVIOUS	33	3.00	0.50	6.48
22	35.28	745	3.64	35	PERVIOUS	33	3.00	0.50	6.48
23	39.81	784	4.20	36	PERVIOUS	33	3.00	0.50	6.48
24	31.89	536	3.44	40	PERVIOUS	33	3.16	0.54	6.17
25	54.87	1030	7.72	72	PERVIOUS	33	4.10	0.78	4.30
30	26.63	611	3.92	89	PERVIOUS	33	3.00	0.50	6.48
31	22.63	238	2.49	77	IMPERVIOUS	50	3.00	0.50	6.48
32	47.55	388	2.93	57	IMPERVIOUS	50	3.00	0.50	6.48
33	64.39	1147	5.72	50	PERVIOUS	33	3.81	0.70	4.88
34	31.81	374	3.95	57	IMPERVIOUS	50	4.30	0.82	3.91
35	42.24	578	3.82	75	IMPERVIOUS	50	4.38	0.85	3.74
40	107.57	706	0.58	94	IMPERVIOUS	50	4.68	0.92	3.14
41	32.81	921	1.65	80	IMPERVIOUS	50	3.17	0.54	6.15
42	42.13	444	1.31	80	IMPERVIOUS	50	3.00	0.50	6.48
43	73.76	571	2.39	42	PERVIOUS	33	3.00	0.50	6.48
44	54.20	617	2.09	35	PERVIOUS	33	3.00	0.50	6.48
45	57.89	450	2.11	44	PERVIOUS	33	3.00	0.50	6.48
50	46.52	307	2.28	80	IMPERVIOUS	50	3.94	0.74	4.61
51	65.28	503	2.89	80	IMPERVIOUS	50	3.65	0.66	5.2
52	19.06	411	9.34	66	IMPERVIOUS	50	3.00	0.50	6.48

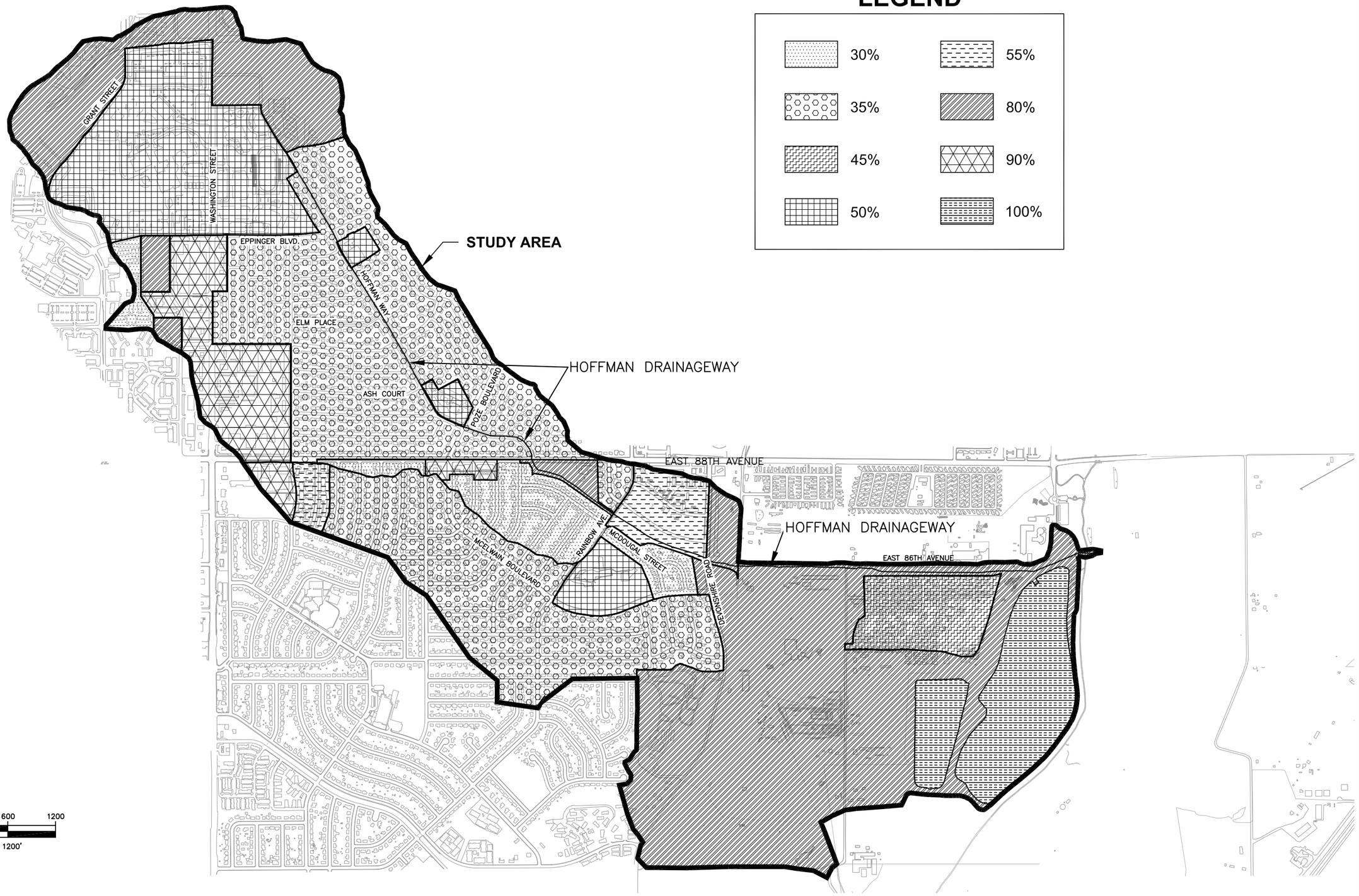
Table B-2
Peak Flow Summary

Mainline Sta	Design Point	Location	Drainage Area (ac)	100-Yr Runoff Volume (ac-ft)	2-Year (cfs)	5-Year (cfs)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
0+00	100	Outfall to S. Platte	213	0.3	207	226	238	274	302	338	390
13+00	110	Maintenance Road	207.7	2.5	206	222	233	267	293	326	374
28+00	120	Steele Street	140	0.6	191	196	200	214	224	237	256
51+00	130	Devonshire Road	131.2	0.6	187	193	197	206	213	223	235
63+00	140	Rainbow Avenue	550.5	1.0	202	336	413	617	797	1007	1329
76+00	150	Downstream East 88th Avenue	507.2	0.5	196	323	408	598	772	975	1287
76+50	160	Devonshire Road	13.3	0.5	7	11	14	19	24	30	40
76+50	200	Upstream East 88th Avenue	488.5	0.4	190	315	399	583	751	948	1252
86+50	210	Poze Boulevard	468.7	1.7	185	308	387	570	733	925	1220
96+50	220	East 90th Avenue	397.1	0.8	167	285	358	521	666	840	1108
104+00	230	Elm Place	312.6	0.9	126	214	270	387	493	621	820
117+00	240	Eppinger Blvd.	86.8	0.8	56	91	114	147	186	233	307
128+00	250	Dorthy Blvd	54.9	2.4	43	69	86	118	149	178	234
	300	Corona Street	49.2	1.9	35	60	74	107	134	167	217
	310	Washington Street	22.6	1.5	14	24	30	42	53	66	86
	320	Elm Place	186	2.4	72	118	146	206	260	327	430
	330	Washington Street	138.4	1.9	52	83	102	140	178	224	294
	340	High School	31.8	1.6	23	36	43	58	74	87	113
	350	Grant Street	42.2	2.8	37	59	70	94	119	146	185
	351	Grand Street Storm Sewer		-	36	58	70	94	118	145	198
	400	Outfall to S. Platte	816.6	2.2	82	237	339	590	816	1109	1513
	410	Inflow to Gravel Lakes	709	2.3	72	221	319	562	779	1061	1451
	420	Rainbow Split at Steele Street	676.2	2.9	69	229	322	574	793	1069	1466
	430	McElwain at Devonshire	634.1	1.9	60	216	307	550	764	1024	1413
	431	Industrial Plant at LCCC Bridge	634.1	-	57	214	306	549	763	1026	1414
	440	McElwain at Rainbow Avenue	112.1	1.1	24	41	51	76	98	125	167
	450	McElwain at Evelyn Court	57.9	1.5	16	27	34	47	60	77	101
	500	Railroad Ditch at Niver Creek	130.9	3.2	57	94	117	170	214	270	354
	510	Railroad Ditch at Culvert	84.4	4.6	36	60	75	106	134	170	223
	520	Railroad Ditch at LCCC Bridge	19.1	1.1	23	38	47	61	75	88	111

DFHAD Prototype

LEGEND

30%	55%
35%	80%
45%	90%
50%	100%



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MOSER & associates ENGINEERING
720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

DESIGNED	DPD	DATE	08/31/07
DRAWN	ACT	DATE	08/31/07
CHECKED	TLP	DATE	08/31/07
REVISED		DATE	

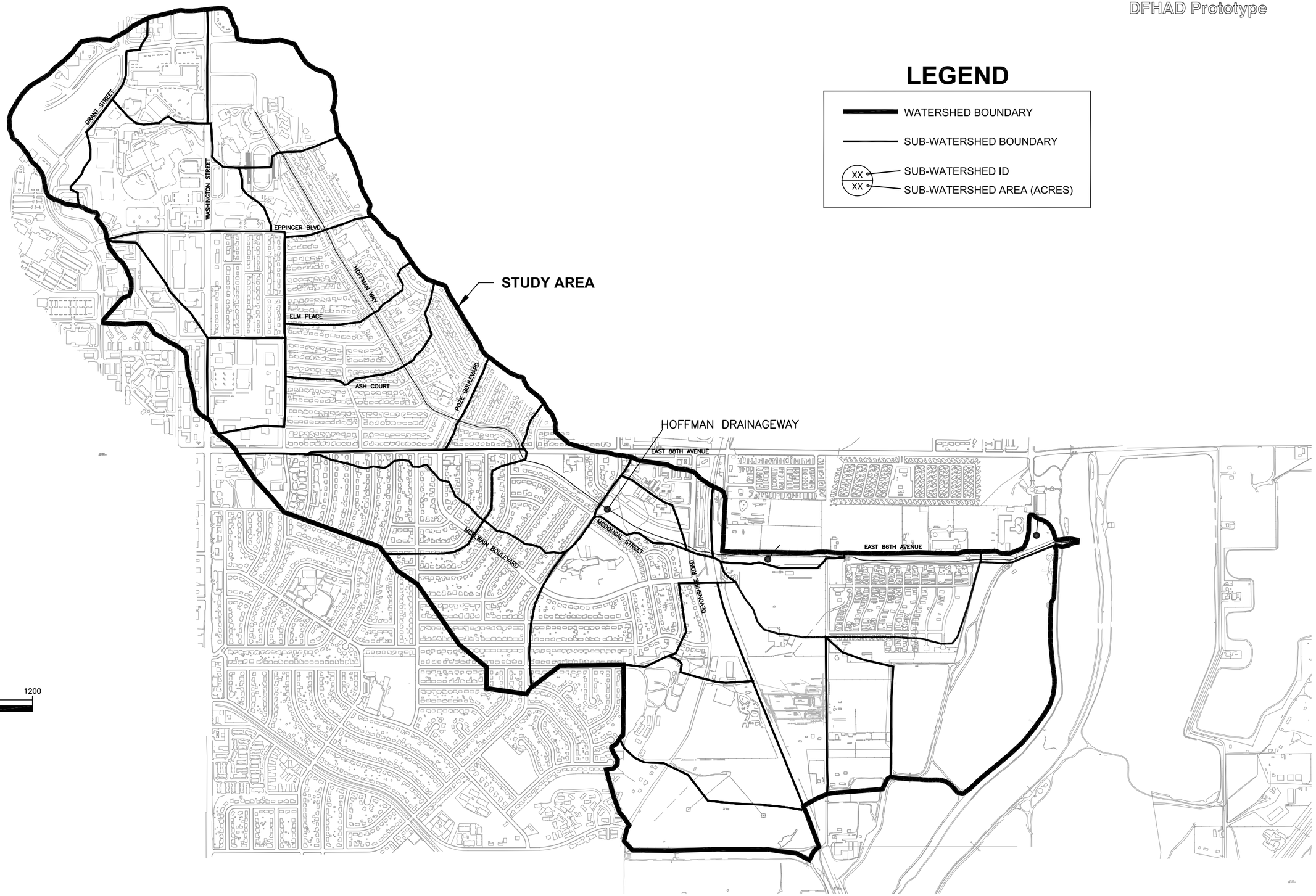
CITY OF THORNTON, ADAMS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

HOFFMAN DRAINAGEWAY FLOOD HAZARD AREA DELINEATION

IMPERVIOUSNESS MAP

FIGURE B-1

DFHAD Prototype



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MOSER & associates ENGINEERING
720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

DESIGNED	DPD	DATE	08/31/07
DRAWN	ACT	DATE	08/31/07
CHECKED	TLP	DATE	08/31/07
REVISED		DATE	

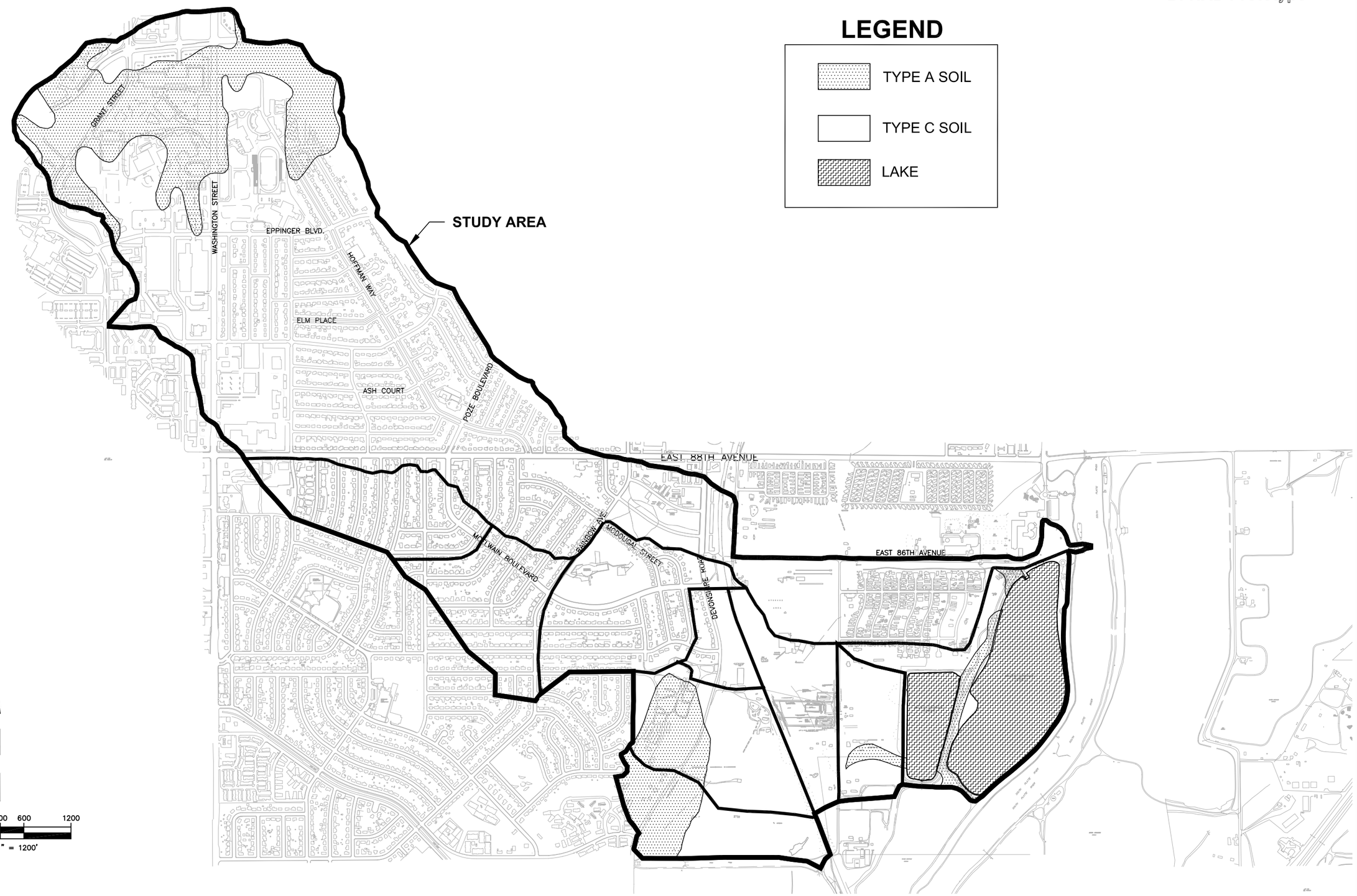
CITY OF THORNTON, ADAMS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

HOFFMAN DRAINAGEWAY FLOOD HAZARD AREA DELINEATION

SUBWATERSHED BOUNDARIES

FIGURE B-2

DFHAD Prototype



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MOSER & associates ENGINEERING
720 S. COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

