CDM

In association with Kirkham Michael and Heartland Center

CITY OF LINCOLN
NEBRASKA

Lower Platte South
Natural Resources District

City of Lincoln, NE

Evaluation of Storage Areas in the Salt Creek Watershed

March 2009

Final Report

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Executive Summary

Introduction

The City, Nebraska Department of Natural Resources (NRD), and United States Army Corp of Engineers (USACE) have been working together for the past several decades to provide flood protection for residents that live near the Salt Creek channel. The first major flood control effort began with the USACE Salt Valley Flood Control Project (1960s), which included 10 flood control dams and a levee system in Lincoln. Following the completion of these improvements, numerous planning efforts have been completed, including the USACE 205 and 216 studies, to identify additional feasible flood control improvements to increase the level of flood protection for area residents.

The USACE 205 study identified two technically feasible locations for constructing flood storage areas that would provide measurable flood control benefits, including an area along Oak Creek (Location 1) adjacent to the Lincoln airport, and the other location along Middle Creek (Location 2) between SW 27th and SW 40th Streets. In addition, the USACE 216 study results showed that Wilderness Park provides valuable flood control benefits and should be preserved (Location 3). These locations, shown in Figure ES-1, were examined in more detail for this report to determine their flood benefit along Salt Creek through Lincoln, NE.

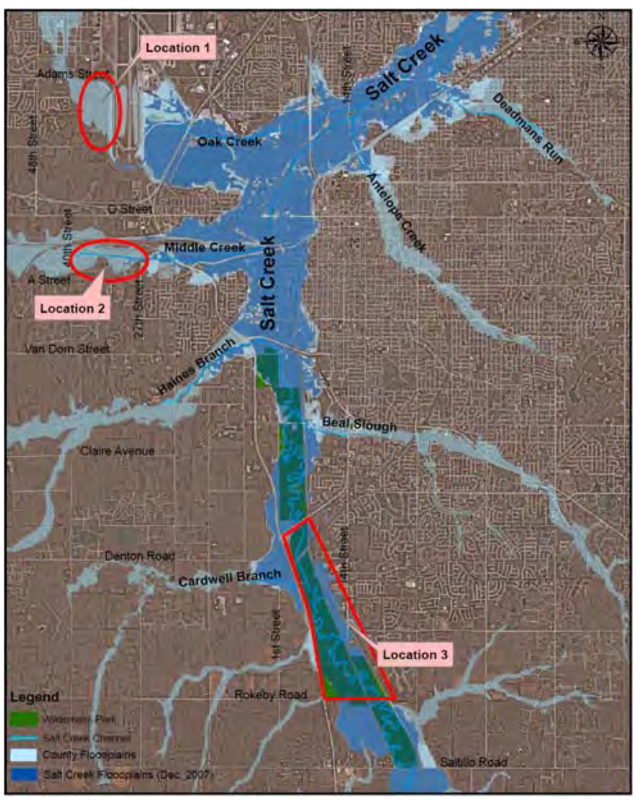


Figure ES-1 Locations for Flood Control Storage Areas

With the recent completion of the Salt Creek DFIRM Update project, a state-of-the-practice hydrologic and hydraulic computer model is now available to further evaluate the feasibility of constructing additional flood control projects. The updated FEMA DFIRM identified over 5,600 habitable buildings within the Salt Creek floodplain between Saltillo Road and 98th Street. Therefore, the purpose of this project is to simulate the two storage area facilities as previously identified by USACE, and locations near Wilderness Park, using the latest computer model to better quantify the flood control benefits of these potential facilities. In addition, the functionality of each storage facility will be further evaluated based on the existing site characteristics, multi-use features, construction constraints, and input received during the public participation process.

Wilderness Park

Wilderness Park is characterized by dense wooded area with few large opens spaces. It is owned by Lancaster County, and encompasses all of Salt Creek from Saltillo Road to Van Dorn Street, where the Creek enters City boundaries.

Existing Overbank Flood Storage

Wilderness Park along Salt Creek has preserved approximately 1,400 acres of undeveloped space that serves as overbank flood storage. During large rainfall events when Salt Creek exceed its banks this open space is temporarily flooded. Figure ES-2 is a photograph taken near S 14th Street and Yankee Hill Road which shows overbank flow in Wilderness Park. This was the result of a flood event on June 5, 2008.

Figure ES-2 Wilderness Park Overbank Flood Storage

This existing overbank flood storage within Wilderness Park has a flood benefit downstream. Using the available unsteady HEC-RAS model of Salt Creek the project team simulated two hypothetical conditions within Wilderness Park (Figure ES-3):

1) Loss of overbank flood storage up to the mapped FEMA floodway; and

2) Loss of overbank flood storage to width no greater than 300-feet.

This second more extreme encroachment case was an approximate representation of the typical encroached of Salt Creek downstream from Wilderness Park.

Figure ES-3 Wilderness Park Evaluation Scenarios

The analysis clearly showed that the existing overbank storage within Wilderness Park provides a reduction in flow and water surface elevations in the Park and downstream to the confluence with Haines Branch, with a diminished reduction downstream. As shown in Tables ES-1 and ES-2, peak flow attenuation is also seen immediately downstream of Beal Slough to the confluence with Middle Creek. Overall, this analysis shows that flood attenuation provided by Wilderness Park reduces flooding in heavily urban areas of Lincoln, NE, along Salt Creek, especially downstream of the Park and upstream of Middle Creek (South Bottoms vicinity).

Table ES-1 Wilderness Park Analysis –Maximum Water Surface Comparison

	Salt Creek Storage Area Analysis				
Location Description	Salt Creek DFIRM Maximum Water Surface Elevation (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
US of Saltillo Rd	1,199	1,199	0.2	1,205	5.8
DS of 14th St	1,184	1,184	0.6	1,190	6.8
DS of Cardwell Branch	1,175	1,175	0.0	1,178	3.2
US of Old Cheney	1,166	1,166	0.5	1,172	5.5
DS of Beal Slough	1,159	1,159	0.2	1,161	1.9
DS of Haines Branch	1,156	1,156	0.0	1,156	0.2
DS of Middle Creek	1,153	1,153	0.0	1,153	0.3
US of Railroad Bridge	1,152	1,152	0.0	1,152	0.3
DS of Oak Creek	1,139	1,139	0.0	1,139	0.2

Shaded locations are within Wilderness Park

Table ES-2 Wilderness Park Analysis –Peak Flow Comparison

	Salt Creek Storage Area Analysis				
Location Description	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Difference between Scenario 2 & DFIRM
US of Saltillo Rd	14,401	14,321	-0.6%	14,394	-0.1%
DS of 14th St	14,486	14,350	-0.9%	14,555	0.5%
DS of Cardwell Branch	14,723	14,637	-0.6%	14,645	-0.5%
US of Old Cheney	14,697	14,623	-0.5%	14,689	-0.1%
DS of Beal Slough	14,880	15,571	4.6%	17,491	17.5%
DS of Haines Branch	21,031	21,025	0.0%	23,576	12.1%
DS of Middle Creek	28,005	28,028	0.1%	27,767	-0.8%
US of Railroad Bridge	24,658	24,760	0.4%	25,034	1.5%
DS of Oak Creek	40,410	40,514	0.3%	40,951	1.3%

Shaded locations are within Wilderness Park

Additional Offline Detention

Within the Wilderness Park Area several options were considered for locations of additional offline storage. However, there were limited opportunities for additional flood storage without significantly impacting the mature riparian vegetation. In addition, existing linear transportation infrastructure that bound the area on the west and east limit the area for additional offline flood detention. One area of existing open space located to the west of Yankee Hill Road and South 14th Street, shown in Figure ES-4, was determined to be the best available option for additional offline detention. An evaluation of this offline detention location resulted in no additional flood benefit downstream. The primary reason for the lack of flood benefit at this location is the large drainage area to this point and the double runoff peak of Salt Creek. As shown in Figure ES-5, Salt Creek has a double peak runoff response which significantly limits the flood benefit of offline detention because the offline detention is filled by the first peak leaving no flood storage for the larger second peak. Therefore no further evaluation of additional offline detention was completed for this study.

Figure ES-4 Wilderness Park Offline Storage Site

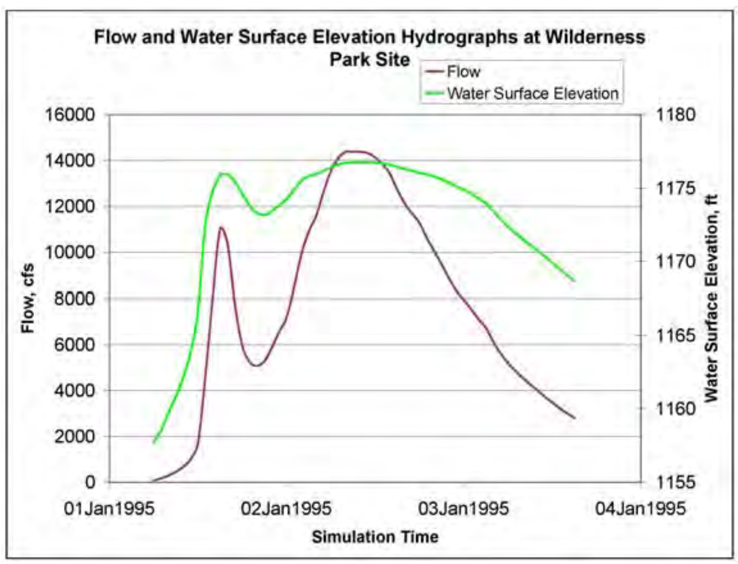


Figure ES-5 100-Year Runoff Flow and WSE

Storage Area Evaluation

Offline storage sites were evaluated in detail at only two of the three proposed locations because the Wilderness Park site was eliminated during the preliminary evaluation. As shown in Figure ES-6, three offline detention sites were evaluated for the two remaining locations. The three offline storage sites that were evaluated in detail for this study were:

- Middle Creek Site - South of A Street, between SW 27th and SW 40th Streets
- Oak Creek Upstream Site - Near the airport located west of the airport runway and south of Lincoln Air Park West; and
- Oak Creek Downstream Site - Located south of the Air National Guard base and north of Oak Creek.