DESIGNED	DPD	DATE 08/31/07
DRAWN	ACT	DATE 08/31/07
CHECKED	TLP	DATE 08/31/07
REVISED		DATE

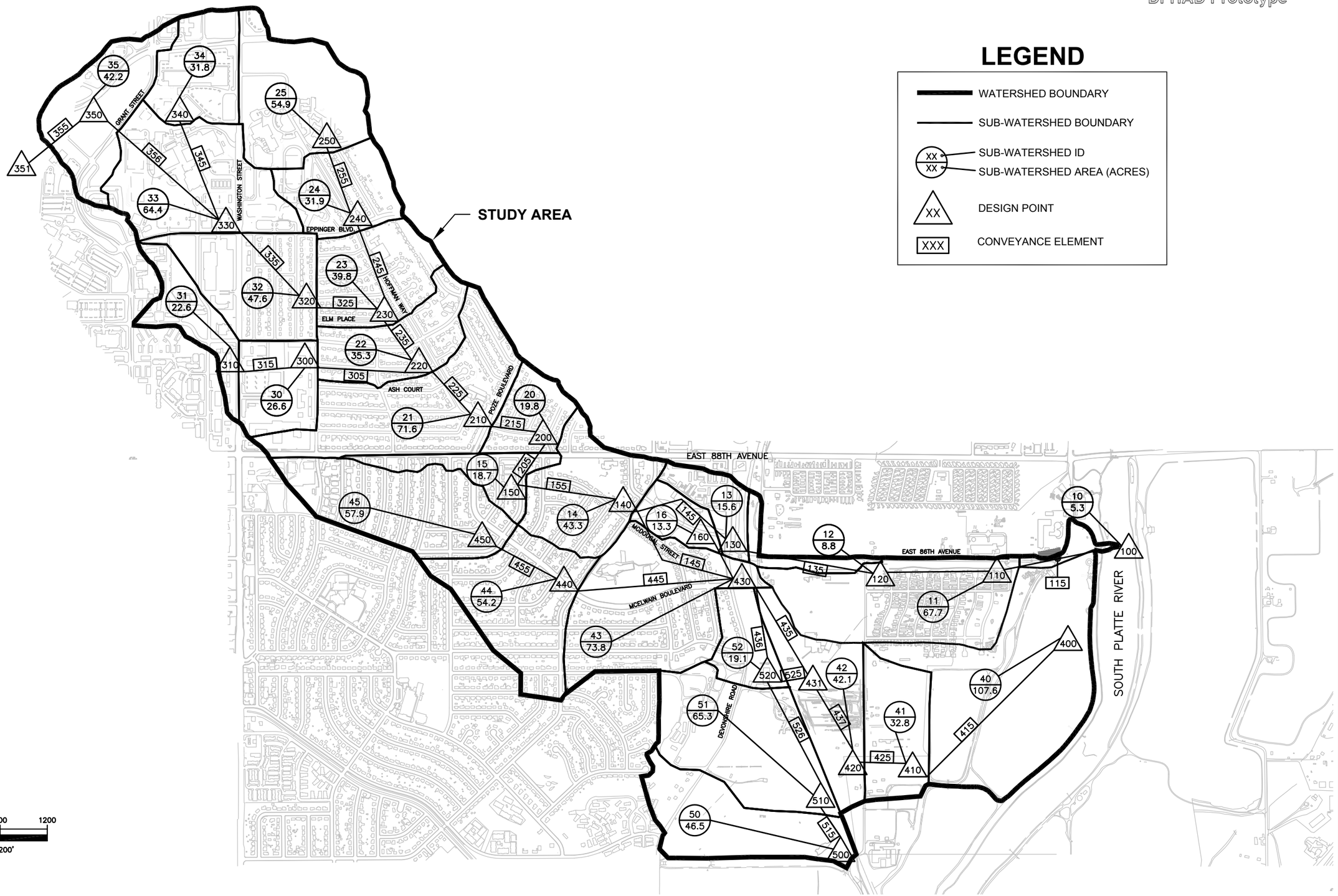
CITY OF THORNTON, ADAMS COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

HOFFMAN DRAINAGEWAY
FLOOD HAZARD AREA DELINEATION

SOILS MAP

FIGURE B-3

DFHAD Prototype



MOSER & associates ENGINEERING 720 S. COLORADO BLVD. SUITE 410 S DENVER, CO 80246 PHONE: 303-757-3655 FAX: 303-300-1635	DESIGNED DPD DATE 08/31/07 DRAWN ACT DATE 08/31/07 CHECKED TLP DATE 08/31/07 REVISED DATE	CITY OF THORNTON, ADAMS COUNTY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT	HOFFMAN DRAINAGEWAY FLOOD HAZARD AREA DELINEATION	EPA SWMM ROUTING	FIGURE B-4

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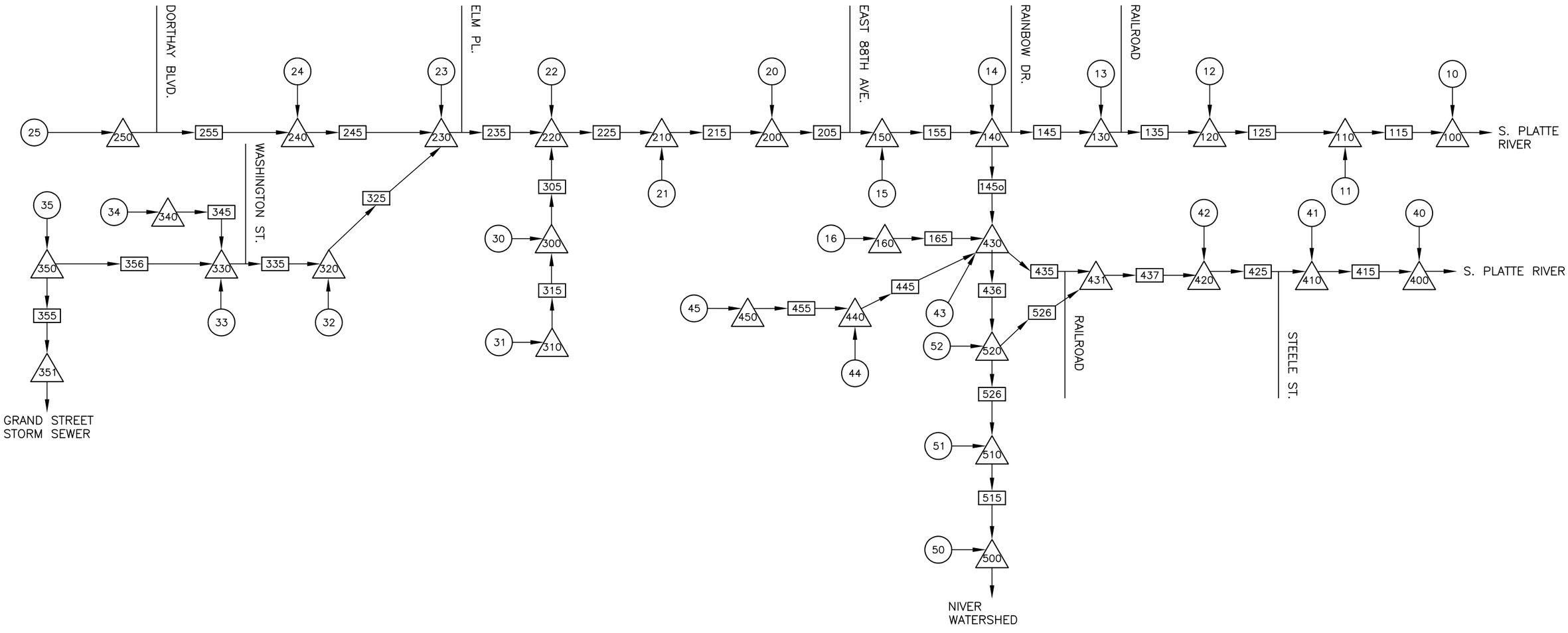
LEGEND

DFHAD Prototype

- XX — BASIN ID
- XX — DESIGN POINT
- XXX — CONVEYANCE ELEMENT



MOSER & associates ENGINEERING — 720 S. COLORADO BLVD. SUITE 410 S DENVER, CO 80246 PHONE: 303-757-3655 FAX: 303-300-1635	DESIGNED DPD DATE 08/31/07 DRAWN ACT DATE 08/31/07 CHECKED TLP DATE 08/31/07 REVISED DATE	CITY OF THORNTON, ADAMS COUNTY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT	HOFFMAN DRAINAGEWAY FLOOD HAZARD AREA DELINEATION	EPA SWMM ROUTING SCHEMATIC	FIGURE B-5

NAME: Z:\UDFCD PLANNING\Digital FHAD Guidelines\Prototype\CAD - DFHAD\Fig B-5 UDSWM SCHEMATIC.dwg
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Chart B-1
Peak Flow Profile for Hoffman Drainageway Mainstem

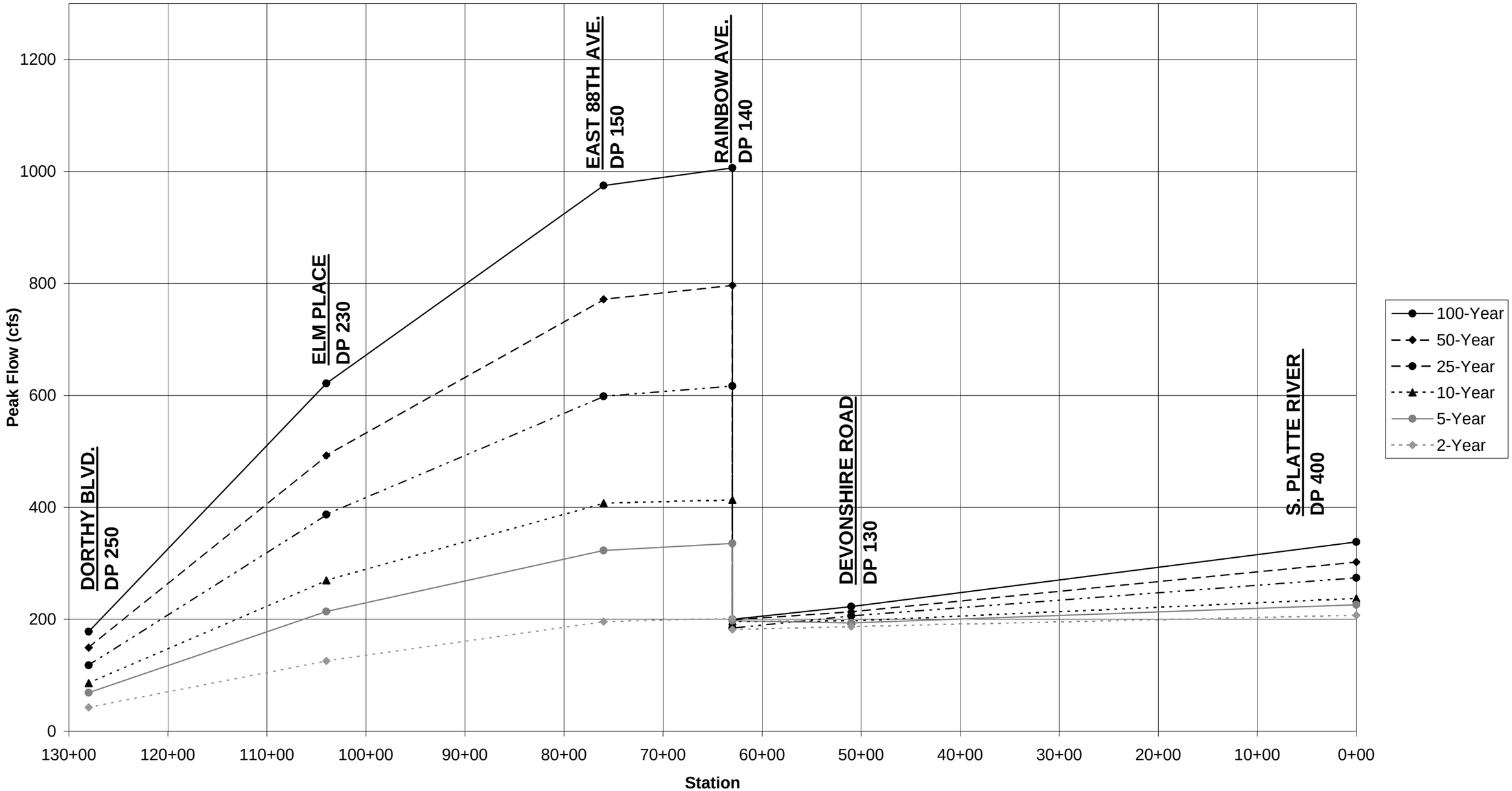


Chart B-2
Peak Flow Profile for Hoffman Drainageway Rainbow Split

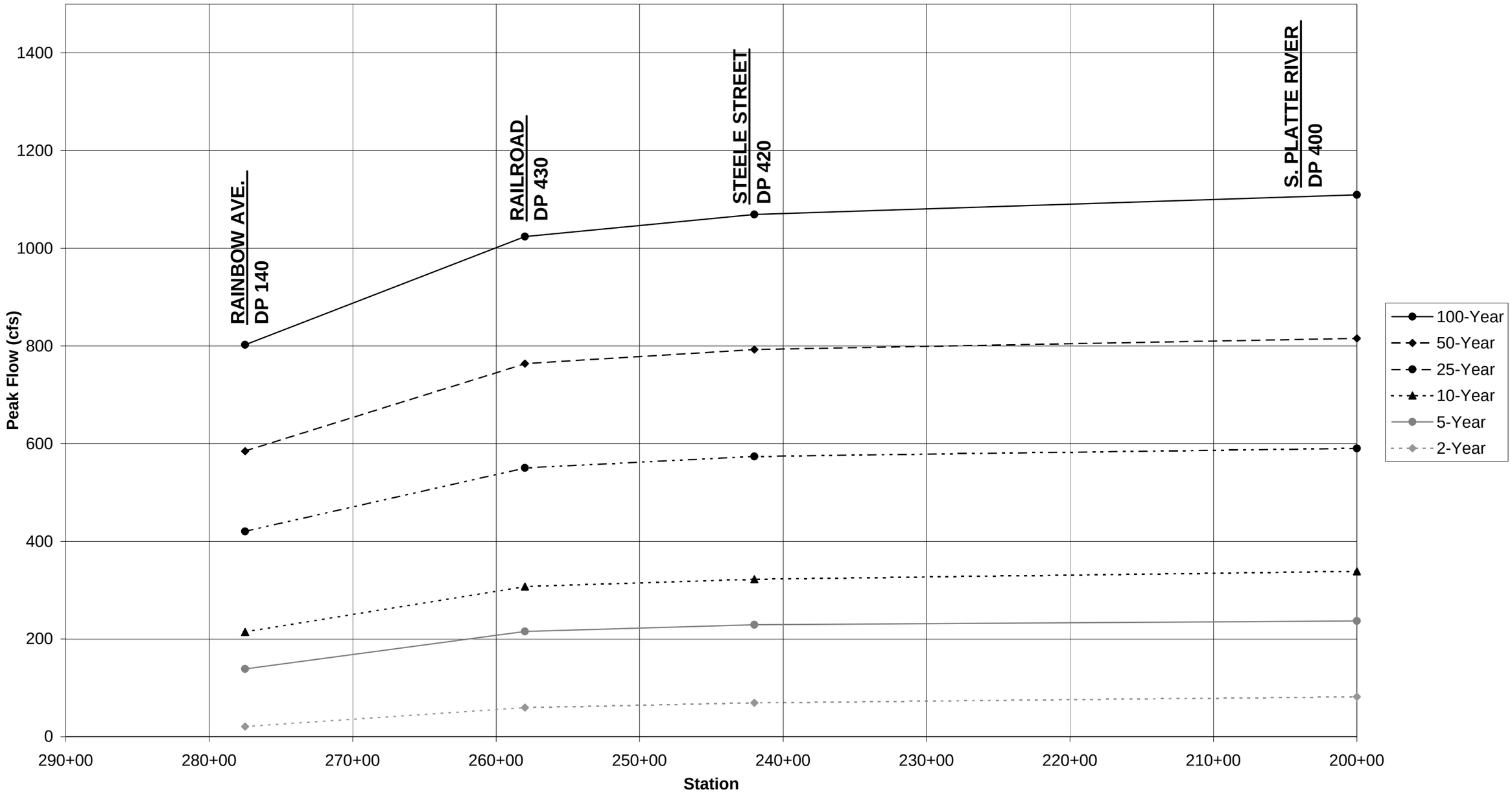
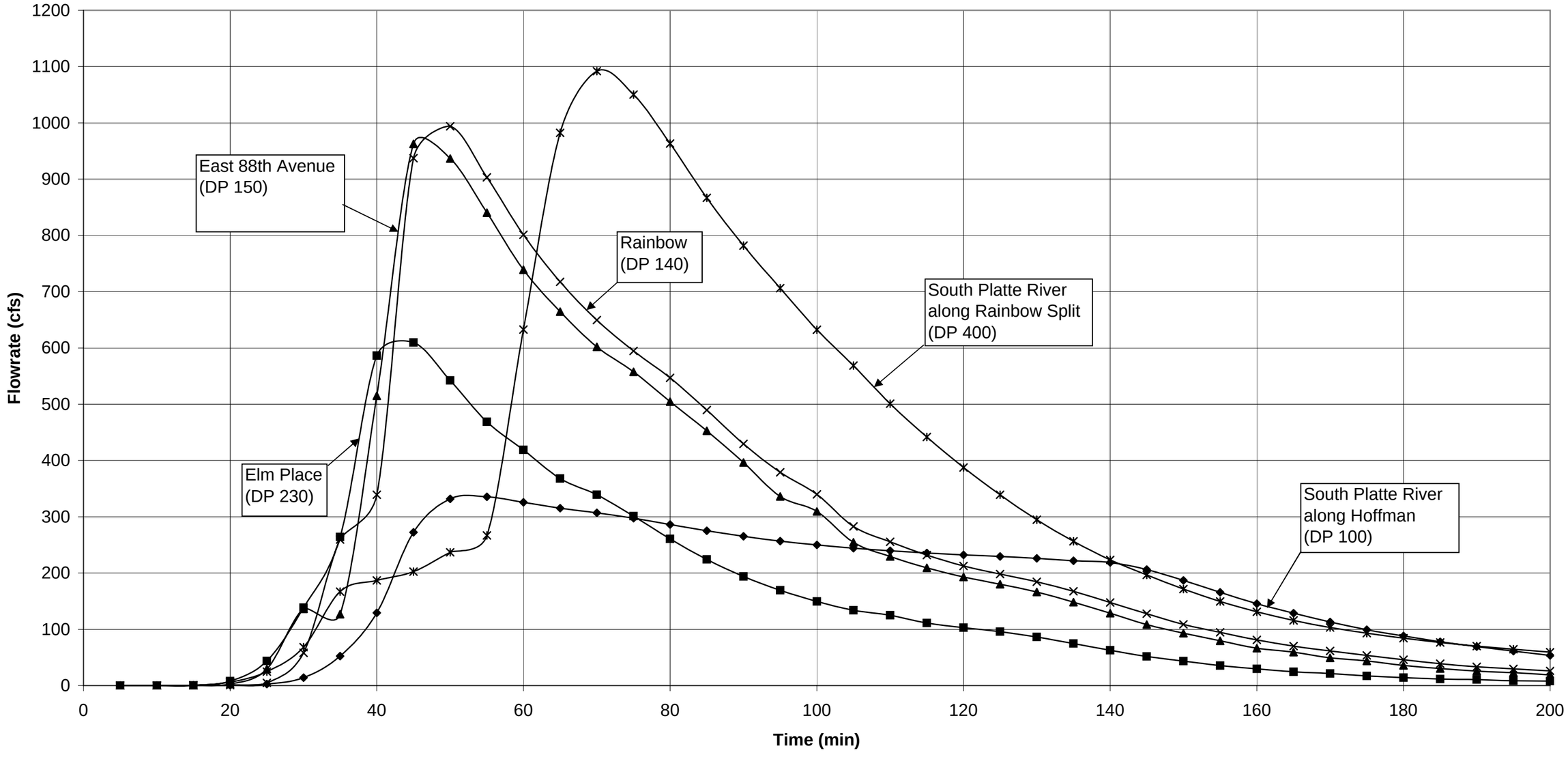


Chart B-3
100-Year Hydrograph
Baseline Hydrology



Mannings “n” Photographs

Segment 115 – Devonshire Road to South Platte River
Manning’s n=0.04

Segment 205 – Hoffman Way
Manning’s n=0.020

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APPENDIX C –Hydraulic Analysis

Supporting Documents

DFHAD Prototype

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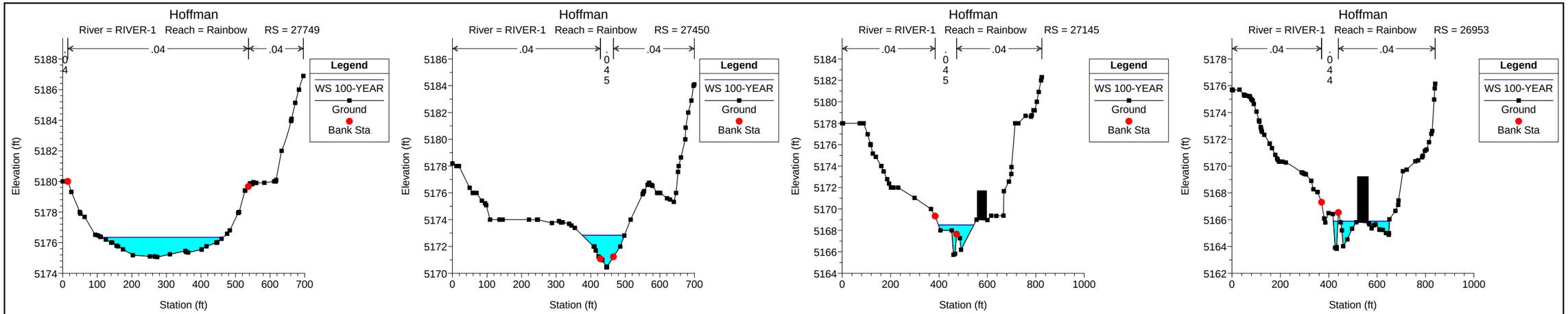
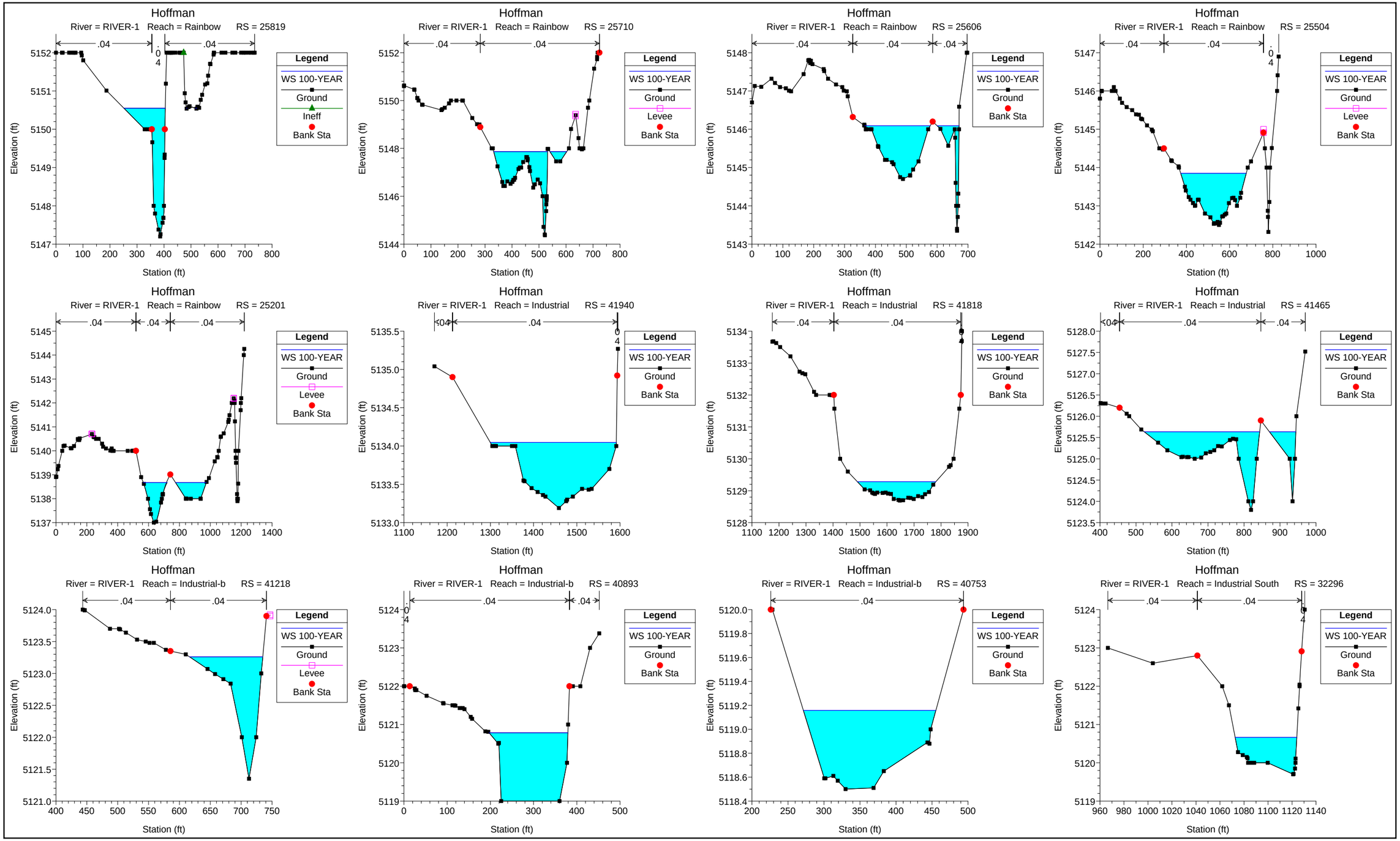
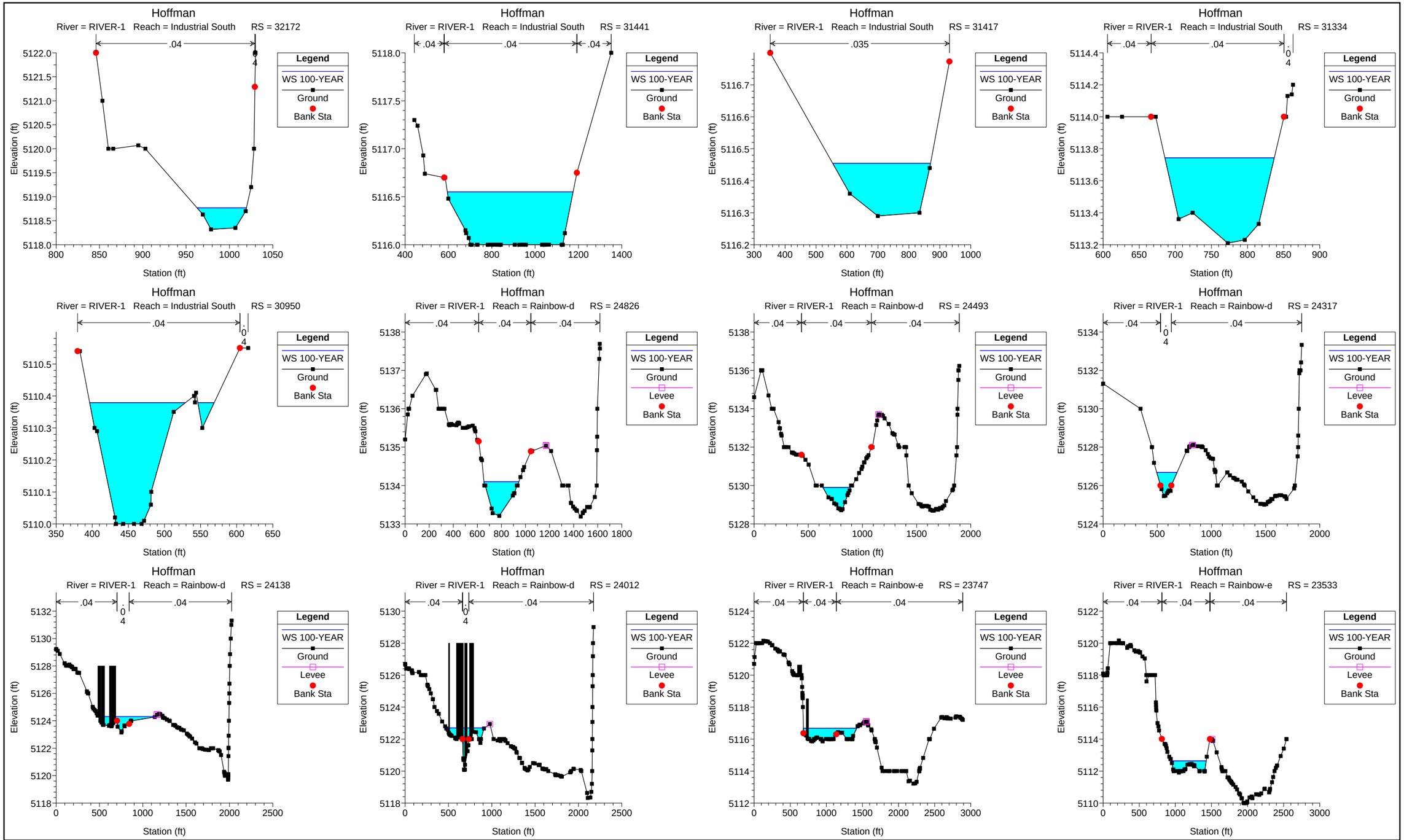
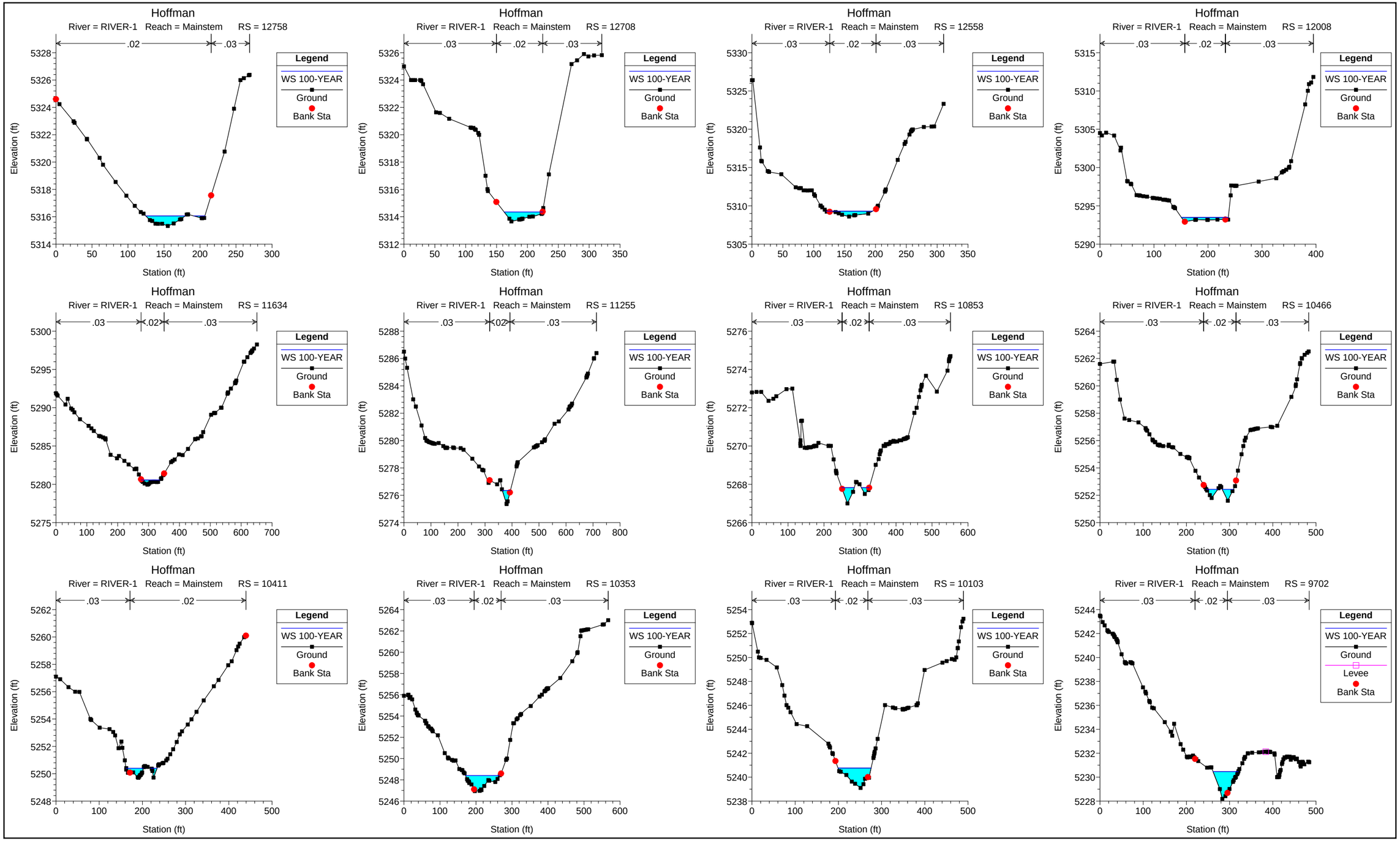
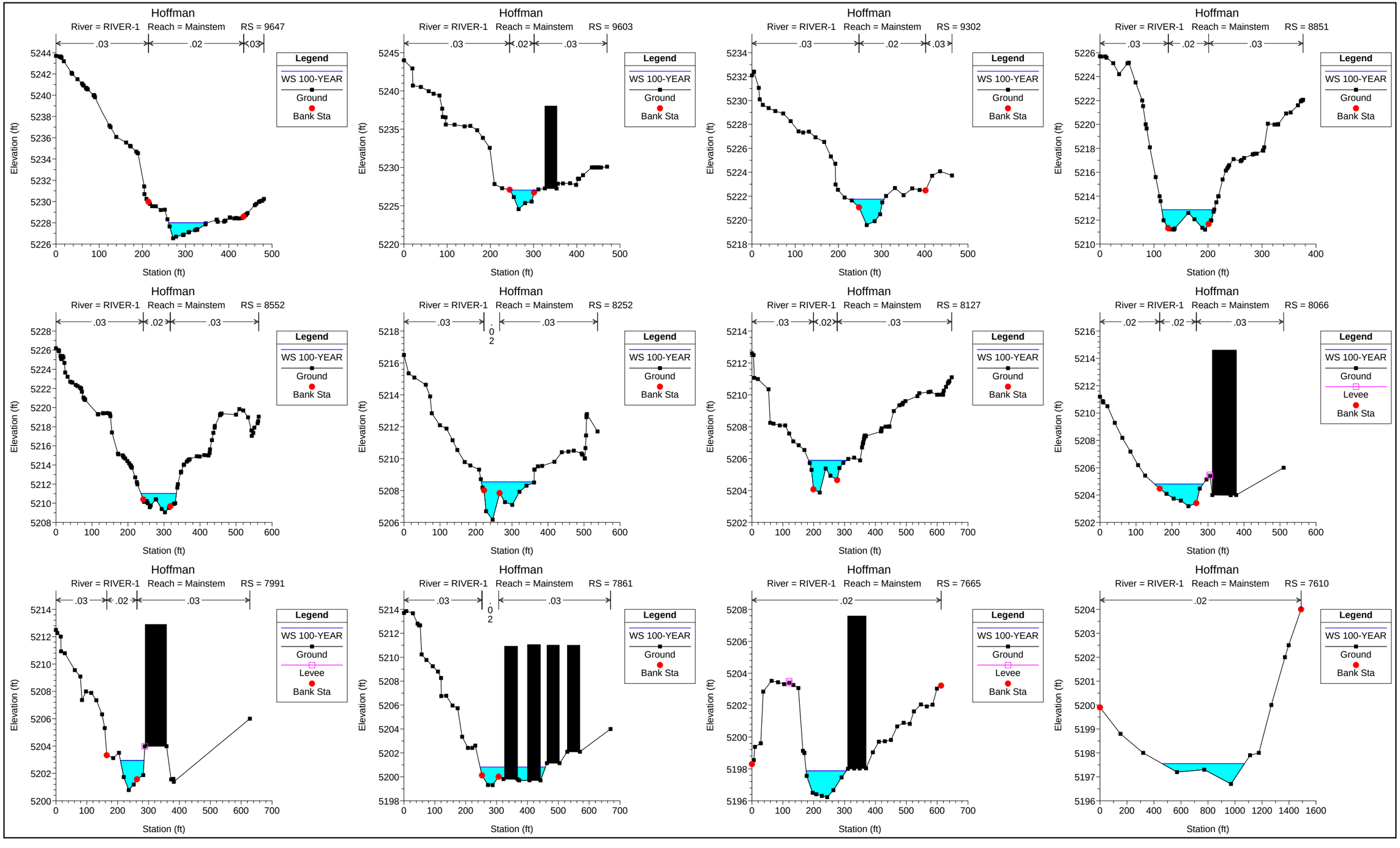
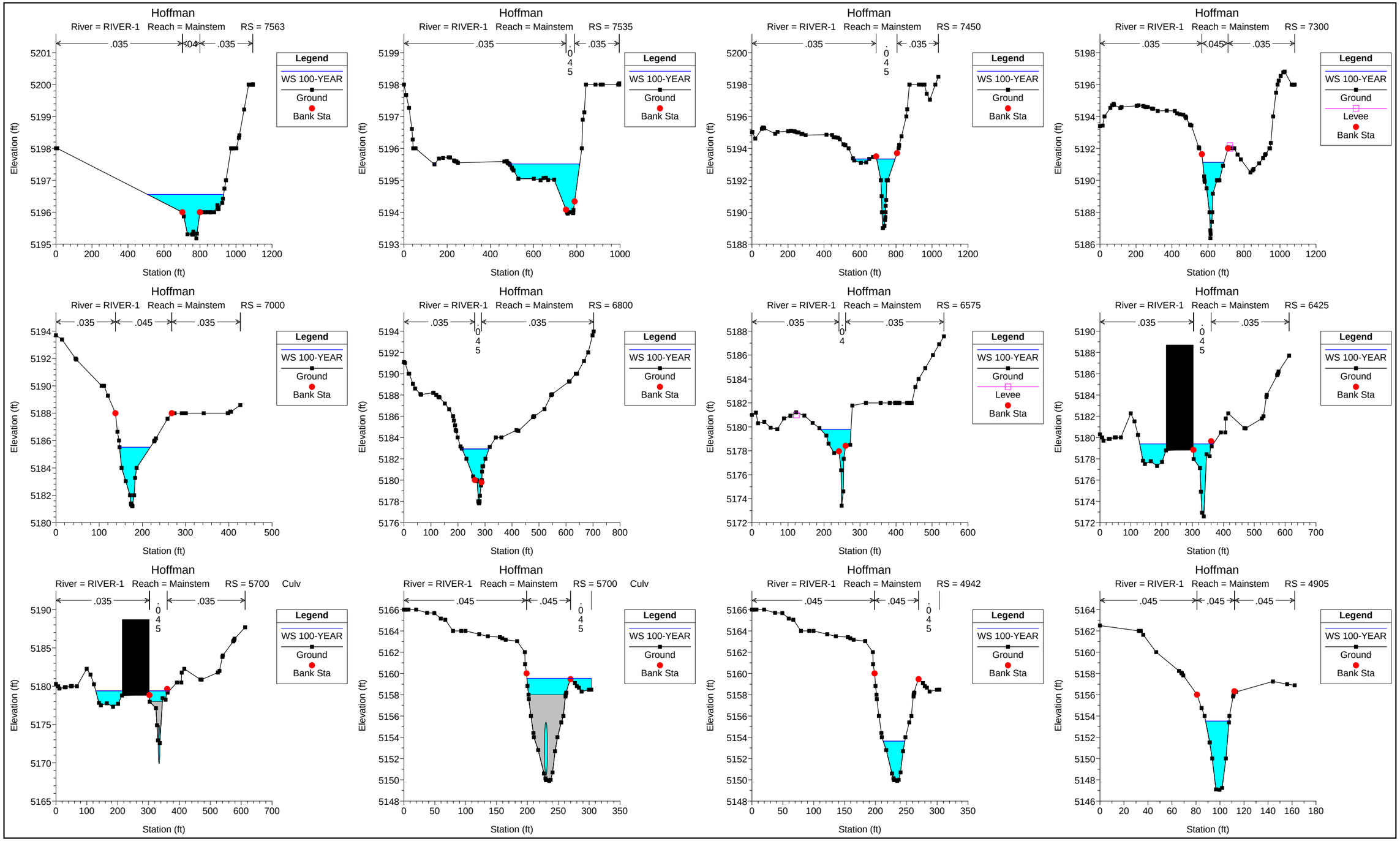