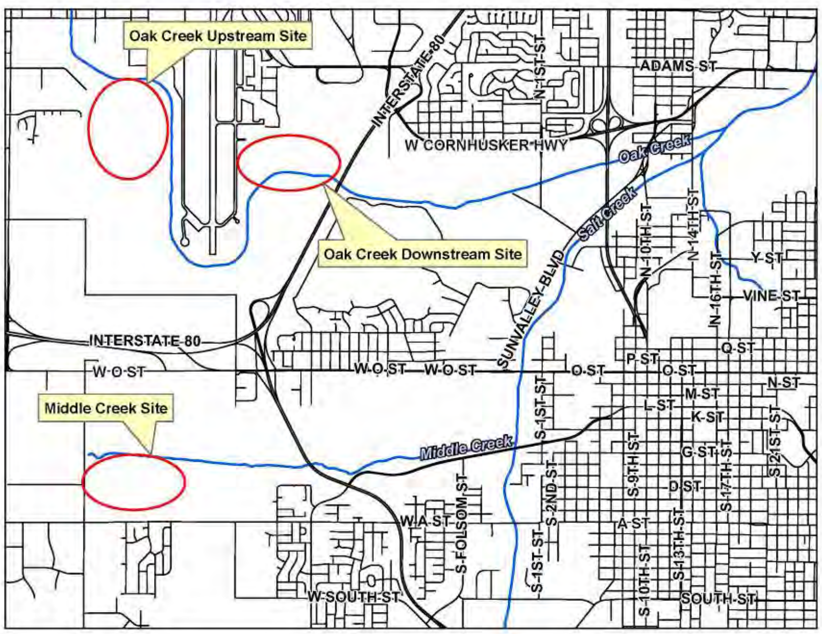


Figure ES-6 Offline Storage Sites Evaluated

Middle Creek Site

The Middle Creek site generally bounded by Southwest 40th Street to the west, Southwest 27th Street to the east, West "A" Street to the south, and Middle Creek to the north, is characterized by open space which is currently agricultural fields . As shown in Figure ES-7, the conceptual offline storage area design is two large storage basins that are hydraulically connected which provided maximum flood storage at this site. This design allowed for expanded storage along Middle Creek with an East Middle Creek and West Middle Creek storage basin. Several options for conveying flow into, out, and between the basins were considered. The resulting design uses concrete culverts with flap gates to control flow into and out of the basins and concrete culverts to connect the various cells. An unsteady HEC-RAS model was used to simulate this

Middle Creek offline storage design which simulated the filling and dewatering of the basins.

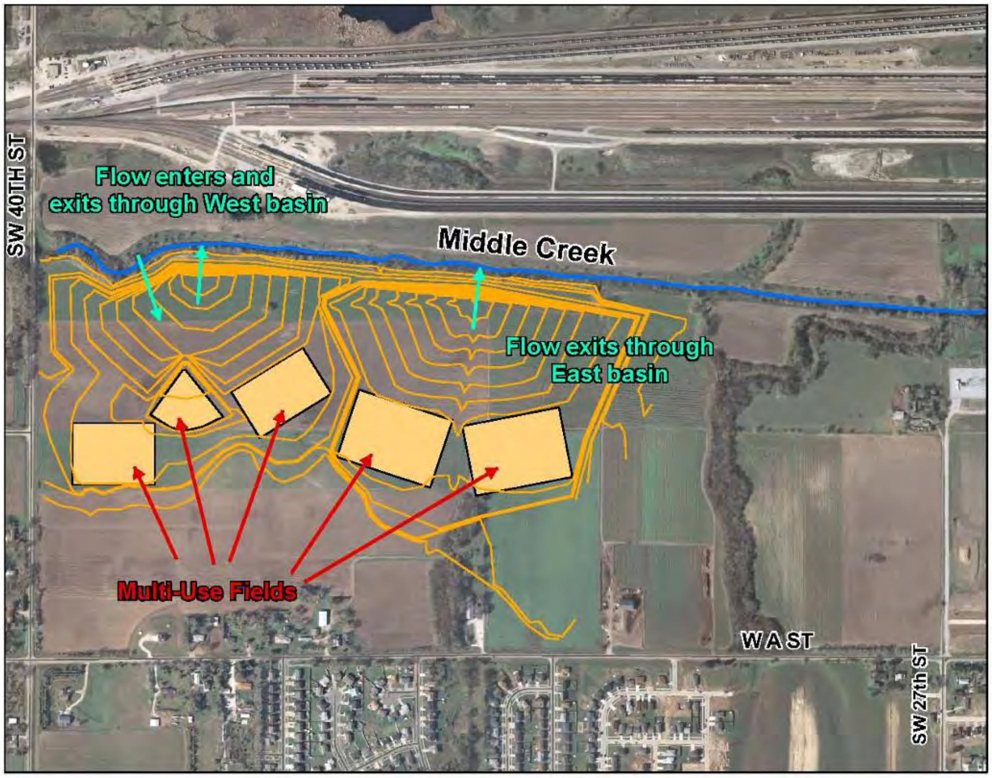


Figure ES-7 Middle Creek Offline Storage

The westernmost basin has a maximum storage of 222.9 acre-feet at water surface elevation of 1,164 feet, and the eastern most basin has a maximum storage of 334.1 acre-feet at a water surface elevation of 1,164 feet. The conceptual design allows for the possibility of the inclusion of five multi-use fields to utilize the site area during dry conditions.

Excavation will be extensive with an estimated **680,000 cubic yards** of excess material. As proposed, the excess material will be disposed on the adjoining site to the south and southeast. Disposing the excess fill material on site was the most cost effective alternative. The estimated cost of these storage basins along Middle Creek was **$15.4 million**.

Oak Creek Upstream Site

The Oak Creek upstream site is generally bounded by Oak Creek to the north, Lincoln Airport to the east, and Northwest 41st Street to the west. It is characterized by open space which is currently used as agriculture, as shown in Figure ES-8.

The Oak Creek upstream storage basin conceptual design followed a similar process to that of Middle Creek to increase the volume of storage; two hydraulically connected basins were designed as well as a third, separate basin. This allowed storage to expand along Oak Creek, producing a Northwest (NW) upstream Oak Creek storage basin, a Northeast (NE) upstream Oak Creek storage basin, and a South (S) upstream Oak Creek storage basin (Figure ES-8). Several options for conveying flow between the basins were considered, and concrete culverts were found to be the most cost-effective solution. An unsteady HEC-RAS model was used to simulate this offline storage design which simulated the filling and dewatering of the basins.

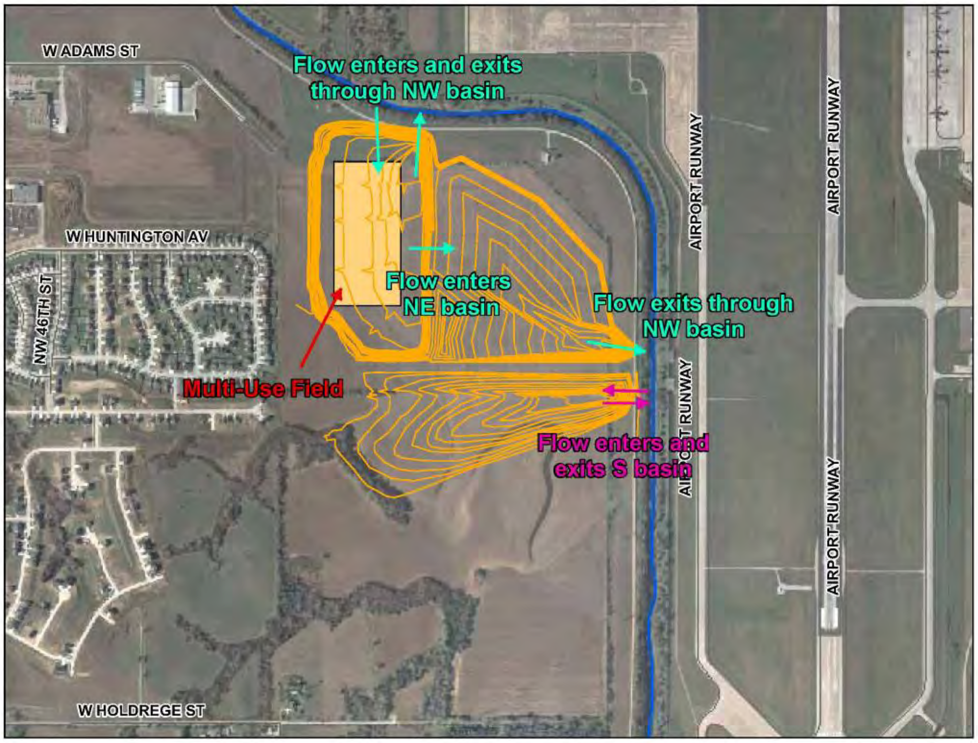


Figure ES-8. Oak Creek Upstream Offline Storage

The conceptual-level design included two northernmost basins (NW and NE basins) which are hydraulically connected as well as an independent southern basin. The NW basin has a maximum storage of 545.0 acre-feet at a water surface elevation of 1,164 feet, the NE basin has a maximum storage of 343.3 acre-feet at water surface elevation of 1,164 feet, and the S basin has a maximum storage of 288.8 acre-ft at a water surface elevation of 1,164 feet. The conceptual design provides a total of **1,177.1 acre-feet** of offline flood storage. In addition, the design allows for the possibility of the inclusion of a multi-use field to utilize the site under normal, dry conditions. Flow enters and exits the basins through concrete culverts with tensioned flap gates, which are used to control the timing and amount of flow allowed into and out of the basins.

As with the Middle Creek sites the excavation will be extensive with an estimated **950,000 cubic yards** of excess material. As proposed, the excess material will be disposed on open areas owned by the Lincoln Airport within 1-mile of the site. The estimated cost of these storage basins at the upstream Oak Creek site was **$ 18.2 million**.

Oak Creek Downstream Site

The Oak Creek downstream site was identified during the site evaluation process, and is generally bounded by Oak Creek to the south, Air National Base to the north and Lincoln Airport to the west. It is characterized as an open grassed area as shown in Figure ES-9.