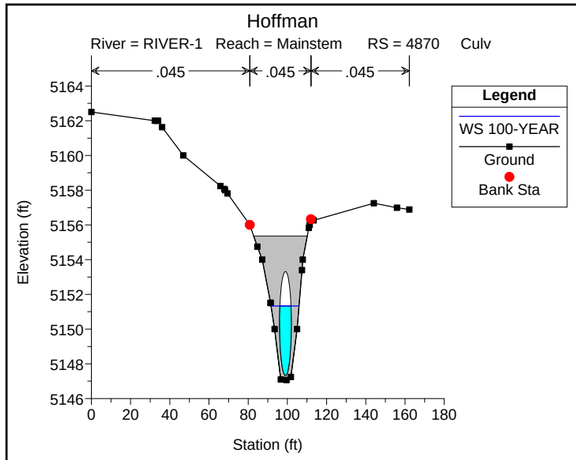


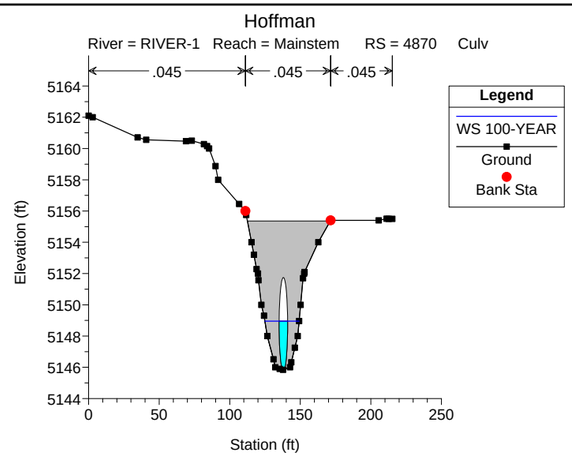


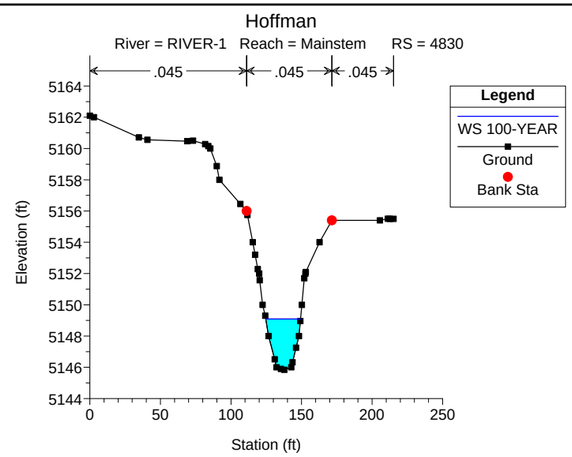


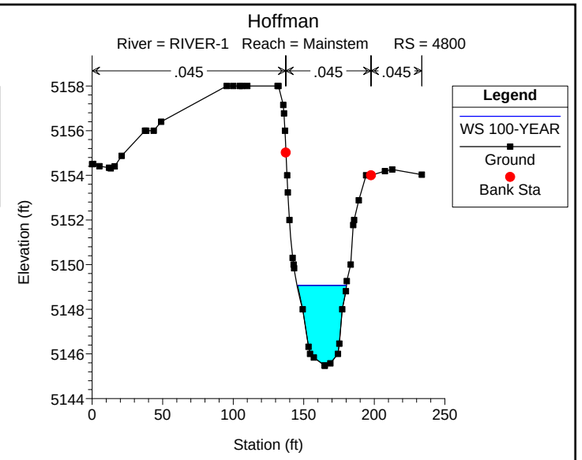


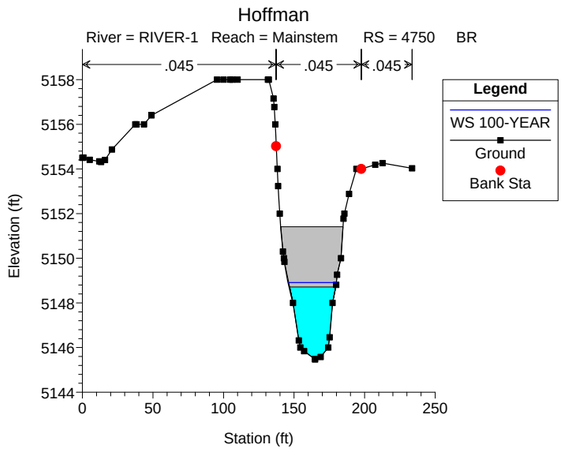


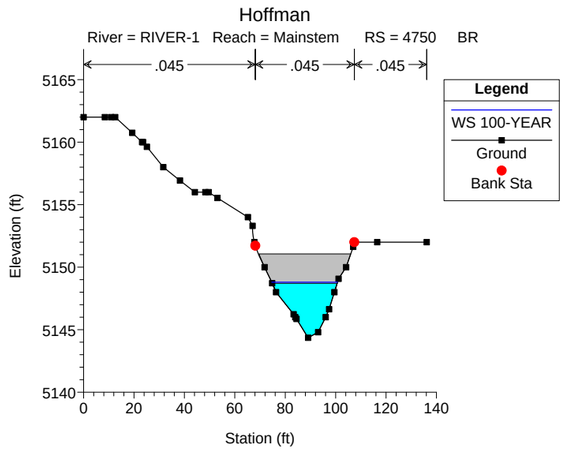


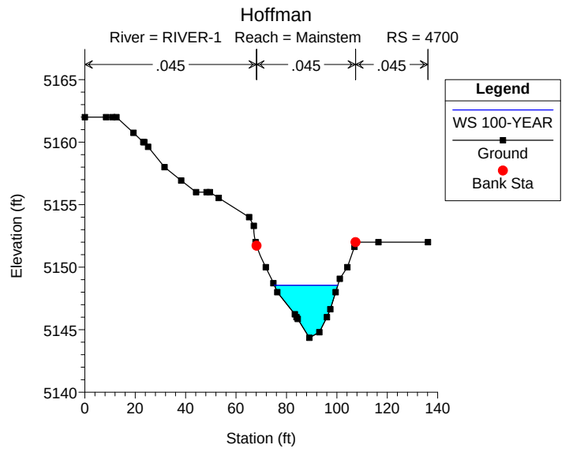


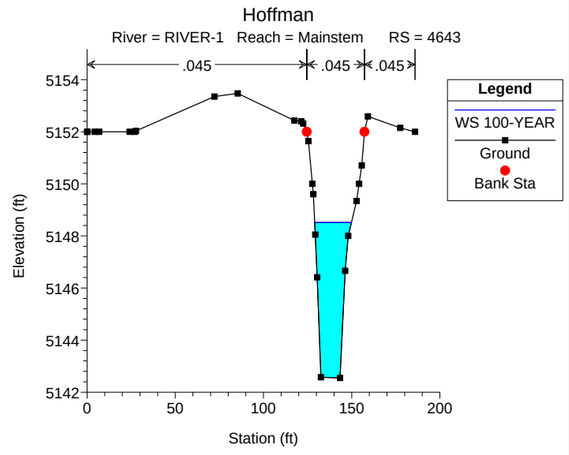


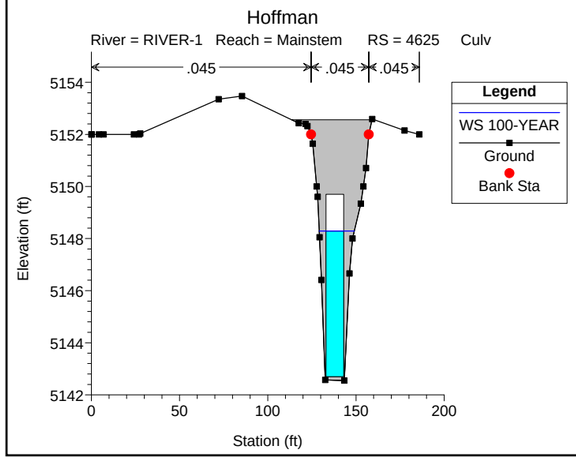


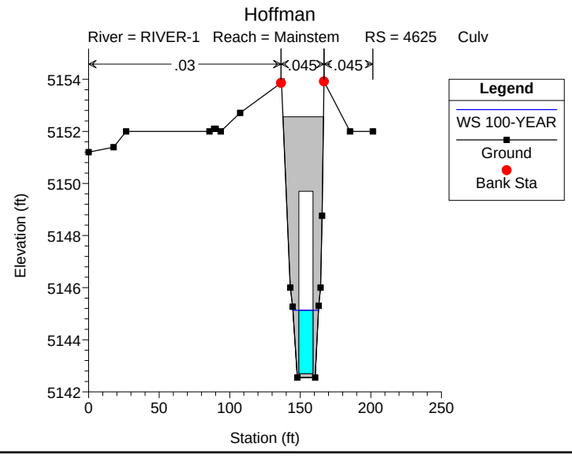


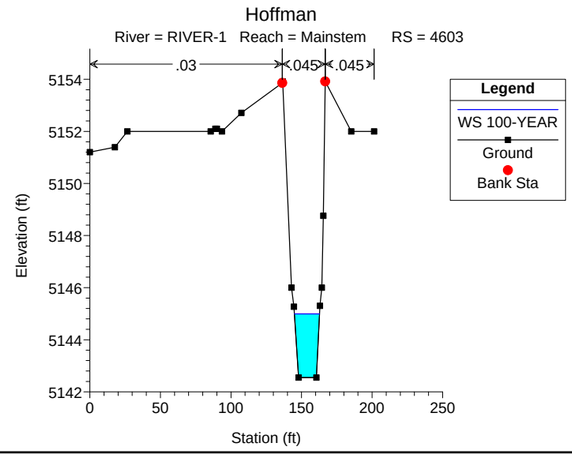


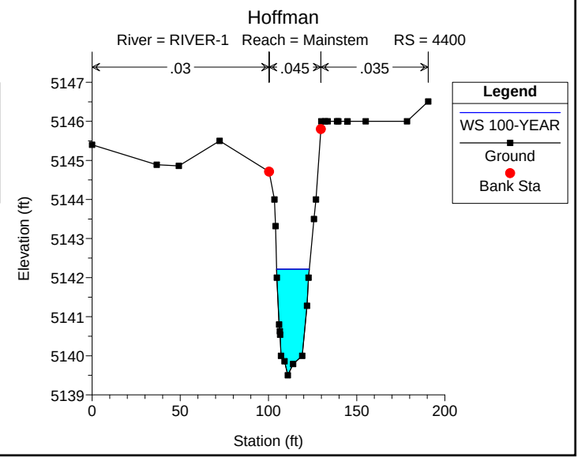


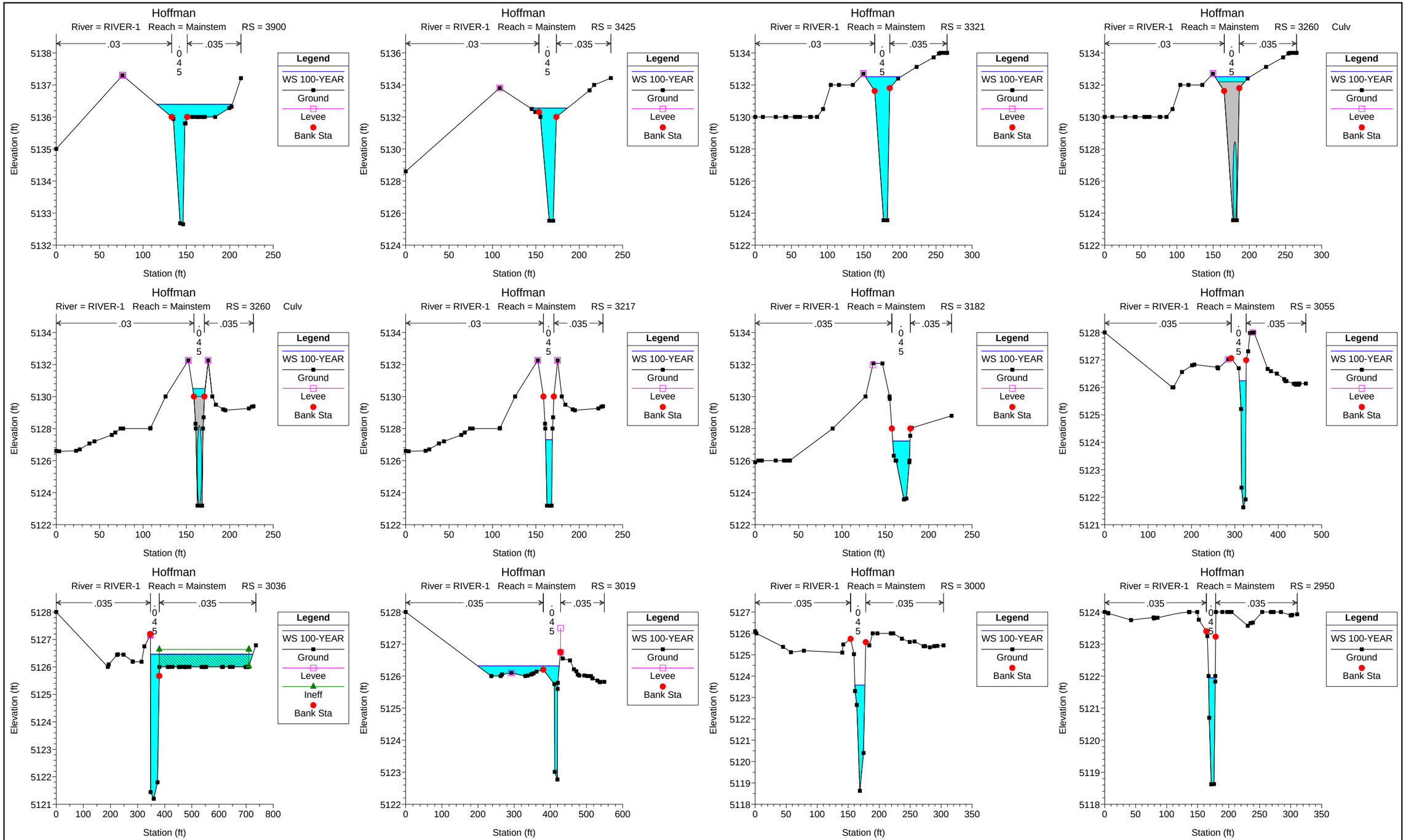


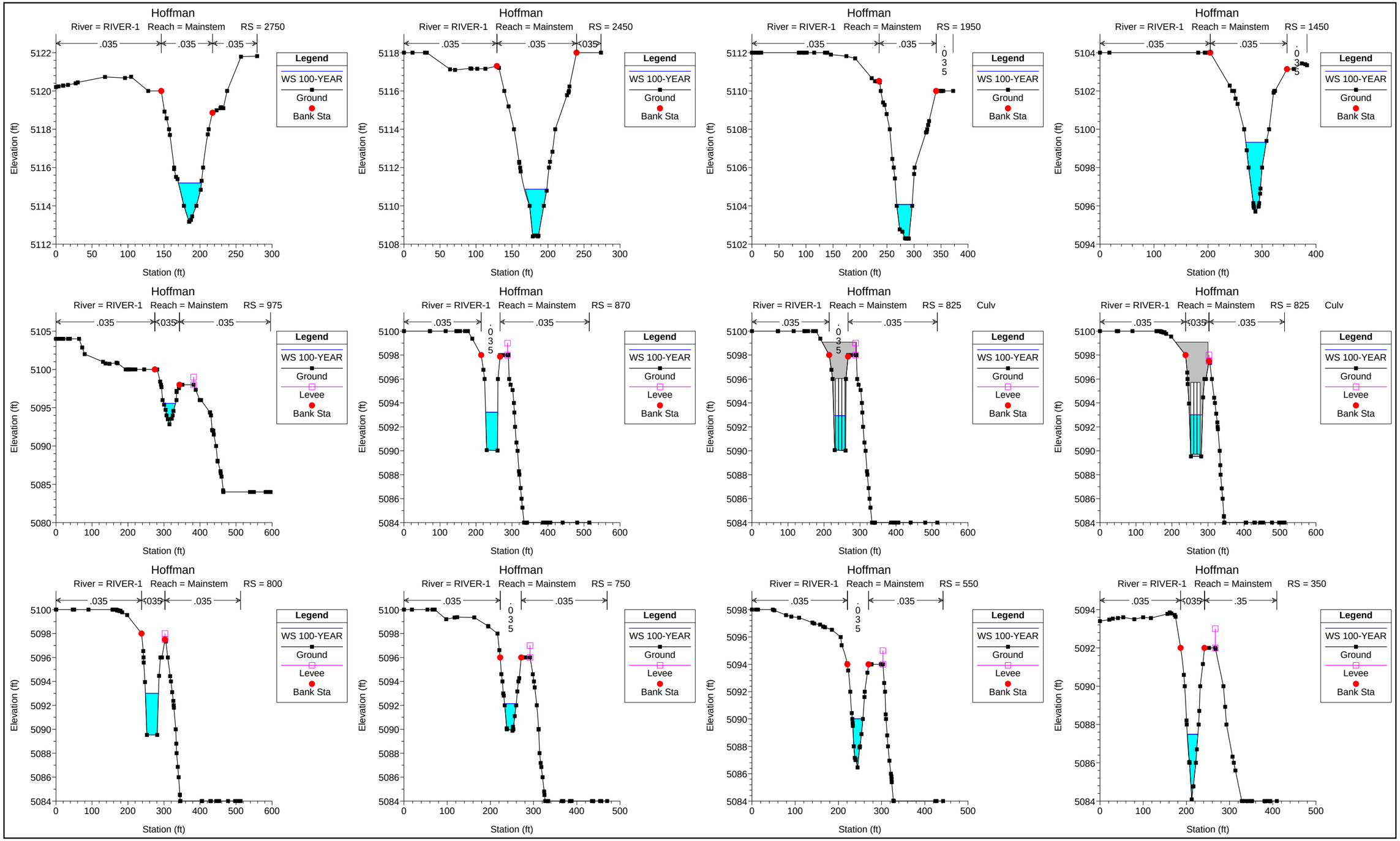


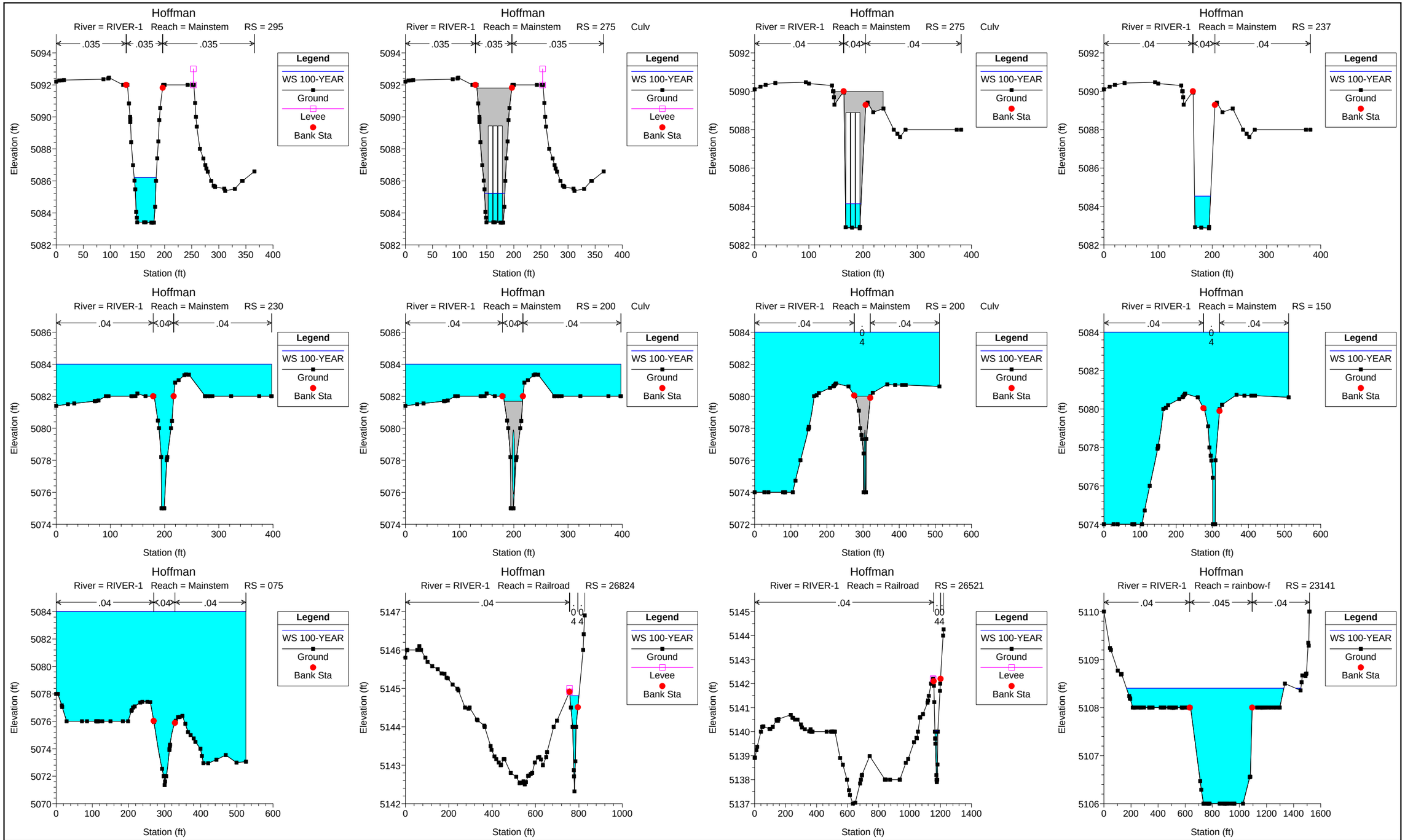


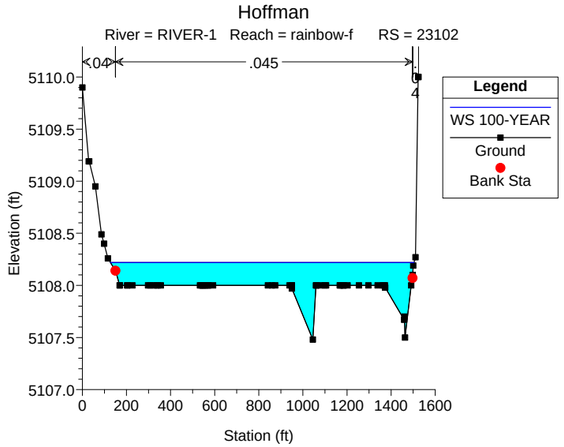


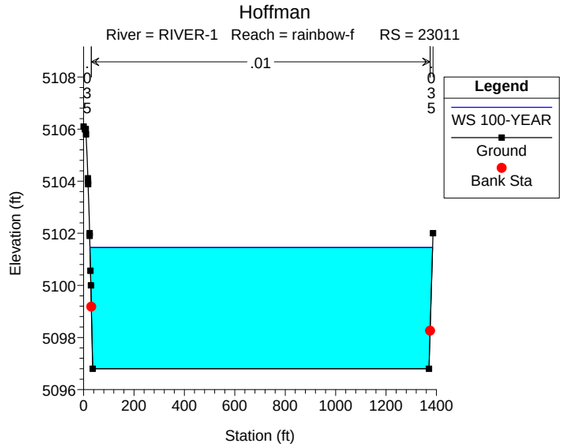


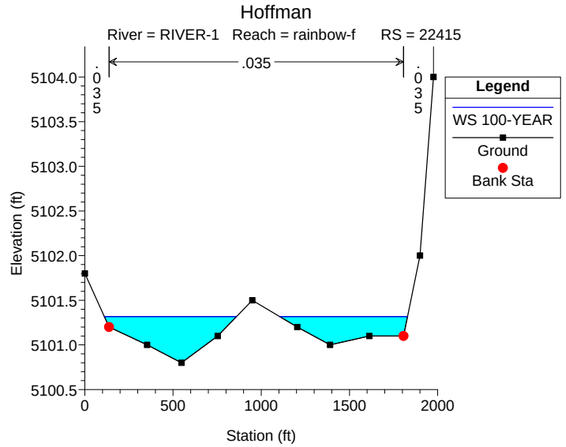


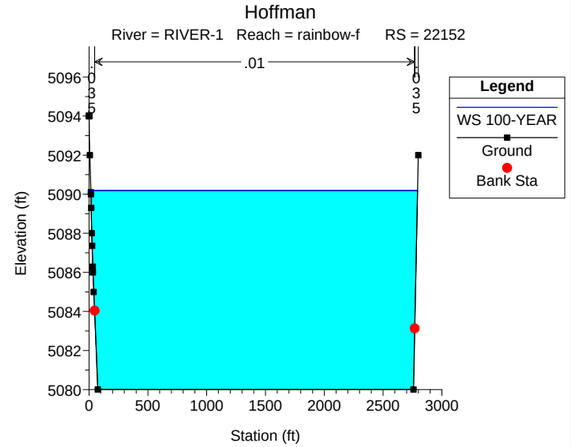


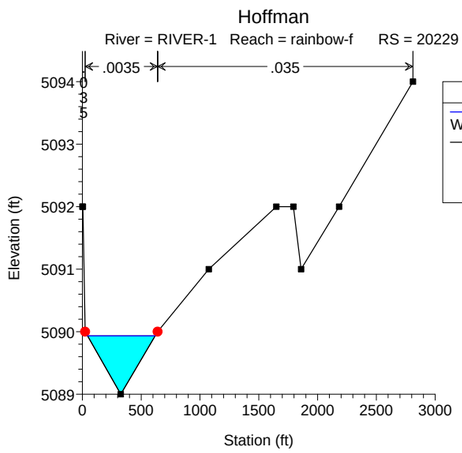










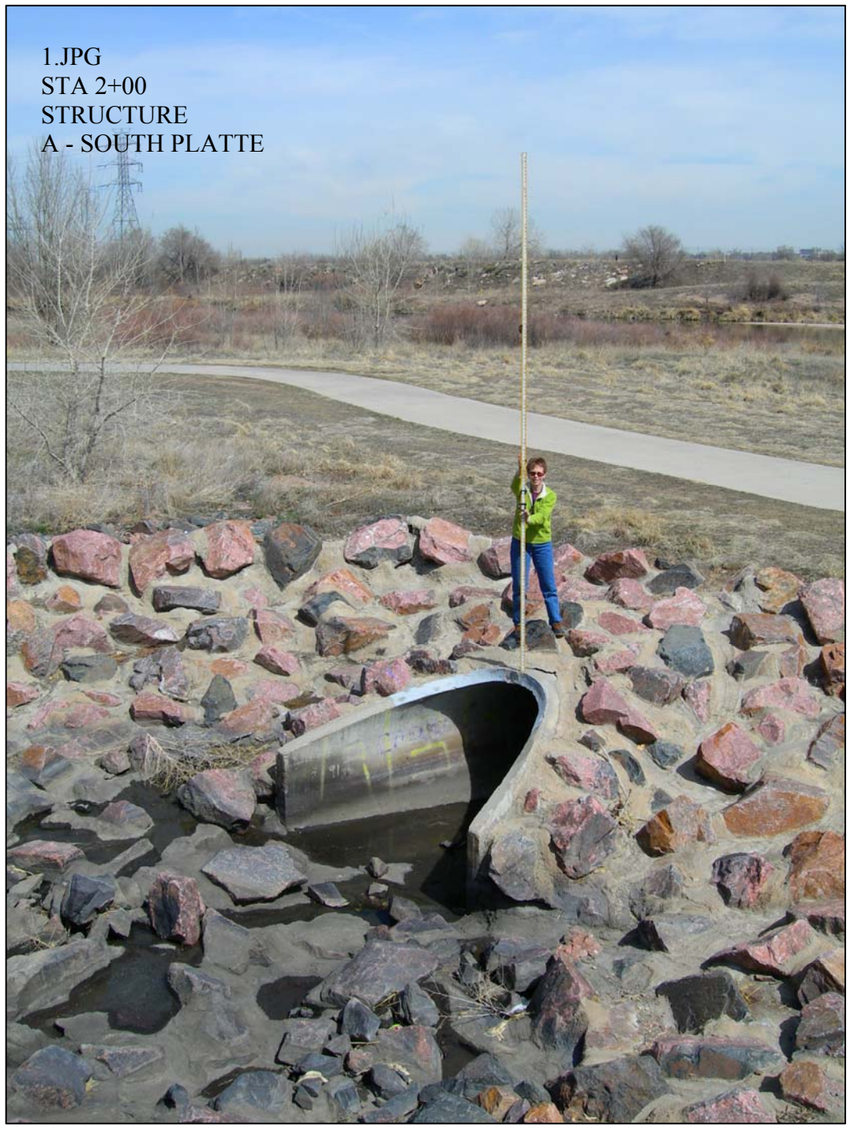


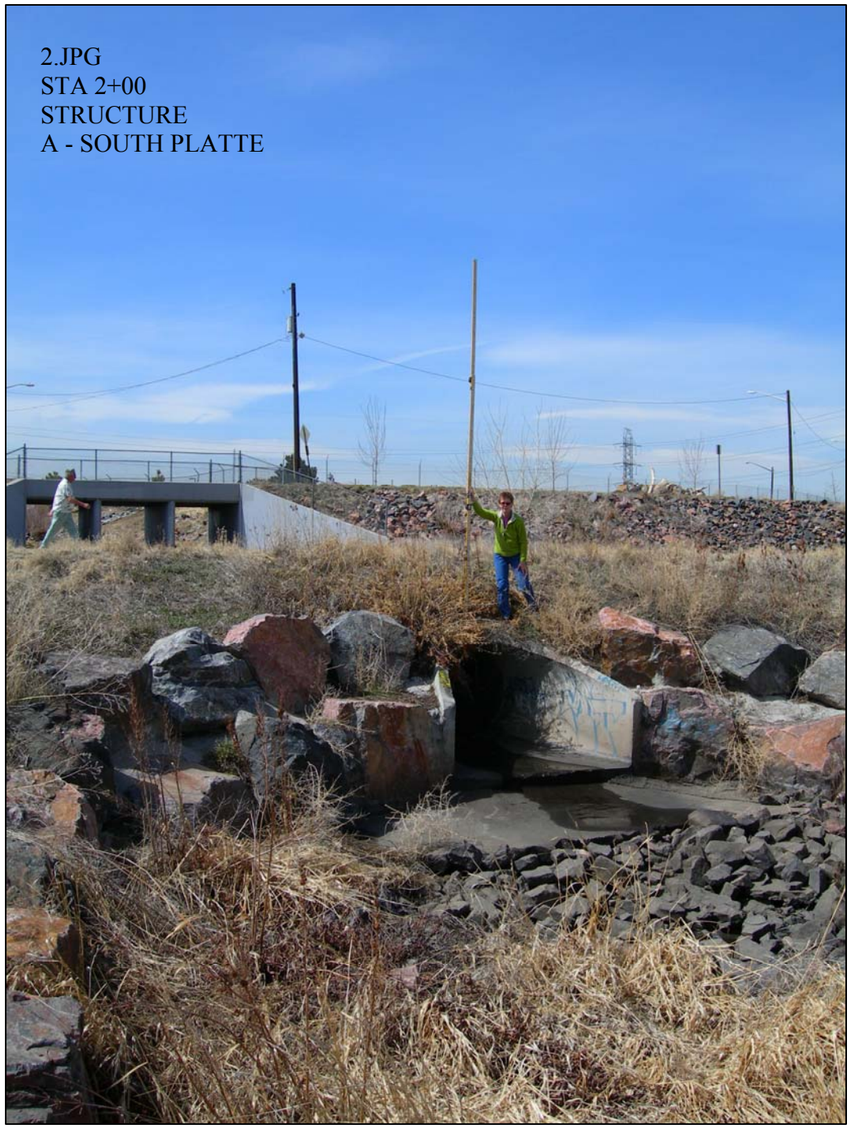
Structure Hydraulic Analysis Details Table

Location	Structure Description	Station	Return Event															
			10-Year				50-Year				100-Year				500-Year			
			Total Flow (cfs)	Structure Flow (cfs)	Overtopping Flow (cfs)	Max Overtopping Depth (feet)	Total Flow (cfs)	Structure Flow (cfs)	Overtopping Flow (cfs)	Max Overtopping Depth (feet)	Total Flow (cfs)	Structure Flow (cfs)	Overtopping Flow (cfs)	Max Overtopping Depth (feet)	Total Flow (cfs)	Structure Flow (cfs)	Overtopping Flow (cfs)	Max Overtopping Depth (feet)