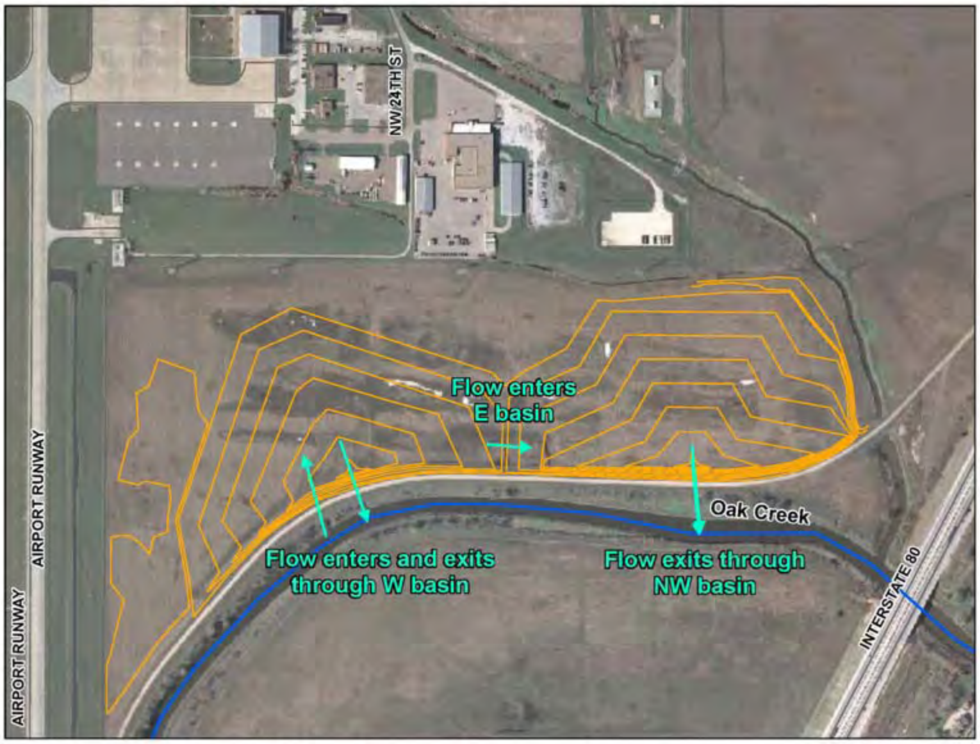


Figure ES-9 Oak Creek Downstream Offline Storage

This storage area was also divided into two cells, east and west. These offline storage sites are relatively small compared to the upstream site. The design included two basins (W and E basins) which are hydraulically connected. The W basin has a maximum storage of 95.4 acre-feet at a water surface elevation of 1,154 feet; the E basin has a maximum storage of 127.7 acre-feet at a water surface elevation of 1,154 feet. The conceptual design provides a total of **223.1 acre-feet** of offline flood storage. Flow enters and exits the basins through concrete culverts with tensioned flap gates, which are used to control the timing and amount of flow allowed into and out of the basins.

The estimated excavation is **240,000 cubic yards** of excess material. As proposed, the excess material will be disposed on open areas owned by the Lincoln Airport within 1-mile of the site. The estimated cost of these storage basins at the downstream Oak Creek site was **$5.0 million**.

Summary of Cost

These seven storage basins at three sites were the preferred storage alternative that provided the most flood benefit downstream along Salt Creek. Table ES-3 provides a summary of the seven basins including the estimated cost.

Table ES-3 Summary of Seven Basins by Location

Site Location (No. of Basins)	Surface Area	Estimated Excavation	Maximum Flood Storage	Cost
Middle Creek (2)	83 ac	680,000 CY	557 ac-ft	$15,400,000
Oak Creek – Upstream (3)	124 ac	950,000 CY	1,177 ac-ft	$18,200,000
Oak Creek – Downstream (2)	41ac	240,000 CY	223 ac-ft	$5,000,000
Total (7)	**248 ac**	**1,870,000 CY**	**1,957 ac-ft**	**$38,600,000**

Summary of Flood Benefit

The combination of all seven basins at the Oak Creek Upstream, Oak Creek Downstream, and Middle Creek sites represents the most beneficial offline storage design, taking into account the combined effect of the basins, site specific issues, constructability, cost, and maintenance. The average and maximum flood benefit downstream along Salt Creek through Lincoln for the 100-year event is shown in Table ES-4. Figure ES-10 provides a map of the flood benefits along Salt Creek.

Table ES-4 Preferred Alternative Flood Depth Reduction

Salt Creek Reach	Average Flood Depth Reduction ft	Maximum Flood Depth Reduction, ft	Approximate Limits
MC110	-0.02	0	Saltillo Road to Confluence with Cardwell Branch
MC80	0.01	0.05	Confluence with Cardwell Branch to Confluence with Haines Branch
MC60	0.09	0.12	Confluence with Haines Branch to Confluence with Middle Creek
MC50	0.12	0.14	Confluence with Middle Creek to Confluence with Oak Creek
MC50	0.06	0.11	Confluence with Oak Creek to Confluence with Little Salt Creek
MC10	0.00	0.03	Confluence with Little Salt Creek to North 98th Street
MC05	0.02	0.02	Confluence with Little Salt Creek to North 112th Street

The preferred alternative would take approximately 31 structures out of the 100-year floodplain, and typically reduces the 100-year flooding depths by 0.1 feet at structures. For the 50-year event, the preferred alternative takes approximately 51 structures out of the floodplain and typically reduces flooding depths by 0.3 feet, and for the 10-year event, it takes approximately 64 structures out of the floodplain and typically reduces flooding depths by 0.4 feet.

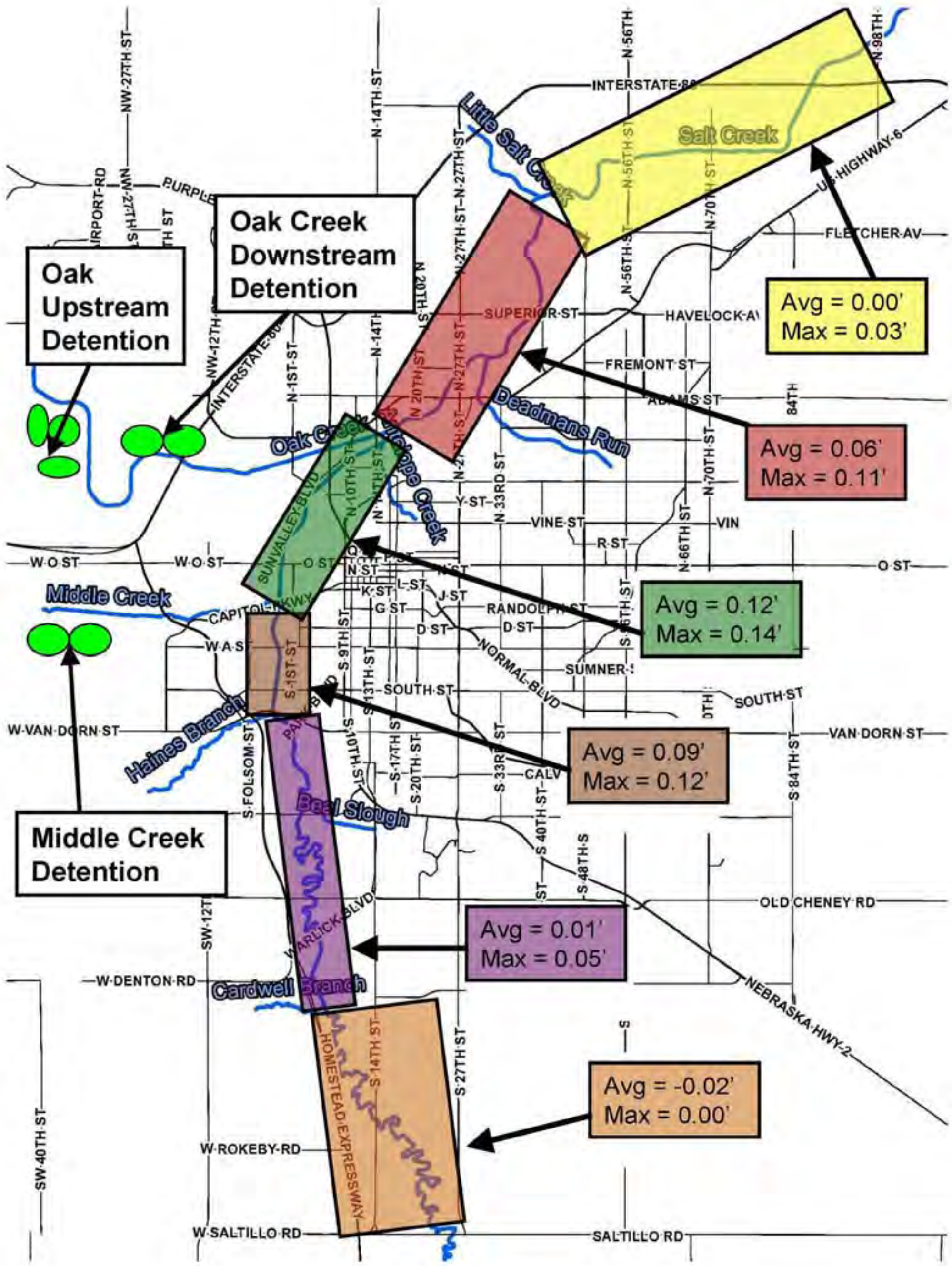


Figure ES-10 Preferred Alternative 100-Year Flood Depth Reduction through Lincoln, Nebraska

Benefit-Cost Analysis

Due to the magnitude of the preferred storage alternative, which encompasses all seven (7) basins, a benefit-cost analysis (BCA) was conducted to evaluate the economic feasibility of implementation. The economic evaluation was conducted using a benefit-cost ratio (BCR) approach based on FEMA procedures.

The FEMA BCR procedure consists of determining whether the cost of the mitigation project today will result in sufficient flood damage reduction in the future to justify the capital investment of the project. If the benefit is determined to be greater than the estimated project cost, then the project is considered justified. However, if the benefit is less than the project cost, then the project is not considered cost-effective. Thus, the BCR, which is calculated by dividing the benefits by the costs, should have a value of 1.0 or greater.

Estimated Benefits

The estimated flood damages before the projects (existing conditions) and after the projects are summarized in Tables ES-5 and ES-6, respectively. The total damages from the 100-year event include damages to the airport estimated in the Oak Creek Levee Study, completed by HWS Consulting Group, Inc.

Table ES-5 Total Physical Damages *Before* Preferred Alternative

Flood Frequency Events (Years)	Buildings	Contents	Streets	Total Damages and Losses
10	$19,000,000	$7,000,000	$400,000	$26,400,000
50	$94,000,000	$39,000,000	$4,000,000	$140,000,000
100	$166,000,000	$64,000,000	$7,000,000	$240,600,000*
Total Annualized Damages				$7,180,000

*The 100-year total damages includes damages to the airport estimated in the Oak Creek Levee Study, completed by HWS Consulting Group, Inc

Table ES-6 Total Physical Damages *After* Preferred Alternative

Flood Frequency Events (Years)	Buildings	Contents	Streets	Total Damages and Losses
10	$16,000,000	$5,000,000	$300,000	$21,300,000
50	$88,000,000	$33,000,000	$3,000,000	$124,000,000
100	$149,000,000	$60,000,000	$7,000,000	$216,000,000
Total Annualized Damages				$6,250,000

The benefit is defined as the avoided physical damages after project compared to that of existing conditions. Subtracting the total annualized damages of existing conditions from the total annualized damages after implementing the preferred alternative, the total annual benefit equals approximately $0.93 million. Before calculating BCR, the expected annual benefit must be converted to present value dollars. Using the current Water Resources Institute discount rate of 4 $^{7/8}$ percent and a project life of 50 years, the present value of $0.93 million equals **$17.3 million**.

The estimated cost for the preferred storage basin alternatives was approximately $38.6 million plus $0.56 million operation and maintenance for a total project cost of **$39.2 million**. In summary, a BCR value of 1.0 or above is desirable to justify the economic feasibility of constructing large-scale improvement projects. For this Study a preliminary BCR value of **0.44** was estimated based solely on physical damages. Typically, if the BCR ratio is above 0.75 when only assuming physical damages, then the BCR will exceed 1.0 when the other three categories (loss of function, emergency management, and casualties) are factored into the calculations. Therefore, at this conceptual stage of the project formulation process, **the preferred alternative does not appear to be economically viable**.