88th Avenue Culvert	60" CMP	76+00	397	119	278	0.6	751	119	632	0.8	948	119	829	0.9	1252	119	1133	1.0
Rainbow Avenue Culvert	9.5' Arch CMP	64+00	972	182	788	2.2	1283	183	1100	2.6	398	181	217	1.2	770	182	587	1.9
Old Welby Road Culvert	5.5' CMP	48+70	215	215	-	-	228	228	-	-	192	192	-	-	207	207	-	-
Railroad Bridge	Bridge	47+50	215	-	-	-	228	-	-	-	192	-	-	-	207	-	-	-
Welby Road Culvert	10' CBC	46+25	215	215	-	-	228	228	-	-	192	192	-	-	207	207	-	-
Steele Street	5' CMP	32+60	235	209	26	0.4	253	212	41	0.5	199	199	-	-	222	207	14	0.3
LCCC Crossing	At Grade Channel	30+00	199	199	-	-	222	150	72	0.3	235	149	86	0.3	253	157	96	0.3
Maintenance Road	3-8' x 6' CBC	8+25	324	324	-	-	372	372	-	-	231	231	-	-	290	290	-	-
Maintenance Road	3-8' x 6' CBC	2+75	324	324	-	-	372	372	-	-	231	231	-	-	290	290	-	-
Pedestrian Trail	4' RCP	2+00	324	4	349	2.6	372	4	368	3.6	231	6	225	1.1	290	4	297	2.1

DRAINAGE STRUCTURE PHOTOS FOR HOFFMAN DRAINAGE MAINSTEM

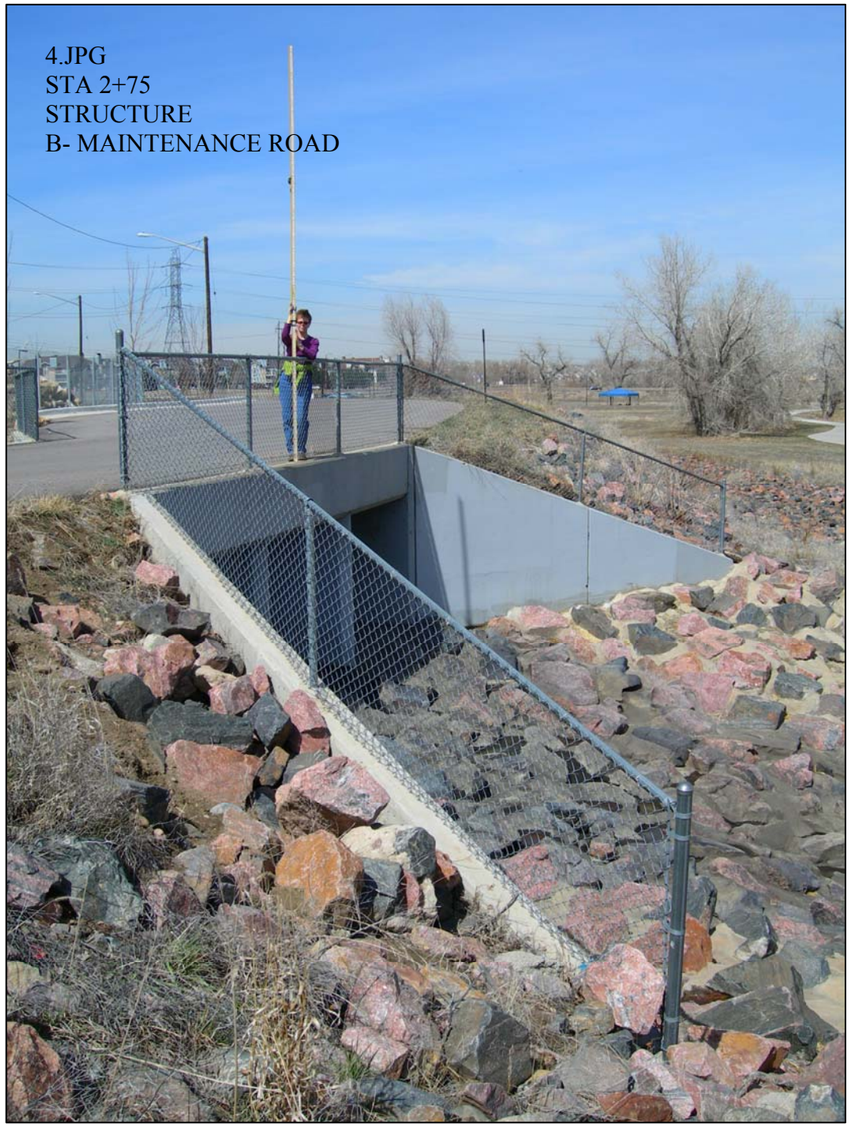
STRUCTURE A





STRUCTURE B


3.JPG
STA 2+75
STRUCTURE
B – MAINTENANCE ROAD


4.JPG
STA 2+75
STRUCTURE
B- MAINTENANCE ROAD

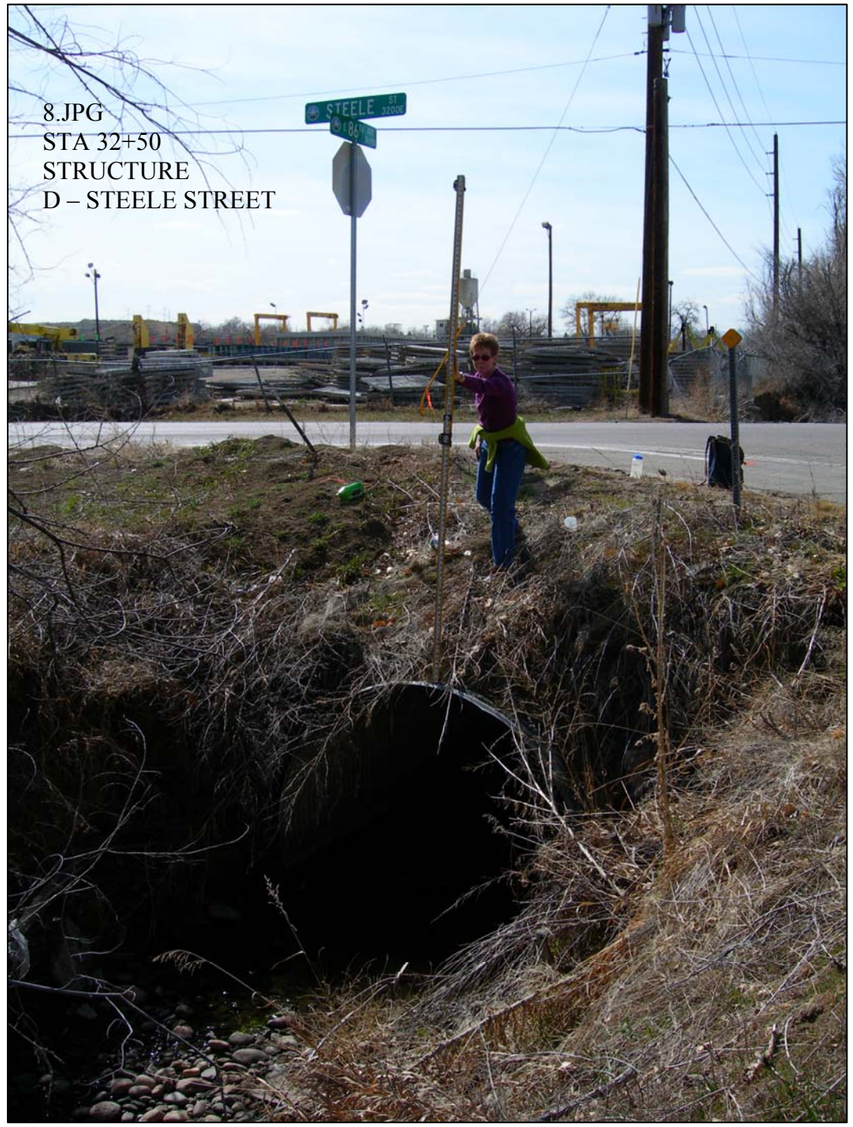
STRUCTURE C


5.JPG
STA 8+25
STRUCTURE
C - MAINTENANCE ROAD


6.JPG
STA 8+25
STRUCTURE
C - MAINTENANCE ROAD

STRUCTURE D

7.JPG
STA 32+50
STRUCTURE
D – STEELE STREET



8.JPG
STA 32+50
STRUCTURE
D – STEELE STREET

STRUCTURE E

STRUCTURE F

11.JPG