However, the proposed storage basins along Oak Creek may be a viable project when considering the local flood benefits along Oak Creek and the desire by the airport to update the existing levees to FEMA standards. A more detailed analysis of this combined benefit would need to be evaluated which was beyond the scope of this study.

Section 1
Introduction and Purpose

1.1 Introduction

The City of Lincoln, Nebraska (City), the Lower Platte South Natural Resources District (NRD), and United States Army Corps of Engineers (USACE) have been working together for the past several decades to provide flood protection for residents that live near the Salt Creek channel. The first major flood control effort began with the USACE Salt Valley Flood Control Project (1960s), which included 10 flood control dams and a levee system. Following the completion of these improvements, numerous planning efforts have been completed, including the USACE 205 and 216 studies, to identify additional feasible flood control improvements to increase the level of flood protection for area residents.

The USACE 205 study identified two technically feasible locations for constructing flood storage areas that would provide measurable flood control benefits, including an area along Oak Creek adjacent to the Lincoln airport, and the other location along Middle Creek between SW 27th and SW 40th Streets. In addition, the USACE 216 study results showed that the meanders and vegetation within Wilderness Park provide valuable flood control benefits and should be preserved.

With the recent completion of the Salt Creek DFIRM Update project, a state-of-the-practice hydrologic and hydraulic computer model is now available to further evaluate the feasibility of constructing additional flood control projects. The updated FEMA DFIRM identified over 5,600 habitable buildings within the Salt Creek floodplain between Saltillo Road and 98th Street. Therefore, the purpose of this project is to simulate the two storage area facilities as previously identified by USACE, and locations near Wilderness Park, using the latest computer model to better quantify the flood control benefits of these facilities. In addition, the functionality of each storage facility will be further evaluated based on the existing site characteristics, multi-use features, construction constraints, and input received during the public participation process.

There were two primary goals for the study. The first was to evaluate the potential impact that proposed offline storage would have on flood depths along Salt Creek. For the study, three locations with high suitability for offline storage were identified and evaluated. These sites were located in Wilderness Park, Middle Creek, and Oak Creek, as shown in Figure 1-1. The second goal was to evaluate the storage benefit of Wilderness Park under existing conditions using the Salt Creek DFIRM update model.

The project team was lead by the City and NRD. The City and NRD retained the consultant team of Camp Dresser & McKee Inc. (CDM), in association with Heartland Center for Leadership Development (HC) and Kirkham Michael Consulting Engineers (KM).

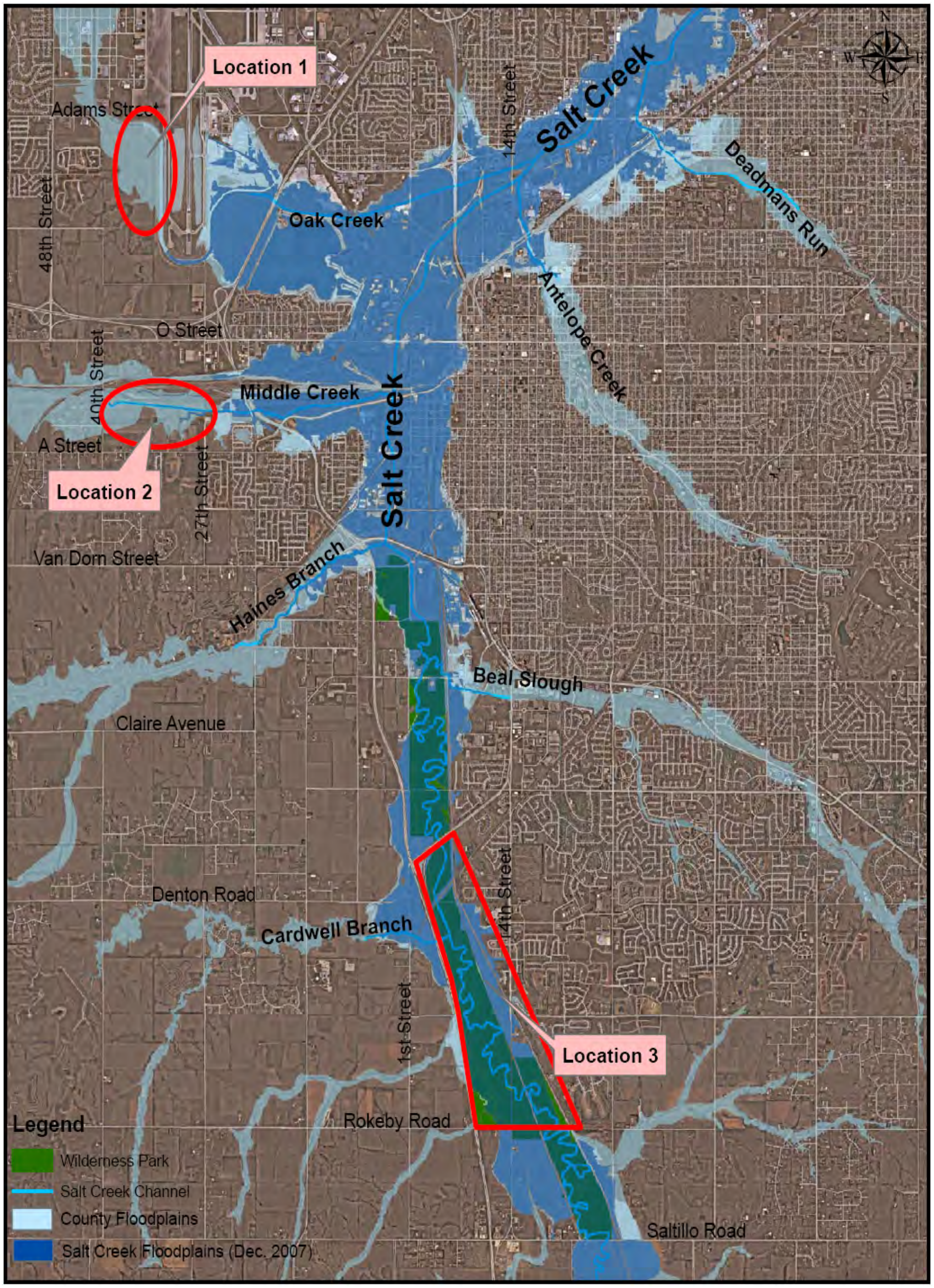


Figure 1-1 Locations for Flood Control Storage Areas

1.1.1 Salt Creek

Salt Creek flows north into Lincoln at Saltillo Road through Wilderness Park combining with Cardwell Branch, Beal Slough, Haines Branch, Middle Creek, and Oak Creek tributaries, as shown in Figure 1-2. Downstream from Oak Creek additional tributaries join Salt Creek including Antelope Creek, Deadmans Run, Little Salt Creek, and Stevens Creek. Salt Creek drainage area is significant; increasing from approximately 200 square miles at Saltillo Road to over 800 square miles after the confluence with Stevens Creek. As shown in Figure 1-2, the largest drainage areas to Salt Creek downstream of Saltillo Road are Middle Creek and Oak Creek. Previous studies had indicated that locations on Middle and Oak Creek were feasible for offline flood storage.

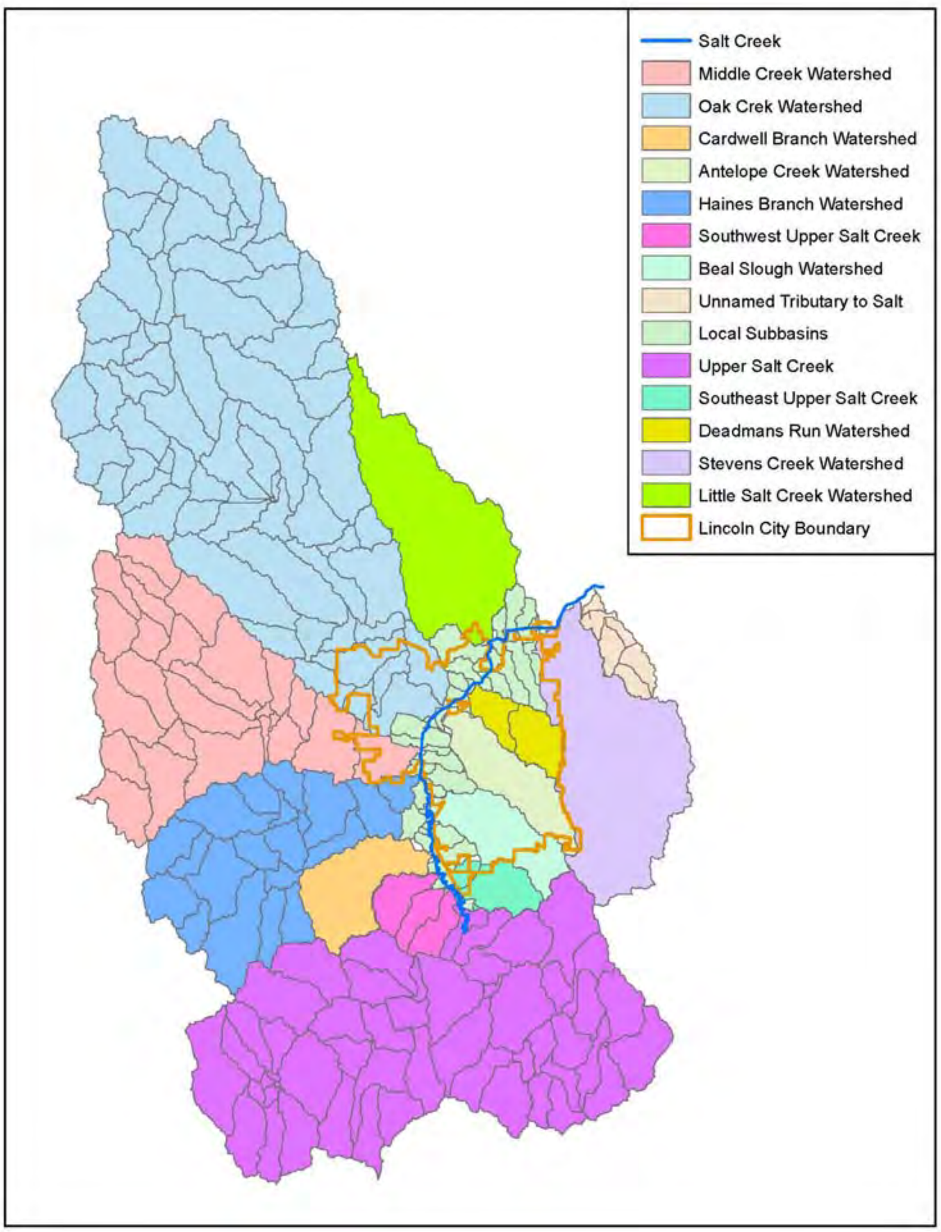


Figure 1-2 Salt Creek Watersheds

1.1.2 Oak Creek

The Oak Creek watershed is approximately 258 square miles, and is comprised of mostly rural, undeveloped land. Oak Creek drains southeast to Salt Creek. The most significant flood control structure in the Oak Creek watershed is Branched Oak Lake, which collects stormwater runoff from the western portion of the watershed. In addition, there are 26 other federal flood control dams in the watershed. Oak Creek flows south into Lincoln at Fletcher Street through Airpark West, a light industrial area that is owned and operated by the Lincoln Airport Authority, before turning east at the south end of the Lincoln Airport. Oak Creek then passes beneath I-80 and joins Salt Creek just downstream of 14th Street.

At the confluence with Salt Creek, the land is highly urbanized, and the high peak flow in Oak Creek during a large event causes flooding in this area. In addition to flooding due to Oak Creek, the Salt Creek channel conveys significant flow during an event, causing a backwater effect at the confluence. This backwater effect intensifies flooding along Oak Creek near the confluence.

1.1.3 Middle Creek

The Middle Creek watershed is approximately 100 square miles, and is also comprised mostly of rural, undeveloped land. Within the upper half of the Middle Creek Watershed are two USACE flood control structures, Pawnee Lake and Twin Lake. These two lakes collect stormwater runoff from the northern portion of the watershed. The southern portion of the watershed is uncontrolled. Middle Creek drains to the east into Lincoln at SW 40th Street beneath Homestead Expressway and then along the railyard area and Capital Parkway West before joining Salt Creek.

At the confluence with Salt Creek, there is a train yard to the north of the creek and a developed urban residential area to the south. As with Oak Creek, during an event, the backwater effect of Salt Creek combined with the high flow in Middle Creek causes flooding along Middle Creek near the confluence during an event.

1.1.4 Wilderness Park

Another feature of Salt Creek is Wilderness Park that is located adjacent to Salt Creek from Saltillo Road to the confluence with Haines Branch. As shown in Figure 1-3, Wilderness Park is a County owned and City operated park containing native grasses and forested area with a trail system along an old railroad. An active railroad also borders the park area. The park is approximately 1,400 acres with additional open space surrounding the park extent. Previous evaluation had indicated that increasing the overbank storage within Wilderness Park may help reduce flood elevations downstream along Salt Creek.

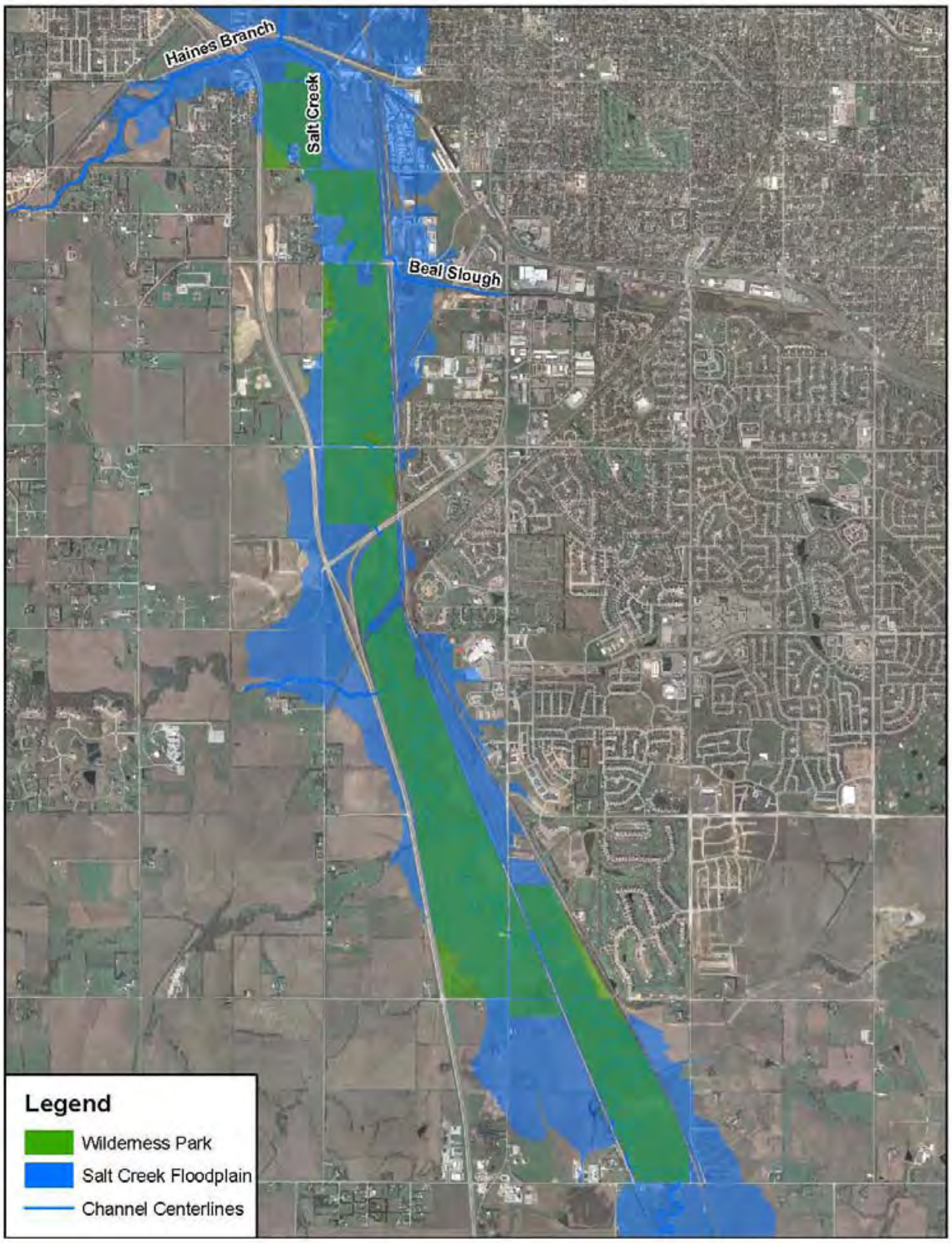


Figure 1-3 Wilderness Park

1.2 Goals and Objectives

The goal of the Study was to evaluate the potential flood benefits of offline storage basins at two previously identified locations along Middle and Oak Creek as well as to estimate the existing overbank flood storage within Wilderness Park. The objective was to demonstrate a greater than one benefit/cost ratio indicating that the flood benefits were greater than the cost of the offline detention basins. Using existing data, previous studies, updated hydrology and hydraulic models of Salt Creek, and established flood benefit procedures for the City of Lincoln, the project team completed the following task objectives.

1.2.1 Existing Data Review

- Review previous studies that evaluated the potential of stormwater detention along Oak Creek, Middle Creek, and Salt Creek.
- Collect and review previously collected field data of the offline storage locations
- Obtain and utilize existing GIS data sets available from the City, NRD, and County
- Utilize latest available Light Detection and Ranging (LiDAR) data to develop a 3-D land surface of study areas.

1.2.2 Hydrology and Hydraulics

- Utilize the recently completed hydrology and hydraulic models developed for the Salt Creek DFIRM project. The modeling program used for the hydrology was the U.S. Army Corps of Engineer's (USACE) Hydrologic Engineering Center's Hydrologic Modeling System program (HEC-HMS) and the hydraulic model used was the USACE Hydrologic Engineering Center's River Analysis System program (HEC-RAS), unsteady simulation.
- Evaluate the existing benefit of overbank flood storage within Wilderness Park using the existing DFIRM update hydraulic model.
- Modify existing hydrologic models used in the Salt Creek DFIRM update to meet Study needs.
- Compared the updated hydraulic model results with the previous Salt Creek DFIRM model.

1.2.3 Storage Area Evaluation

- Evaluated offline storage alternatives using the updated HEC-RAS unsteady model at all three locations.
- Analyzed various storage volumes and control structure configurations for all proposed sites.
- Based on this evaluation determined a preferred storage alternative for reducing flood elevations downstream along Salt Creek.

1.2.4 Conceptual Design of Preferred Alternative

- Develop conceptual-level design of the preferred storage alternative at each proposed site
- Calculate the flood benefit along Salt Creek using the HEC-RAS model and available GIS data layers.

1.2.5 Benefit-Cost Analysis

- Estimate planning-level construction costs of the preferred alternative based on conceptual storage area design.
- Quantify reduction in flooding depths and the associated structural damages for both existing and proposed storage conditions.
- Determine the planning-level benefit-cost ratio using the FEMA Benefit Cost Analysis Toolkit and City of Lincoln depth-damage curves for structural flood damage.

1.2.6 Public Participation (Proposed)

- Property owner meetings for those property owners directly impacted by the proposed storage alternative
- An open house to disseminate information and solicit feedback from the public.
- Project information sheet mailed to approximately 100 individual residents
- News release announcements and additional mailings to inform the public about this project.

1.2.7 Coordination

- Coordination with the Lincoln Airport Authority and Air National Guard base by including them in monthly progress meetings
- Coordination with Nebraska Emergency Management Agency to evaluate the possibility of grant funds that could be applied to this project.

1.3 Public Participation Process

This project originally planned on offering the property owners, citizens, and stakeholders a variety of ways to provide input to the study and to contribute to the development of alternative concepts and solutions. However, since this study resulted in a benefit-cost ratio of less than 0.5 it is not likely that the City will be able to obtain necessary alternative funding to move forward with the proposed offline storage alternatives. Therefore the public involvement process to complete this project is still being considered by the City and NRD. Public participation processes being considered are an information meeting with the property owners, distribution of a one-page factsheet summarizing the study results, or an open house and news release announcement.

Section 2
Previous Studies and Existing Data

2.1 Previous Studies

The following are the previous studies that provided key information for this project. A full list of previous studies reviewed is in Appendix A.

- *Section 205 Feasibility Study Salt Creek, Lincoln, NE: Problem identification Phase Documentation, March 1994.*

- *Section 205 Feasibility Study Salt Creek, Lincoln, NE: Plan Formulation Phase Evaluations of Structural Alternatives Documentation – USACE Omaha District, July 1996.*

  This study evaluated the feasibility of structural alternatives to mitigate flooding on Salt Creek. The alternatives evaluated were offline storage basins at the locations this study evaluated on Middle Creek and the Oak Creek upstream site. This study found a benefit cost ratio of 0.08.