STA 47+50
STRUCTURE
F – UNION PACIFIC RAILROAD

12.JPG
STA 47+50
STRUCTURE
F – UNION PACIFIC RAILROAD

STRUCTURE G

13.JPG
STA 48+60
STRUCTURE
G –OLD WELBY ROAD

14.JPG
STA 48+60
STRUCTURE
G – OLD WELBY ROAD

STRUCTURE H

15.JPG
STA 49+50
STRUCTURE
H - DEVONSHIRE

STRUCTURE I

STRUCTURE J

17.JPG
STA 74+75
STRUCTURE
J – 88TH AVENUE

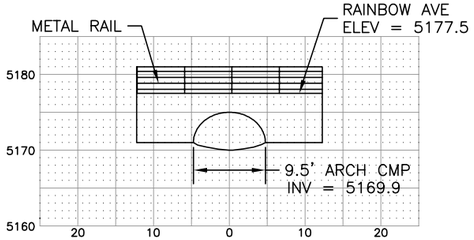
DFHAD Prototype

HOFFMAN DRAINAGEWAY

FLOOD HAZARD AREA DELINEATION

OCTOBER 2007

STRUCTURE SECTIONS



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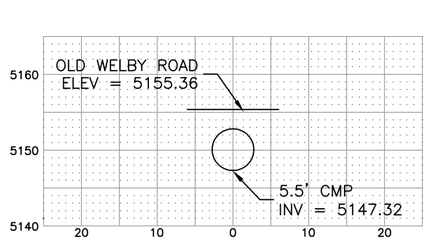

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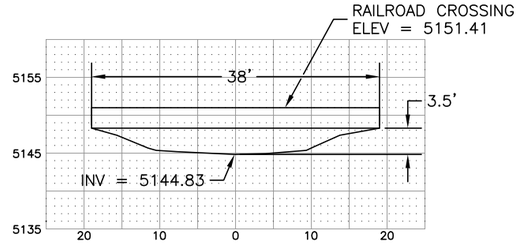

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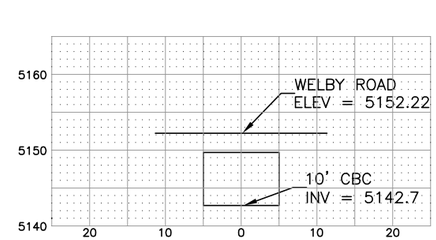

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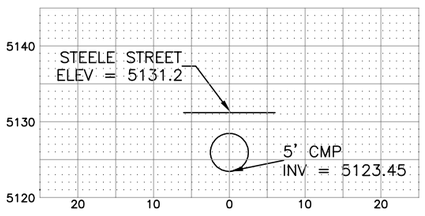

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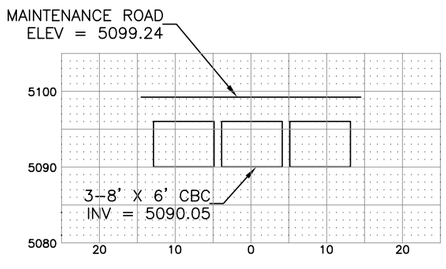
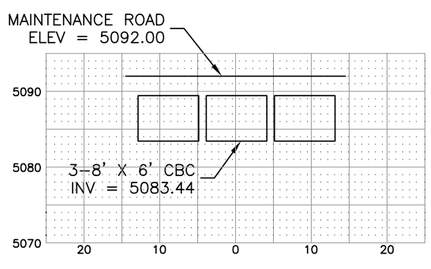


STA. 222+48.20



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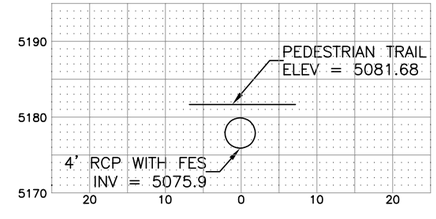

STA. 216+13.30

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0 10 20 40

ORIGINAL SCALE: 1" = 20'

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APPENDIX D – Floodplain and Floodway Data Table

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Floodplain and Floodway Data Table
Hoffman Major Drainageway

REFERENCE LOCATION	RIVER STATION	CROSS SECTION	THALWEG ELEVATION (FT)	PEAK DISCHARGE				WATER SURFACE ELEVATION				100-YEAR FLOODPLAIN		100 YEAR FLOODWAY (0.5' EGL)						100 YEAR FLOODWAY (1.0' EGL)						COMMENTS
				10-YR FLOW (CFS)	50-YR FLOW (CFS)	100-YR FLOW (CFS)	500-YR FLOW (CFS)	10-YR WSEL (FT)	50-YR WSEL (FT)	100-YR WSEL (FT)	500-YR WSEL (FT)	WIDTH (FT)	EGL (FT)	WSEL (FT)	WIDTH (FT)	DIST. LEFT[a] (FT)	DIST. RIGHT[a] (FT)	AREA (SQ FT)	VELOCITY (FT/S)	WSEL (FT)	WIDTH (FT)	DIST. LEFT[a] (FT)	DIST. RIGHT[a] (FT)	AREA (SQ FT)	VELOCITY (FT/S)	
REACH: Mainstem																										
U/S Limit at Dorthy Blvd.	127+58	12758	5315.33	1	54	91	147	5315.44	5315.91	5316.07	5316.22	82.13	5316.25	5316.07[b]	82.13	58.42	23.71	26.17	3.48	5316.07[b]	82.13	58.42	23.71	26.17	3.48	
	127+08	12708	5313.66	1	54	91	147	5313.78	5314.24	5314.35	5314.51	62.35	5314.56	5314.35[b]	62.35	24.89	37.46	24.88	3.66	5314.35[b]	62.35	24.89	37.46	24.88	3.66	
	125+58	12558	5308.60	1	54	91	147	5308.72	5309.16	5309.30	5309.44	74.83	5309.48	5309.30[b]	74.83	45.64	29.19	26.64	3.42	5309.30[b]	74.83	45.64	29.19	26.64	3.42	
	120+08	12008	5292.93	1	54	91	147	5293.05	5293.39	5293.49	5293.61	86.92	5293.65	5293.49[b]	86.92	47.91	39.01	28.60	3.18	5293.49[b]	86.92	47.91	39.01	28.60	3.18	
Eppinger Blvd.	116+34	11634	5279.96	1	22	65	140	5280.07	5280.39	5280.56	5280.79	59.96	5280.74	5280.56[b]	59.96	45.99	13.97	19.54	3.33	5280.56[b]	59.96	45.99	13.97	19.54	3.33	
	112+55	11255	5275.36	1	22	65	140	5275.55	5276.00	5276.35	5276.73	30.20	5276.63	5276.35[b]	30.20	9.31	20.89	15.55	4.18	5276.35[b]	30.20	9.31	20.89	15.55	4.18	
	108+53	10853	5267.00	1	22	65	140	5267.17	5267.58	5267.83	5268.09	76.34	5268.01	5267.83[b]	76.34	41.23	35.11	19.03	3.42	5267.83[b]	76.34	41.23	35.11	19.03	3.42	
	104+66	10466	5251.60	1	22	65	140	5251.79	5252.17	5252.43	5252.69	62.41	5252.61	5252.43[b]	62.41	31.98	30.43	18.89	3.44	5252.43[b]	62.41	31.98	30.43	18.89	3.44	
Elm Pl.	104+11	10411	5249.70	1	22	65	140	5249.84	5250.17	5250.40	5250.64	72.06	5250.58	5250.40[b]	72.06	47.46	24.60	19.44	3.34	5250.40[b]	72.06	47.46	24.60	19.44	3.34	
	103+53	10353	5246.94	29	255	380	580	5247.36	5248.19	5248.40	5248.68	94.57	5248.82	5248.40[b]	94.57	65.82	28.75	76.70	4.95	5248.40[b]	94.57	65.82	28.75	76.70	4.95	
	101+03	10103	5239.10	29	255	380	580	5239.67	5240.53	5240.76	5241.09	76.63	5241.24	5240.76[b]	76.63	44.90	31.73	69.90	5.44	5240.76[b]	76.63	44.90	31.73	69.90	5.44	
	97+02	9702	5228.19	29	255	380	580	5228.87	5230.11	5230.47	5230.94	58.55	5231.03	5230.47[b]	58.55	15.04	43.51	69.56	5.46	5230.47[b]	58.55	15.04	43.51	69.56	5.46	
90th Ave.	96+47	9647	5226.54	29	255	380	580	5227.06	5227.78	5228.00	5228.32	90.69	5228.42	5228.00[b]	90.69	9.96	80.73	73.38	5.18	5228.00[b]	90.69	9.96	80.73	73.38	5.18	
	96+03	9603	5224.56	106	410	581	848	5225.80	5226.69	5227.05	5227.57	63.80	5227.78	5227.03	55.83	20.16	35.67	82.93	7.01	5227.05	55.83	20.16	35.67	85.19	6.82	
	93+02	9302	5219.59	106	410	581	848	5220.54	5221.38	5221.75	5222.33	82.12	5222.42	5221.72	57.63	0.52	57.11	84.18	6.90	5221.75	57.63	0.52	57.11	93.12	6.24	
	88+51	8851	5211.20	106	410	581	848	5212.05	5212.67	5212.86	5213.18	96.84	5213.41	5212.86	96.83	57.39	39.44	101.99	5.70	5212.86	96.83	57.39	39.44	101.99	5.70	
Poze Blvd.	85+52	8552	5209.05	140	486	676	972	5210.20	5210.79	5211.02	5211.36	98.74	5211.63	5211.02	98.73	38.61	60.12	112.71	6.00	5211.02	98.73	38.61	60.12	112.71	6.00	
	82+52	8252	5206.17	140	486	676	972	5207.45	5208.18	5208.54	5208.81	146.26	5209.03	5208.44	119.43	52.43	67.00	134.88	5.01	5208.54	119.43	52.43	67.00	151.35	4.47	
	81+27	8127	5203.87	140	486	676	972	5204.96	5205.64	5205.89	5206.31	123.22	5206.48	5205.89	167.15	57.40	109.75	120.58	5.61	5205.89	167.15	57.40	109.75	120.58	5.61	
	80+66	8066	5203.19	140	486	676	972	5203.99	5204.58	5204.81	5205.12	135.12	5205.30	5204.82	116.16	92.79	23.37	117.64	5.75	5204.81	116.16	92.79	23.37	126.10	5.36	
	79+91	7991	5200.78	140	486	676	972	5201.91	5202.64	5202.95	5203.45	76.63	5203.63	5203.13	53.80	30.68	23.12	92.29	7.32	5202.95	53.80	30.68	23.12	108.77	6.21	
	78+61	7861	5199.31	140	486	676	972	5200.09	5200.60	5200.82	5201.12	211.83	5201.34	5201.11	78.32	34.11	44.21	107.96	6.26	5200.82	78.32	34.11	44.21	130.89	5.16	
	76+65	7665	5196.23	275	634	830	1134	5197.49	5197.66	5197.87	5198.12	231.32	5198.40	5197.87	130.38	36.41	93.97	142.09	5.84	5197.87	130.38	36.41	93.97	142.09	5.84	
88th Ave.	76+10	7610	5196.70	275	634	830	1134	5197.33	5197.48	5197.55	5197.65	610.30	5197.75	5197.55[b]	610.30	511.15	99.15	231.84	3.58	5197.55[b]	610.30	511.15	99.15	231.84	3.58	
	75+63	7563	5195.18	275	634	830	1134	5196.17	5196.48	5196.56	5196.69	421.70	5196.83	5196.56[b]	421.69	249.90	171.79	221.92	3.74	5196.56[b]	421.69	249.90	171.79	221.92	3.74	
	75+35	7535	5193.96	275	634	830	1134	5195.15	5195.38	5195.51	5195.53	322.32	5195.78	5195.51[b]	322.32	276.40	45.92	213.53	3.89	5195.51[b]	322.32	276.40	45.92	213.53	3.89	
	74+50	7450	5189.00	398	770	972	1283	5192.18	5193.00	5193.33	5193.64	231.17	5193.87	5193.33[b]	231.17	175.26	55.91	173.44	5.60	5193.34[b]	231.17	175.26	55.91	174.18	5.58	
	73+00	7300	5186.37	398	770	972	1283	5190.23	5190.86	5191.13	5191.49	118.30	5191.52	5191.13[b]	118.20	43.96	74.24	193.24	5.03	5191.03[b]	118.20	43.96	74.24	182.15	5.34	
	70+00	7000	5181.20	398	770	972	1283	5184.29	5185.16	5185.51	5185.94	71.06	5186.41	5185.51	71.14	30.89	40.25	127.64	7.61	5185.67	71.14	30.89	40.25	139.30	6.98	
	68+00	6800	5177.81	398	770	972	1283	5181.59	5182.58	5182.93	5183.38	100.41	5183.38	5182.64	91.33	58.96	32.37	164.87	5.90	5182.39	91.33	58.96	32.37	142.31	6.83	
	65+75	6575.00	5173.41	398	770	972	1283	5178.87	5179.46	5179.79	5180.22	84.44	5180.64	5180.17	84.44	61.96	22.48	174.09	5.58	5180.59	84.44	61.96	22.48	209.14	4.65	
U/S of Rainbow Ave.	64+25	6425.00	5172.58	398	770	972	1283	5178.47	5179.11	5179.40	5179.75	238.12	5179.57	5180.00	200.00	174.18	25.82	314.69	3.09	5180.37	200.00	174.18	25.82	301.74	3.22	
D/S of Devonshire Blvd.	49+42	4942.00	5149.90	192	207	215	228	5153.21	5153.49	5153.63	5153.88	35.04	5153.75	5153.63	35.04	24.76	10.28	78.15	2.75	5153.63	35.04	24.76	10.28	78.15	2.75	
	49+05	4905.00	5147.07	192	207	215	228	5153.09	5153.38	5153.52	5153.77	19.57	5153.64	5153.52	19.57	4.25	15.32	78.12	2.75	5153.52	19.57	4.25	15.32	78.12	2.75	
	48+30	4830.00	5145.84	192	207	215	228	5148.65	5148.84	5149.09	5149.29	24.70	5149.31	5149.09	24.69	15.72	8.97	57.89	3.71	5149.09	24.69	15.72	8.97	57.89	3.71	
Union Pacific Railroad	48+00	4800.00	5145.47	192	207	215	228	5148.60	5148.80	5149.07	5149.27	34.48	5149.16	5149.07	34.48	19.15	15.33	87.79	2.45	5149.07	34.48	19.15	15.33	87.79	2.45	
	47+00	4700.00	5144.35	192	207	215	228	5148.18	5148.43	5148.56	5148.76	25.20	5148.75	5148.56	25.21	13.22	11.99	60.32	3.56	5148.56	25.21	13.22	11.99	60.32	3.56	
	46+43	4643.00	5142.55	192	207	215	228	5148.15	5148.39	5148.52	5148.72	20.87	5148.61	5148.52	20.87	13.41	7.46	88.52	2.43	5148.52	20.87	13.41	7.46	88.52	2.43	
Welby Road	46+03	4603.00	5142.55	192	207	215	228	5144.56	5144.66	5144.99	5145.07	17.80	5145.51	5144.99	17.80	9.01	8.79	37.13	5.79	5144.99	17.80	9.01	8.79	37.13	5.79	
	44+00	4400.00	5139.50	192	207	215	228	5142.58	5142.71	5142.22	5142.30	18.50	5142.75	5142.22	18.50	7.77	10.73	36.73	5.85	5142.22	18.50	7.77	10.73	36.73	5.85	
	39+00	3900.00	5132.65	192	207	215	228	5135.74	5135.92	5136.40	5136.42	87.00	5136.71	5136.40	87.00	26.11	60.89	56.12	3.83	5136.40	87.00	26.11	60.89	56.12	3.83	
	34+25	3425.00	5125.52	192	207	215	228	5132.06	5132.44	5132.56	5132.70	42.88	5132.65	5132.56	42.97	23.95	19.02	90.64	2.37	5132.56	42.97	23.95	19.02	90.64	2.37	
	33+21	3321.00	5123.55	199	222	235	253	5132.02	5132.40	5132.51	5132.65	49.09	5132.57	5132.51	49.19	25.07	24.12	133.92	1.75	5132.51	49.19	25.07	24.12	133.92	1.75	
Steele St.	32+17	3217.00	5123.18	199	222	235	253	5127.38	5127.26	5127.31	5127.36	7.88	5128.45	5127.38	7.92	5.39	2.53	27.91	8.42	5127.38	7.92	5.39	2.53	27.91	8.42	
	31+82	3182.00	5123.57	199	222	235	253	5127.38	5127.15	5127.22	5127.33	20.00	5127.65	5127.38	20.04	10.12	9.92	47.98	4.90	5127.38	20.04	10.12	9.92	47.98	4.90	
	30+55	3055.00	5121.63	199	222	235	253	5126.84	5126.26	5126.24	5126.22	15.31	5126.62	5126.70	15.58	8.18	7.40	54.78	4.29	5126.70	15.58	8.18	7.40	54.78	4.29	

[a]Distance to floodway from the control line looking downstream

[b]Floodway is equal to floodplain'