- *Middle Creek and Oak Creek Flood Storage Detention Area Pre-Feasibility Study – HWS Consulting Group Inc, January 1996.*

  This pre-feasibility study evaluated hydrologic issues at the sites identified in the Section 205 Feasibility Study Plan Formulation Phase. Issues studied included geology with respect to groundwater occurrences, location of the water table, and likely water table fluctuations over time as well as the suitability of the existing soils encountered at both sites for use as engineered earth fill. This study recommended further groundwater monitoring to understand seasonal changes in groundwater. It also determined that standing groundwater may be a problem for a basin at the Middle Creek site. In addition, it was determined that some soil types at both sites, after manipulation, are suitable for use as fill material.

- *Salt Creek at Wilderness Park Hydrologic Study – US Army Corps of Engineers, June 1999.*

  This study simulated the effect of various alternatives on peak flows and water surface elevations on Salt Creek through, and downstream of, Wilderness Park. These alternatives included the following changes: stormwater runoff changes, channel modifications, bridge removal/addition, bridge opening reduction, Wilderness Park storage changes, channel confinement, and channel alignment modification. Of particular interest to this study are the results from the channel confinement study. These are compared to this study's analysis of the storage benefits of Wilderness Park as described in Section 3.4 and shown in Appendix B.

- *Geotechnical Engineering Report: Oak Creek Levee Study – HWS Consulting Group Inc, December 2006.*

  This report evaluated the levee on Oak Creek which extends from West Mathis Street to Interstate 80. It determined that the existing levee does not meet minimum requirements for FEMA freeboard requirements of 3 feet. In addition, it determined through subsurface exploration and the analysis of subsurface materials that the stability of the levee is adequate under base flood conditions both before and after an event. However, dispersive soils were found, which were recommended to be addressed to improve the levee system.

2.2 Watershed Inventory

The project team collected and reviewed applicable information from several sources. A list of the existing information collected during the study included:

- Existing land use and street network
- Existing floodway and flood fringe boundaries
- Existing hydrologic and hydraulic models
- Land ownership information
- Stream gage and precipitation data
- As-built plans for drainage structures/bridges
- City of Lincoln Flood Insurance Study
- Color aerial photography
- U. S. Geological Survey LiDAR data (non-bare earth points)
- LOMR submittals within project area
- City Drainage Manual
- Past public involvement correspondence
- Lancaster County soil map

Several new datasets were developed using GIS technology to organize the technical evaluations during the study and are included in Appendix C under GIS datasets. A description of each GIS dataset created during the study is provided below.

- **Potential Offline Storage Locations** - This dataset includes a polygon shapefile identifying offline storage locations

- **Proposed Contours** - These datasets include GIS polyline shapefiles showing proposed contours for both offline storage and excess cut spoils locations. These contours were used for to calculate storage volume in the offline basins and cut and fill calculations and for the benefit-cost analysis.

- **Hydrologic Evaluation** - These datasets include the HEC-HMS model input files used during the hydrologic evaluation process. The files include time of concentration flow paths, subbasins, detention ponds, merged land-use and soils curve number files, and location of divergence nodes.

- **Hydraulic Information** - These datasets relate to the hydraulic model output and include the stream centerlines and the cross sections from the hydraulic models.

- **Benefit-Cost Analysis** - These datasets were used to develop the benefit-cost analysis described in Section 6. Shapefiles include structures impacted by the existing conditions floodplain as well as those impacted by the recommended storage alternative (Section 7). Also included are the depth grids used in the estimation of damages and a comparison of existing conditions flooding depths versus flooding depths with proposed offline detention basins for the 100-year event.

- **Fieldwork Photographs** - This dataset includes location of photographs taken throughout the project sites with a reference to the photo identification number.

2.2.1 Electronic Files

The electronic files associated with the study have been organized according to the following folder structure:

- Study Report and Appendix Information
- Field Photographs
- GIS Datasets (as described above; can be accessed using ArcGIS)
- Hydrologic and Hydraulic Models

2.3 Drainage Structures

All drainage structure information required to refine the Salt Creek DFIRM model for this study was obtained from as-built surveys provided by the City, NRD, and the LAA. Table 2-1 lists the structure location, source of information, and description of the structure. No field survey data was collected for this study.

Table 2-1 Structure Data Information

Structure Location	Source of Information	Description
West Mathis Street	As-builts from LAA	West Mathis Street Crossing over Oak Creek
South of Lincoln Airport	As-builts from LAA	Located on airport property, bridge crossing over Oak Creek that is not accessible to the public
I-80	As-builts from the City	I-80 bridge crossing over Oak Creek
1st Street	As-builts from the City	1st Street bridge crossing over Oak Creek
I-180	As-builts from the City	I-180 bridge crossing over Oak Creek
10th Street	Salt Creek DFIRM Update Model	10th Street bridge crossing over Oak Creek
14th Street	Salt Creek DFIRM Update Model	14th Street bridge crossing over Oak Creek
Homestead Expressway	As-builts from the City	Homestead Expressway bridge crossing over Middle Creek

- **Bridges** - The types of information needed for each bridge included a stream cross section to define the upstream face of the bridge opening, centerline profile of the bridge decking, low chord elevation of the bridge, physical characteristics of the support system, and piers. The upstream cross-section representing the bridge opening was obtained from the LiDAR contour data and supplemented with record drawings. All other information for the 8 bridges was obtained from available record drawings or was taken from the Salt Creek DFIRM HEC-RAS model.

- **Detention Facilities** – Two upstream detention facilities located in two subareas along Middle Creek were evaluated during the hydrologic analysis. However these two facilities were not included in the hydrologic analysis because they lack sufficient size to have an impact on the overall results and there was not any available information on the control structure for either of these facilities.

2.4 Base Mapping

The base map used for the hydrologic and hydraulic model and floodplain mapping was created using ArcInfo technology by converting the City's 2003 bare earth LiDAR data into a triangular irregular network (TIN). The TIN is a three-dimensional representation of the ground topography. The 2003 LiDAR data are the most recent information and were assumed to represent existing conditions. The creation of the hydrologic and hydraulic models is discussed in greater detail in Section 3.

The quality control results, which evaluated the accuracy of the LiDAR TIN, were evaluated as part of a separate project, Salt Creek DFIRM project completed by CDM in December 2007. In summary, the quality control analysis indicated that the data met the National Mapping Accuracy Standards criteria for vertical accuracy as a function of horizontal accuracy, as required in *Appendix A of the FEMA Guidelines and Specifications for Flood Hazard Mapping Partners*. Therefore, the LiDAR data were used for the hydraulic evaluation and mapping process.

2.5 Salt Creek DFIRM Update

The Salt Creek DFIRM project included the development of hydrologic and hydraulic computer models using HEC-HMS 2.2.2 and HEC-RAS 3.1.3, respectively. For the hydraulic modeling, the unsteady option in HEC-RAS was used. For this project, these models were used as a tool to model offline storage at the previously identified locations. Updates to the hydrologic and hydraulic models, as described in Section 3, were completed to more accurately represent the effects of offline storage.

2.6 Groundwater Data Evaluation

Available groundwater data for the Middle and Oak Creek sites were reviewed and evaluated by the project team. The data included two separate groundwater table monitoring efforts. The first measured depth to groundwater on a monthly basis. It spanned from March 1996 to May 2000, with a data gap from May 1998 to May 1999. For this effort, 3 wells were located at the Oak Creek proposed storage site, and 4 were located at the Middle Creek proposed storage site. These are shown in Figures 2-1 and 2-2.

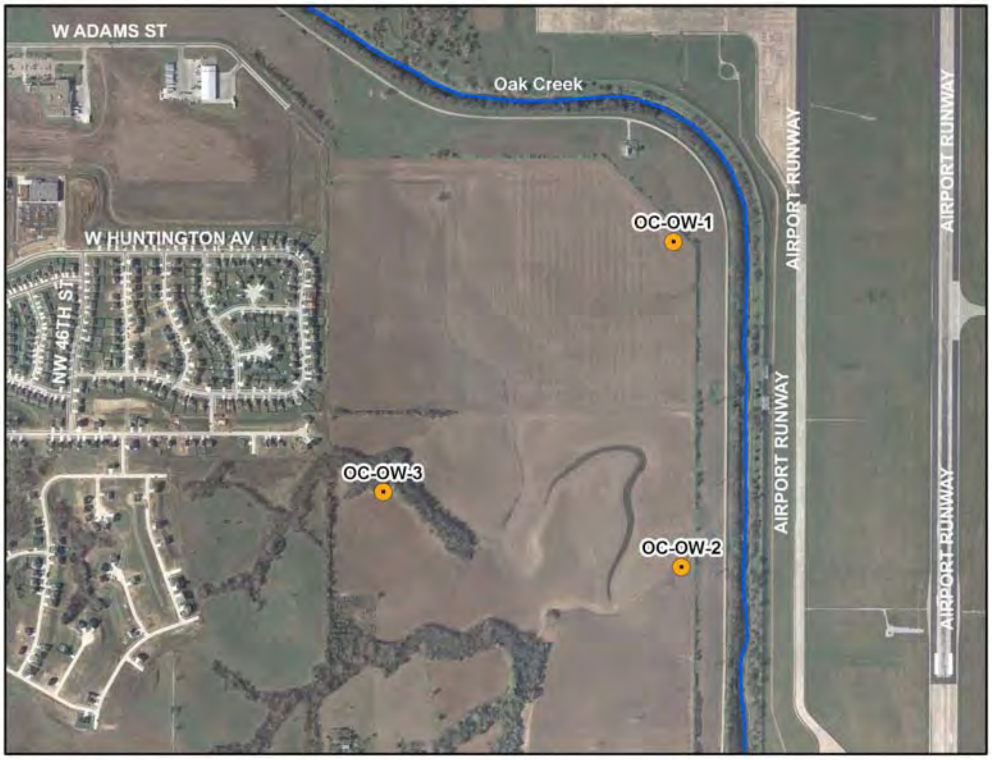


Figure 2-1 Oak Creek Well Monitoring Locations (Monitoring Period 1)

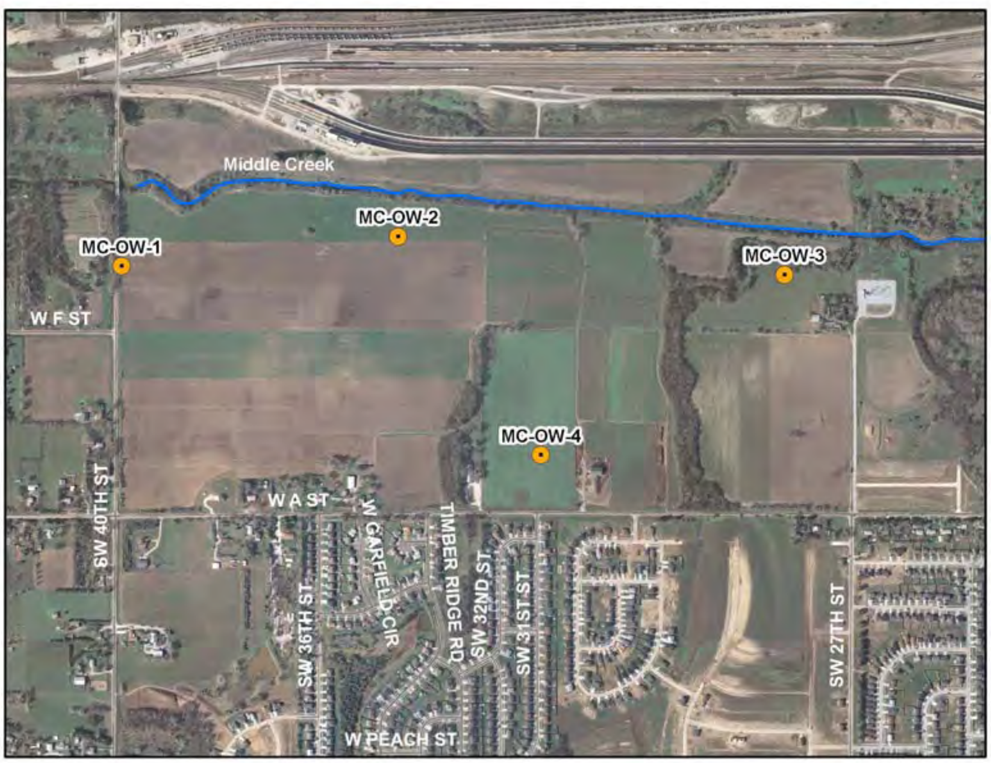


Figure 2-2 Middle Creek Well Monitoring Locations (Monitoring Period 1)

The second monitoring effort was conducted from April 1999 to April 2000. Depth to groundwater was measured in the spring of 1999, the fall of 1999, and spring of 2000. For this effort, 4 wells were located at the Middle Creek proposed storage site. These are shown in Figure 2-3.

Figure 2-3 Middle Creek Well Monitoring Locations (Monitoring Period 2)

In general, the groundwater data indicated that groundwater levels vary throughout the year depending on the amount of rainfall. The first monitoring effort indicated that at the Middle Creek site, the depth to groundwater varied from 1,147 feet to 1,152 feet with an average of 1,150 feet. At the Oak Creek site, similar results were found with the depth to groundwater varied from 1,141 feet to 1,161 feet with an average of 1,148 feet.

The complete analysis of the groundwater data is provided in Appendix D.

2.7 Stream Baseflow

The average monthly stream baseflow was calculated using USGS stream gage data for the gages located on Salt Creek at Pioneers Boulevard (Gage #06803080); Middle Creek at Southwest 40th Street (Gage #06803170); and Oak Creek at Air Park Road (Gage #06803486). These values are listed in Table 2-2. The maximum average stage values were used to establish the offline storage basin bottom elevations in the design of offline storage. Using the stage data in Table 2-2 and LiDAR data the bottom elevations were determined to be 1,146 feet at Middle Creek and 1,140 feet for both sites on Oak Creek.

Table 2-2 Average Monthly Stream Baseflow Values

Salt Creek at Pioneers Boulevard		Middle Creek at Southwest 40th Street		Oak Creek at Air Park Road	
Month	**Average Stage, ft**	**Month**	**Average Stage, ft**	**Month**	**Average Stage, ft**
January	4.1	January	1.3	January	0.9
February	4.2	February	1.4	February	1.0
March	4.3	March	1.4	March	0.9
April	4.5	April	1.4	April	0.9
May	5.5	May	1.8	May	1.1
June	5.0	June	1.7	June	1.0
July	4.2	July	1.3	July	0.7
August	4.0	August	1.2	August	0.9
September	4.0	September	1.2	September	0.8
October	4.0	October	1.2	October	0.9
November	4.1	November	1.3	November	0.9
December	4.1	December	1.3	December	0.9
Yearly Average	4.3	Yearly Average	1.4	Yearly Average	0.9

Maximum Average Monthly Stage shown in shaded cells

2.8 Airport Issues

Lincoln Municipal Airport has and will continue to receive federal funds, which means that they are obligated by grant assurance to identify and mitigate potential hazards to navigable airspace at the airport. Further, it is prudent for the Authority to protect the airspace around the airport to prevent loss of existing approaches or other negative impacts affecting utilization of the airport.

Under FAA guidelines the following shall be completed should the design be carried forward to a preliminary design phase. This would include any and all improvements.

- Coordinate preliminary designs with Lincoln Airport Authority staff for local requirements.
- 7460 forms must be filed during the preliminary design following AC 70/7460-2K. This will give all Departments at FAA Central Region an opportunity to review the proposed improvements.
- Coordinate with AC 150/5200-33 Hazardous Wildlife Attractions on or near Airports and the local wildlife control programs.

Section 3
Hydrology and Hydraulics

3.1 Introduction

This section summarizes the methodology used to modify the hydrologic and hydraulic models used for this study. The models used for this study were developed by modifying previously completed models of Salt Creek. The following sections summarize the modifications made to the existing models.

3.2 Hydrology

Hydrologic modeling was performed using the U. S. Army Corps of Engineer's (USACE) Hydrologic Engineering Center's Hydrologic Modeling System program (HEC-HMS) Version 2.2.2. Existing HEC-HMS models for each major subwatershed that drains into Salt Creek between Saltillo Road and downstream of North 98th Street were updated for this study.

3.2.1 Subarea Modification

Modifications to the existing hydrologic models were completed for this study to more fully understand local drainage at the offline storage sites. This effort consisted of modifying the subarea delineation and updating subarea hydrologic parameters in a manner consistent with the methodology used previously to model Salt Creek. Subarea delineations completed for the Oak Creek and Middle Creek models are shown in Table 3-1 and Figure 3-1.

Table 3-1 Subarea Updates

	DFIRM Subarea	Split into:
Oak Creek	R3320W3320	OAK-N1
		OAK-S1
		OAK-S2
		OAK-S2a
Middle Creek	R3590W3590	MID-TO SALT[1]
		MID-S1
		MID-S2
		MID-S3
		MID-S4
		MID-S5

[1]Subarea "MID-TO SALT" was loaded directly onto Salt Creek

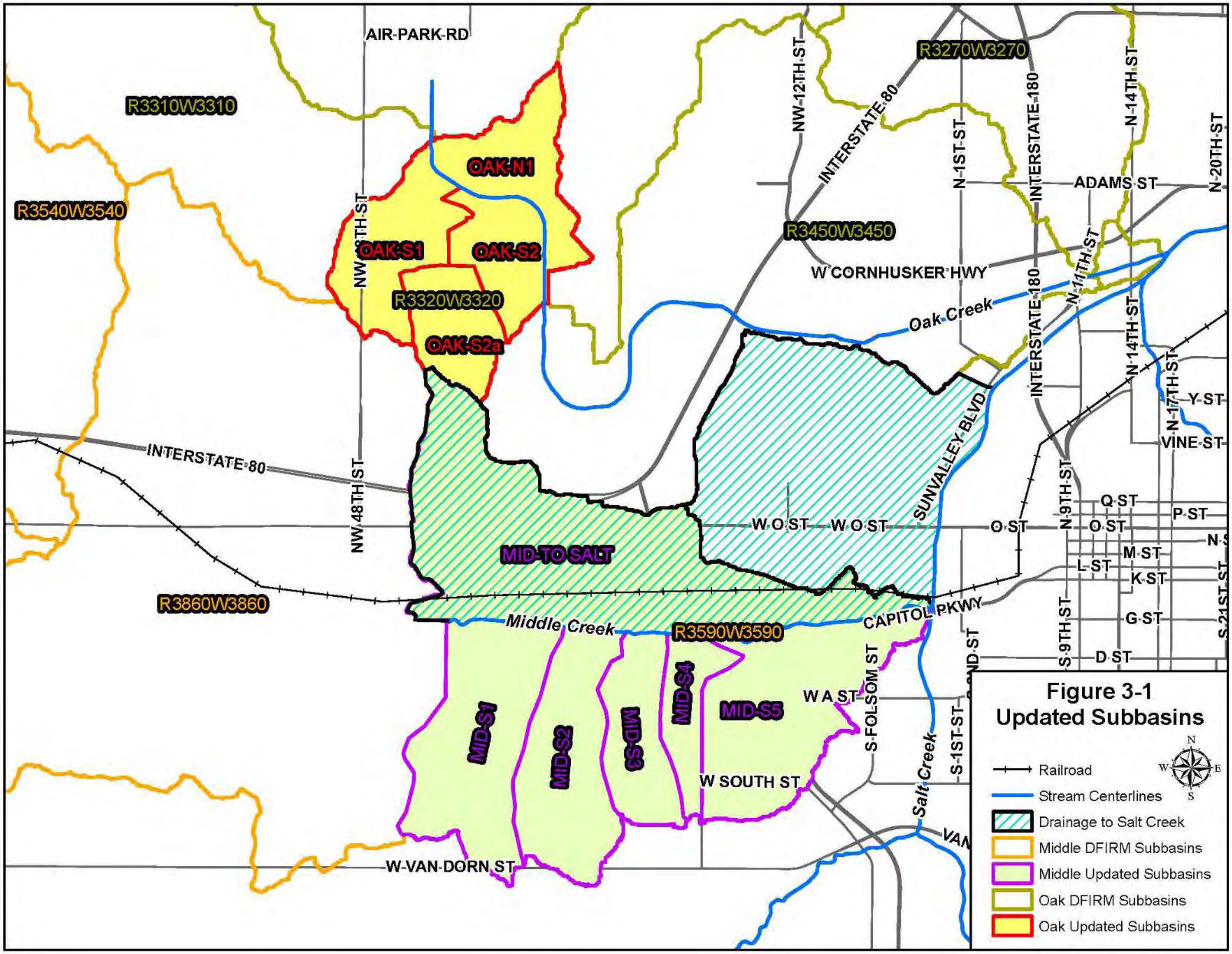


Figure 3-1
Updated Subbasins
Railroad
Stream Centerlines
Drainage to Salt Creek
Middle DFIRM Subbasins
Middle Updated Subbasins
Oak DFIRM Subbasins
Oak Updated Subbasins
AIR PARK RD
R3310W3310
R3540W3540
R3270W3270
R3450W3450
R3320W3320
R3860W3860
R3590W3590
OAK-N1
OAK-S1
OAK-S2
OAK-S2a
MID-TO SALT
MID-S1
MID-S2
MID-S3
MID-S4
MID-S5
INTERSTATE 80
INTERSTATE 180
NW 48TH ST
NW 12TH ST
N 1ST ST
N 14TH ST
N 20TH ST
ADAMS ST
W CORNHUSKER HWY
Oak Creek
Middle Creek
Salt Creek
SUNVALLEY BLVD
W O ST
O ST
P ST
Q ST
M ST
L ST
K ST
G ST
D ST
Y ST
VINE ST
N 9TH ST
S 9TH ST
N 17TH ST
CAPITOL PKWY
W A ST
S FOLSOM ST
S 1ST ST
W SOUTH ST
W VAN DORN ST

3.2.2 Rainfall

The HEC-HMS models were used to simulate the runoff volumes and hydrographs resulting from 10-, 50-, 100-, and 500-year return period events. Precipitation depth quantiles used previously were used for this project as well. The precipitation depths were originally derived from TP-40, and depths not included in TP-40 were extrapolated from the available TP-40 depths. The HEC-HMS "frequency storm" option was employed for distributing the rainfall and reducing point rainfalls to reflect the watershed area. The rainfall input is listed in Table 3-2. The non-shaded data was taken from TP-40, while the shaded data was extrapolated. Duration extrapolations were performed by constructing a linear form between the precipitation depth and the log of duration. Extrapolations to the 500-year storm were conducted using the Gumbel distribution.