Floodplain and Floodway Data Table
Hoffman Major Drainageway

REFERENCE LOCATION	RIVER STATION	CROSS SECTION	THALWEG ELEVATION (FT)	PEAK DISCHARGE				WATER SURFACE ELEVATION				100-YEAR FLOODPLAIN		100 YEAR FLOODWAY (0.5' EGL)						100 YEAR FLOODWAY (1.0' EGL)						COMMENTS
				10-YR FLOW	50-YR FLOW	100-YR FLOW	500-YR FLOW	10-YR WSEL	50-YR WSEL	100-YR WSEL	500-YR WSEL	WIDTH	EGL	WSEL	WIDTH	STA. LEFT[a]	STA. RIGHT[a]	AREA	VELOCITY	WSEL	WIDTH	STA. LEFT[a]	STA. RIGHT[a]	AREA	VELOCITY	
REACH: Mainstem																										
	30+36	3036.00	5121.20	199	222	235	253	5126.96	5126.45	5126.46	5126.48	377.47	5126.50	5126.86	33.19	6.74	26.45	162.69	1.44	5126.86	33.19	6.74	26.45	162.69	1.44	
LCC Canal	30+19	3019.00	5122.77	199	222	235	253	5125.61	5126.28	5126.32	5126.33	225.45	5126.47	5126.37[b]	44.50	36.10	8.40	42.75	5.50	5126.37[b]	44.50	36.10	8.40	42.75	5.50	
	30+00	3000.00	5118.63	199	222	235	253	5123.23	5123.46	5123.58	5123.74	16.20	5124.02	5123.58[b]	16.19	9.11	7.08	43.96	5.35	5123.58[b]	16.19	9.11	7.08	43.96	5.35	
	29+50	2950.00	5118.62	199	222	235	253	5121.66	5121.85	5121.95	5122.09	10.78	5123.19	5121.95[b]	10.78	8.89	1.89	26.30	8.94	5121.95[b]	10.78	8.89	1.89	26.30	8.94	
	27+50	2750.00	5113.17	199	222	235	253	5115.06	5115.14	5115.20	5115.26	31.91	5115.80	5115.20[b]	31.91	16.50	15.41	37.68	6.24	5115.20[b]	31.91	16.50	15.41	37.68	6.24	
	24+50	2450.00	5108.40	199	222	235	253	5110.70	5110.82	5110.87	5110.94	29.82	5111.33	5110.87[b]	29.82	15.43	14.39	42.88	5.48	5110.87[b]	29.82	15.43	14.39	42.88	5.48	
	19+50	1950.00	5102.29	199	222	235	253	5103.93	5104.02	5104.07	5104.15	28.69	5104.72	5104.07[b]	28.69	18.84	9.85	36.54	6.43	5104.07[b]	28.69	18.84	9.85	36.54	6.43	
	14+50	1450.00	5095.70	231	290	324	372	5098.85	5099.16	5099.32	5099.53	37.79	5099.59	5099.32[b]	37.79	17.58	20.21	77.52	4.18	5099.32[b]	37.79	17.58	20.21	77.52	4.18	
	9+75	975.00	5092.84	231	290	324	372	5095.19	5095.44	5095.57	5095.75	32.78	5096.29	5095.57[b]	32.78	14.43	18.35	47.80	6.78	5095.57[b]	32.78	14.43	18.35	47.80	6.78	
	8+70	870.00	5090.02	231	290	324	372	5092.66	5093.03	5093.22	5093.49	33.77	5093.38	5093.22[b]	33.77	18.04	15.73	101.83	3.18	5093.22[b]	33.77	18.04	15.73	101.83	3.18	
	8+00	800.00	5089.53	231	290	324	372	5092.51	5092.84	5093.01	5093.23	36.49	5093.14	5093.01[b]	36.49	19.79	16.70	113.17	2.86	5093.01[b]	36.49	19.79	16.70	113.17	2.86	
	7+50	750.00	5089.88	231	290	324	372	5091.74	5092.00	5092.14	5092.32	27.29	5092.93	5092.14[b]	27.29	17.21	10.08	45.43	7.13	5092.14[b]	27.29	17.21	10.08	45.43	7.13	
	5+50	550.00	5086.46	231	290	324	372	5089.56	5089.87	5090.02	5090.25	24.37	5090.64	5090.02[b]	24.37	11.49	12.88	51.37	6.31	5090.02[b]	24.37	11.49	12.88	51.37	6.31	
	3+50	350	5084.09	231	290	324	372	5087.04	5087.33	5087.49	5087.65	24.30	5088.35	5087.49[b]	24.30	8.88	15.42	43.39	7.47	5087.49[b]	24.30	8.88	15.42	43.39	7.47	
	2+95	295	5083.39	231	290	324	372	5085.65	5086.02	5086.22	5086.49	40.73	5086.37	5086.22[b]	40.72	20.52	20.20	101.60	3.19	5086.22[b]	40.72	20.52	20.20	101.60	3.19	
Access Road	2+37	237	5082.87	231	290	324	372	5084.21	5084.43	5084.54	5084.70	29.55	5085.32	5084.54[b]	29.55	12.01	17.54	45.68	7.09	5084.54[b]	29.55	12.01	17.54	45.68	7.09	
	2+30	230	5075.00	231	290	324	372	5082.49	5083.50	5084.00	5085.00	397.57	5084.00	5084.00[b]	N/A	N/A	N/A	892.14	0.36	5084.00[b]	397.57	N/A	N/A	892.14	0.36	
	1+50	150	5074.00	231	290	324	372	5082.50	5083.50	5084.00	5085.00	511.37	5084.00	5084.00[b]	N/A	N/A	N/A	2791.46	0.12	5084.00[b]	511.37	N/A	N/A	2791.46	0.12	
Outfall at S. Platte	0+75	75	5071.35	231	290	324	372	5082.50	5083.50	5084.00	5085.00	525.01	5084.00	5084.00[b]	N/A	N/A	N/A	4616.71	0.07	5084.00[b]	525.01	N/A	N/A	4616.71	0.07	
REACH: Rainbow																										
Rainbow Ave,	277+49	27749	5175.06	215	585	803	1119	5175.74	5176.16	5176.35	5176.59	352.25	5176.46	5176.77	175.00	138.35	36.65	217.70	3.69	5176.36	175.00	138.35	36.65	301.26	2.67	
	274+50	27450	5170.44	215	585	803	1119	5171.87	5172.58	5172.84	5173.15	121.90	5173.40	5173.14	54.48	16.33	38.15	118.37	6.78	5172.80	54.48	16.33	38.15	139.42	5.76	
	271+45	27145	5165.73	60	430	648	964	5166.98	5168.24	5168.51	5168.82	146.18	5168.81	5168.96	92.23	52.60	39.63	129.45	5.01	5168.75	92.23	52.60	39.63	187.32	3.46	
	269+53	26953	5163.83	60	430	648	964	5164.78	5165.66	5165.89	5166.11	179.23	5166.25	5166.10	99.16	3.80	95.36	106.19	6.10	5166.33	99.16	3.80	95.36	90.66	7.15	
	268+44	26844	5160.36	60	430	648	964	5160.93	5161.79	5162.07	5162.27	331.71	5162.25	5162.52	257.76	2.47	255.29	172.59	3.75	5162.65	257.76	2.47	255.29	351.88	1.84	
	266+74	26674	5160.22	60	430	648	964	5160.23	5160.74	5161.03	5161.25	334.12	5161.14	5161.52	227.00	5.22	221.78	191.42	3.39	5161.63	227.00	5.22	221.78	127.08	5.10	
	265+88	26588	5158.60	215	585	803	1119	5159.11	5159.47	5159.60	5159.77	383.21	5159.97	5159.90	182.76	50.61	132.15	144.87	5.54	5159.60	182.76	50.61	132.15	166.35	4.83	
	264+01	26401	5155.33	215	585	803	1119	5156.11	5156.40	5156.60	5156.85	224.26	5157.08	5156.82	85.00	39.79	45.21	119.40	6.73	5156.60	85.00	39.79	45.21	147.25	5.45	
Devonshire Blvd.	262+45	26245	5154.36	215	585	803	1119	5155.31	5155.87	5156.12	5156.46	281.89	5156.24	5156.63	128.02	44.41	83.61	249.18	3.22	5156.12	128.02	44.41	83.61	305.07	2.63	
	261+61	26161	5151.96	283	720	980	1359	5155.09	5155.73	5156.00	5156.33	363.58	5156.11	5156.44	123.24	47.61	75.63	259.11	3.78	5156.00	123.24	47.61	75.63	372.15	2.63	
	261+13	26113	5151.50	283	720	980	1359	5154.24	5155.08	5155.30	5155.57	264.00	5155.80	5155.38	70.00	38.06	31.94	128.68	7.62	5155.30	70.00	38.06	31.94	173.60	5.65	
	260+74	26074	5151.07	283	720	980	1359	5153.48	5154.37	5154.37	5154.50	314.46	5154.69	5154.68	125.72	28.49	97.23	172.95	5.67	5154.37	125.72	28.49	97.23	218.49	4.49	
Union Pacific Railroad	258+19	25819	5147.20	283	720	980	1359	5148.75	5149.73	5150.55	5151.06	283.59	5151.27	5150.18	47.74	13.52	34.22	112.00	8.75	5150.55	47.74	13.52	34.22	166.05	5.90	
	257+10	25710	5144.37	283	720	980	1359	5147.01	5147.60	5147.86	5148.08	270.51	5148.13	5148.31	135.00	87.29	47.71	176.69	5.55	5147.86	135.00	87.29	47.71	238.60	4.11	
	256+06	25606	5144.70	283	720	980	1359	5145.52	5145.91	5146.09	5146.29	305.80	5146.46	5146.31	110.00	40.47	69.53	147.46	6.65	5146.09	110.00	40.47	69.53	203.68	4.81	
	255+04	25504	5142.50	283	720	980	1359	5143.33	5143.70	5143.85	5144.08	303.47	5144.10	5144.09	120.00	50.27	69.73	165.97	5.90	5143.85	120.00	50.27	69.73	247.10	3.97	
Industrial Flow Split	252+01	25201	5137.00	283	720	980	1359	5138.15	5138.52	5138.67	5138.83	408.46	5138.97	5139.01	221.07	41.48	179.59	194.31	5.04	5138.67	221.07	41.48	179.59	235.23	4.17	
	248+26	24826	5133.21	237	468	593	780	5133.79	5134.01	5134.10	5134.22	290.33	5134.33	5134.27	102.67	36.91	65.76	101.81	5.82	5134.10	102.67	36.91	65.76	153.93	3.85	
	244+93	24493	5128.71	237	468	593	780	5129.56	5129.81	5129.90	5130.08	254.69	5130.10	5130.22	85.06	50.82	34.24	113.91	5.21	5129.90	85.06	50.82	34.24	168.70	3.52	
Steele St.	243+17	24317	5125.45	237	468	593	780	5126.25	5126.54	5126.68	5126.86	188.09	5127.04	5126.83	75.24	40.41	34.83	93.35	6.35	5126.68	75.24	40.41	34.83	131.49	4.51	
	241+38	24138	5123.15	237	468	593	780	5123.97	5124.19	5124.32	5124.43	624.87	5124.47	5124.77	130.00	69.96	60.04	161.00	3.68	5124.32	130.00	69.96	60.04	212.13	2.80	
	240+12	24012	5120.07	237	468	593	780	5122.31	5122.63	5122.70	5122.85	447.54	5122.99	5123.01	187.38	143.66	43.72	121.20	4.89	5122.70	187.38	143.66	43.72	167.25	3.55	
	237+47	23747	5115.86	279	678	919	1268	5116.37	5116.58	5116.68	5116.79	707.31	5116.76	5117.02	271.18	97.21	173.97	272.13	3.38	5116.68	271.18	97.21	173.97	398.67	2.31	
	235+33	23533	5111.90	279	678	919	1268	5112.32	5112.56	5112.64	5112.76	482.71	5112.88	5113.01	190.00	79.63	110.37	170.54	5.39	5112.64	190.00	79.63	110.37	231.45	3.97	
	231+41	23141	5106.00	298	757	1043	1435	5108.15	5108.31	5108.40	5108.51	1198.70	5108.42	5108.40	1286.47	213.18	1073.29	1235.44	0.84	5108.40	1286.47	213.18	1073.29	1235.44	0.84	
Upper Gravel Pond	231+02	23102	5107.48	298	757	1043	1435	5108.07	5108.17	5108.22	5108.29	1376.61	5108.36	5108.22	1376.61	255.68	1120.93	348.48	2.99	5108.22	1376.61	255.68	1120.93	348.48	2.99	

[a]Distance to floodway from the control line looking downstream

[b]Floodway is equal to floodplain'

Floodplain and Floodway Data Table
Hoffman Major Drainageway

REFERENCE LOCATION	RIVER STATION	CROSS SECTION	THALWEG ELEVATION (FT)	PEAK DISCHARGE				WATER SURFACE ELEVATION				100-YEAR FLOODPLAIN		100 YEAR FLOODWAY (0.5' EGL)						100 YEAR FLOODWAY (1.0' EGL)						COMMENTS
				10-YR FLOW	50-YR FLOW	100-YR FLOW	500-YR FLOW	10-YR WSEL	50-YR WSEL	100-YR WSEL	500-YR WSEL	WIDTH	EGL	WSEL	WIDTH	STA. LEFT[a]	STA. RIGHT[a]	AREA	VELOCITY	WSEL	WIDTH	STA. LEFT[a]	STA. RIGHT[a]	AREA	VELOCITY	
REACH: Rainbow																										
	230+11	23011	5096.80	298	757	1043	1435	5101.22	5101.38	5101.46	5101.55	1359.75	5101.46	5101.46	1359.74	274.30	1085.44	6271.68	0.17	5101.46	1359.74	274.30	1085.44	6271.68	0.17	
	224+15	22415	5100.80	298	757	1043	1435	5101.15	5101.26	5101.32	5101.38	1578.87	5101.44	5101.32	1718.82	435.06	1283.76	367.11	2.84	5101.32	1718.82	435.06	1283.76	367.11	2.84	
Lower Gravel Pond	221+52	22152	5080.00	298	757	1043	1435	5089.72	5090.05	5090.19	5090.36	2778.85	5090.19	5090.19	2778.85	1747.79	1031.06	27871.57	0.04	5090.19	2778.85	1747.79	1031.06	27871.57	0.04	
Outfall at S. Platte	202+29	20229	5089.00	298	757	1043	1435	5089.57	5089.82	5089.93	5090.04	574.49	5090.17	5089.93	574.49	306.32	268.17	267.89	3.89	5089.93	574.49	306.32	268.17	267.61	3.90	
REACH: Industrial																										
	419+40	41940	5133.19	46	252	387	579	5133.50	5133.88	5134.05	5134.18	291.52	5134.17	5134.24	90.00	37.78	52.22	84.42	4.58	5134.05	90.00	37.78	52.22	138.32	2.80	
	418+18	41818	5128.69	46	252	387	579	5128.94	5129.18	5129.28	5129.41	290.73	5129.48	5129.63	90.00	58.16	31.84	74.34	5.21	5129.28	90.00	58.16	31.84	110.05	3.52	
Industrial South Split	414+65	41465	5123.80	46	252	387	579	5124.73	5125.48	5125.63	5125.80	393.70	5125.69	5125.96	102.00	77.07	24.93	111.17	3.48	5125.63	102.00	77.07	24.93	206.91	1.87	
	412+18	41218	5121.35	42	210	326	488	5122.15	5122.99	5123.26	5123.48	118.71	5123.57	5123.26	118.71	90.62	28.09	73.09	4.46	5123.26	118.71	90.62	28.09	73.09	4.46	
	408+93	40893	5119.00	42	210	326	488	5119.63	5120.41	5120.79	5121.21	182.50	5120.81	5120.74	179.17	125.07	54.10	265.07	1.23	5120.79	179.17	125.07	54.10	272.85	1.19	
Confluence w/ Rainbow	407+53	40753	5118.50	42	210	326	488	5118.75	5119.03	5119.16	5119.31	183.99	5119.39	5119.27	194.58	59.49	135.09	105.11	3.10	5119.16	194.58	59.49	135.09	84.40	3.86	
REACH: Industrial South																										
	322+96	32296	5119.70	4	42	61	91	5119.93	5120.53	5120.66	5120.83	51.31	5120.71	5121.08	20.00	9.04	10.96	24.58	2.48	5120.66	20.00	9.04	10.96	34.52	1.77	
	321+72	32172	5118.32	4	42	61	91	5118.42	5118.69	5118.77	5118.89	57.05	5118.94	5119.06	17.00	7.74	9.26	12.33	4.95	5118.77	17.00	7.74	9.26	18.38	3.32	
	314+41	31441	5116.00	4	42	61	91	5116.36	5116.50	5116.55	5116.61	580.42	5116.55	5117.19	80.00	38.51	41.49	95.08	0.64	5116.55	80.00	38.51	41.49	277.58	0.22	
Steele St.	314+17	31417	5116.29	8	52	76	111	5116.34	5116.42	5116.46	5116.49	316.10	5116.52	5116.84	36.00	17.23	18.77	18.56	4.09	5116.46	36.00	17.23	18.77	38.65	1.97	
	313+34	31334	5113.21	8	52	76	111	5113.33	5113.66	5113.74	5113.85	151.47	5113.77	5114.26	35.00	16.71	18.29	31.31	2.43	5113.74	35.00	16.71	18.29	57.69	1.32	
Confluence w/ Rainbow	309+50	30950	5110.00	8	52	76	111	5110.09	5110.30	5110.38	5110.44	170.32	5110.48	5110.65	26.00	13.37	12.63	16.83	4.51	5110.38	26.00	13.37	12.63	30.64	2.48	

[a]Distance to floodway from the control line looking downstream

[b]Floodway is equal to floodplain'

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APPENDIX E – Flood Map

APPENDIX E - FLOOD MAP

HOFFMAN DRAINAGEWAY

FLOOD HAZARD AREA DELINEATION

OCTOBER 2007

INSTRUCTIONS TO PRINT AN AREA SMALLER THAN THE FULL PAGE TO SCALE:

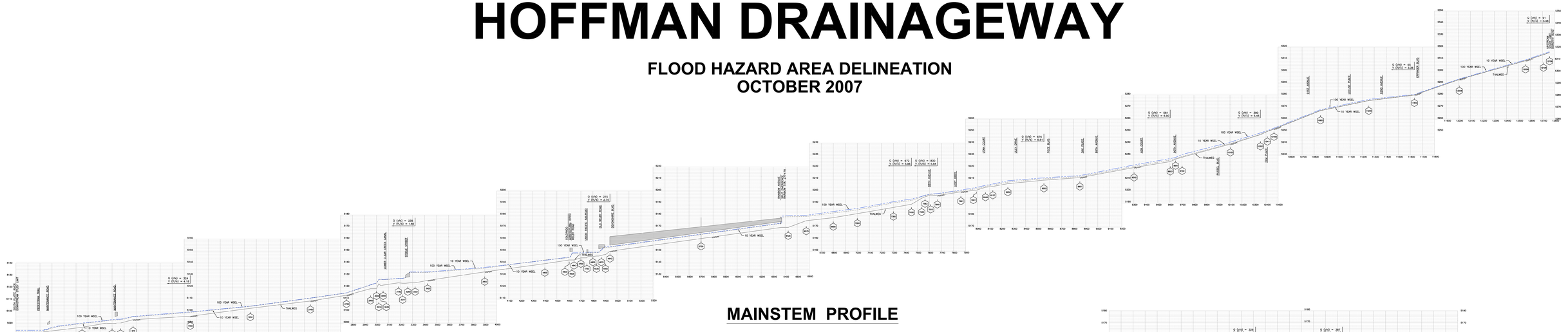
1. USING THE "SNAPSHOT" TOOL, SELECT THE DESIRED AREA TO PRINT.
2. CLICK FILE>PRINT...
3. SELECT YOUR PRINTER FROM THE PRINTER DROPDOWN MENU.
4. SET THE DESIRED PAPER SIZE USING THE PRINTER "PROPERTIES" MENU.
5. CHOOSE THE "SELECTED GRAPHIC" OPTION UNDER "PRINT RANGE".
6. SELECT "NONE" FROM THE "PAGE SCALING" DROPDOWN MENU.
7. UNSELECT "CHOOSE PAPER SOURCE BY PDF PAGE SIZE".
8. CLICK "OK" TO PRINT SELECTION.

APPENDIX F – Flood Profiles

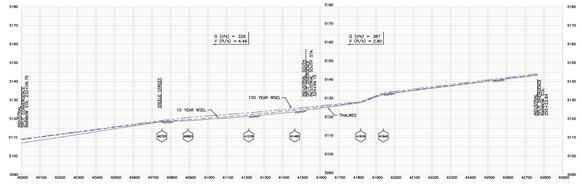
APPENDIX F - FLOOD PROFILES

HOFFMAN DRAINAGEWAY

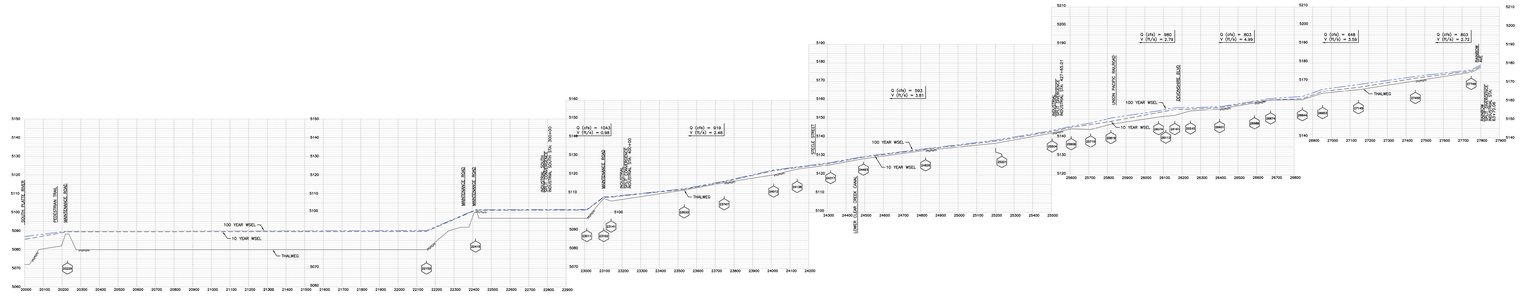
FLOOD HAZARD AREA DELINEATION
OCTOBER 2007



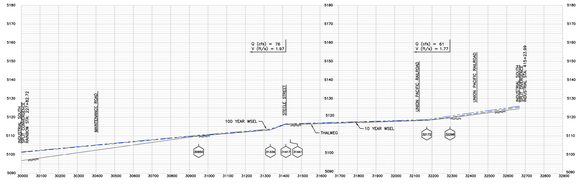
MAINSTEM PROFILE



INDUSTRIAL PROFILE



RAINBOW PROFILE



INDUSTRIAL SOUTH PROFILE

LEGEND

100-YEAR WSEL
10-YEAR WSEL
STREAM BED

CROSS SECTION LOCATION

SCALE

200 0 100 200 400

ORIGINAL HORIZ. SCALE: 1" = 200'
ORIGINAL VERT. SCALE: 1" = 20'

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