Table 3-2 HEC-HMS Precipitation Input

Duration	Storm depths in inches			
(hours)	10-year	50-year	100-year	500-year
0.08	0.72	0.94	1.05	1.31
0.25	1.40	1.84	2.04	2.54
0.50	1.95	2.55	2.83	3.53
1	2.50	3.27	3.63	4.34
2	2.87	3.75	4.25	5.04
3	3.13	4.00	4.50	5.41
6	3.50	4.75	5.25	6.33
12	4.17	5.33	6.00	7.16
24	4.67	6.00	6.67	8.05
48	5.08	6.55	7.31	8.81
96	5.56	7.16	7.98	9.62

In the HEC-HMS input, a central (50 percent) rainfall peak similar to SCS Type II was used. For this study, no changes in the precipitation input data were made.

3.2.3 Runoff Volume (SCS CN)

The same runoff volume method used for the Salt Creek DFIRM model, the SCS Curve Numbers Loss Rate, was used for this study to generate runoff volumes for new subareas. The SCS option uses an initial abstraction value and composite curve number (CN) to estimate runoff volumes from each subarea for a particular design rainfall event.

Initial abstraction is defined as losses from rainfall before runoff begins. Initial abstraction is a function of the composite CN and is commonly calculated using Equation 1.

$$Ia = 0.2(1000/CN - 10) \qquad \text{Equation 1}$$

The CN is a function of the land use condition and hydrologic soil group (HSG). For each new subarea developed for this study, a new composite CN was developed. These are shown in Table 3-3.

Table 3-3 Curve Numbers for New Subareas

	Subarea	Previous Composite Curve Number	Subarea	Area (square miles)	Curve Number
Oak Creek	R3320W3320	76.5	N1	0.43	88.4
			S1	0.49	80.7
			S2	0.33	80.0
			S2a	0.33	77.1
Middle Creek	R3590W3590	83.5	TO SALT	1.89	87.5
			S1	0.86	78.7
			S2	0.67	77.2
			S3	0.40	85.5
			S4	0.25	88.7
			S5	0.93	90.2

3.2.4 Existing Land Use

The existing land use conditions for Lancaster County were supplied by the City of Lincoln. The land use data were used to determine a CN using the values in the *Drainage Criteria Manual* as a guideline. Table 3-4 shows the land use categories and the assigned CN. Several land use categories did not correspond directly with CN cover types located in the *Drainage Criteria Manual*. CNs for these land uses were assigned by determining an average percent impervious and calculating a composite CN.

As shown in Table 3-4, all agricultural land use was designated a cover description of contour/crop residue in good hydrologic condition. Streams/Creeks, lakes, and wetlands were given a CN of 98. Land uses that did not correspond directly with a cover type were assigned a CN based on approximate average percent impervious and generally accepted engineering practices.

Table 3-4 Curve Numbers for Salt Creek Watershed Study

Lincoln/Lancaster County Land Use	Cover Type (Percent Impervious)	Hydrologic Soil Group A	B	C	D
Agricultural Production: Crops/Tree Farm	Row Crops – Straight Row Good Condition	67	78	85	89
Airport	Compacted Soil	72	82	87	89
Apartments (w/number of units)	Residential 1/8 acre or less (65%)	77*	85*	90*	92*
Attached Single Family (Townhouses)	Residential 1/8 acre or less (65%)	77	85	90	92
Church, Synagogue, or Temple	Churches/Schools (75%)	84*	89*	92*	94*
Commercial NEC	Commercial and business (85%)	89	92	94	95
Duplex	Residential 1/8 acre or less (65%)	77*	85*	90*	92*
Educational Institution	Churches/Schools (75%)	84*	89*	92*	94*
Forest/Woodland	Woods - Fair Condition	36	60	73	79
Golf Course	Open Space - Good Condition	39	61	74	80
Heavy Industrial	Industrial (72%)	81	88	91	93
Lake	Water	98	98	98	98
Light Industrial	Industrial (72%)	81	88	91	93
Mobile Home including parks, courts (w/number of unit)	Residential 1/8 acre or less (65%)	77*	85*	90*	92*
Open Space	Open Space - Fair Condition	49	69	79	84
Park Land	Open Space - Fair Condition	49	69	79	84
Parking Lot (PL)/Street	Impervious (100%)	98	98	98	98
Pasture/Grassland	Pasture - Fair Condition	49	69	79	84
Public & Semi-Public NEC (e.g., cemetery)	Open Space - Fair Condition	49	69	79	84
Railroad	Gravel Covered Surface	76	85	89	91
Single Family (detached)**	Residential 1/3 acre (30%)	57	72	81	86
Stream/Creek	Water	98	98	98	98
Utility Facility (e.g., communication tower)	Commercial and business (85%)	89	92	94	95
VACANT (UNDEVELOPED) LAND	Open Space - Fair Condition	49	69	79	84
Vacated ROW (retained by public entity)	Open Space - Fair Condition	49	69	79	84
Wetland	Water	98	98	98	98

CN was assigned based on average 1/3-acre lot size.
* CN may be adjusted based on actual percent impervious versus reported standard percent impervious
**Single Family (detached) land use includes large and small lots.

The single family (detached) category includes residential lots of varying sizes; however, the *Drainage Criteria Manual* CN tables have lot sizes broken into 1/8 acre, 1/4 acre, 1/3 acre, 1/2 acre, 1 acre, and 2 acres. Single family (detached) land use was assigned to the 1/3 acre average lot size.

3.2.5 Hydrologic Soil Groups (HSG)

HSGs by soil types were determined from the Nebraska DNR Spatial GIS database website. The HSG was used to assign an appropriate CN for each subarea. Table 3-5 shows the soil types and their associated HSG for soils within the Salt Creek watershed.

Table 3-5 Hydrologic Soil Groups

Soil Type	HSG	Soil Type	HSG	Soil Type	HSG	Soil Type	HSG
Aksarben	B	Fillmore	D	Nodaway	B	Urban Land	D
Burchard	B	Geary	B	Pawnee	D	Wabash	D
Butler	D	Judson	B	Salmo	C/D	Water	D
Colo	B/D	Kennebec	B	Sharpsburg	B	Wymore	D
Crete	C	Mayberry	D	Shelby	B	Yutan	B
Crete Variant	D	Morrill	B	Steinauer	B	Zook	C/D

3.2.6 Runoff Hydrographs (Lag Time)

The SCS Dimensionless Unit Hydrograph was used to distribute the runoff volume to a unit hydrograph. The determination of an SCS lag time was required for this method. Consistent with the methodology of the SCS's *Technical Release-55 Urban Hydrology for Small Watersheds* published June 1986, the lag time for a subarea was assumed to equal 0.6 times the time of concentration. The time of concentration, in turn, was defined as the time required for water to travel to the subarea outlet from the most hydraulically distant point in the subarea. The updated lag times used for the new subareas are provided in Table 3-6.

Table 3-6 New Subarea Lag Times

	Subarea	Lag Time (min)
Oak Creek	OAK-N1	33.9
	OAK-S1	15.0
	OAK-S2	21.3
	OAK-S2a	8.0
Middle Creek	MID-TO SALT	36.5
	MID-S1	20
	MID-S2	21.8
	MID-S3	20.7
	MID-S4	25.6
	MID-S5	16.5

The time of concentration for each subarea was calculated using the methodology outlined in TR-55 (SCS 1986). For each subarea, the longest flow path to the subarea outlet was determined using a digital elevation model (DEM) developed from the LiDAR data and ArcView/ArcInfo tools that divided the flow path into four elements:

- Sheet flow
- Shallow concentrated flow
- Secondary channel
- Primary channel

The travel times associated with each of the four elements were added to calculate the time of concentration for each subarea. The methodology described below was used to evaluate existing conditions in the flow elements for each new subarea.

3.2.7 Sheet Flow

Sheet flow was assumed to occur at the most hydraulically distant portion of the flow path. TR-55 recommends a maximum sheet flow length of 300 feet, and best professional judgment indicates that a length more than 100 feet may not be appropriate for some subareas. Consequently, a subarea sheet flow length of 100 feet was used for this study.

Physical data were required to calculate the travel time associated with sheet flow using the TR-55 methodology, including flow length, slope, and overland flow roughness coefficient. An overland flow roughness value was estimated using typical literature values for each surface condition. The surface condition was determined from the aerial photos. Table 3-7 (from TR-55) shows Manning's n values for sheet flow for various surface conditions.

Table 3-7 Roughness Coefficients (Manning's n) for Sheet Flow

Surface Description	n
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils: Residue cover #20 percent Residue cover >20 percent	 0.06 0.17
Grass: Short grass prairie Dense grasses Bermuda grass	 0.15 0.24 0.41
Range (natural)	0.13
Woods: Light underbrush Dense underbrush	 0.40 0.80

3.2.8 Shallow Concentrated Flow

Shallow concentrated flow occurs between the areas of sheet flow and open channel flow. To find shallow concentrated flow length, ArcMap was used to connect the end of sheet flow to the beginning of a defined value, as indicated by 2-foot contours. To calculate the travel time associated with shallow concentrated flow by the TR-55 methodology, physical data including the shallow concentrated flow length, slope, and surface conditions along the path were required. The average velocity was determined using Equation 2.

$$\text{Unpaved } v = 16.1345\,(s)^{0.5} \qquad \text{Equation 2}$$

The travel time for the shallow concentrated flow was calculated based on the segment length and velocity.

3.2.9 Secondary Channel Flow and Primary Channel Flow

Secondary and primary channel flow occurs between the end of shallow concentrated flow and the subarea outlet. Secondary channel flow occurs between the end of shallow concentrated flow and the flow path intersection with the primary stream. The primary streams in this project were the main channels of Middle Creek and Oak Creek. Middle Creek and Oak Creek were evaluated with the HEC-RAS model. Depending on location, a subarea may have one or both of these channel flow features. For example, as shown in Figure 3-2, subbasin OAK-S2a has only the secondary stream network associated with it, while OAK-N1 contains both secondary and primary channel flow.

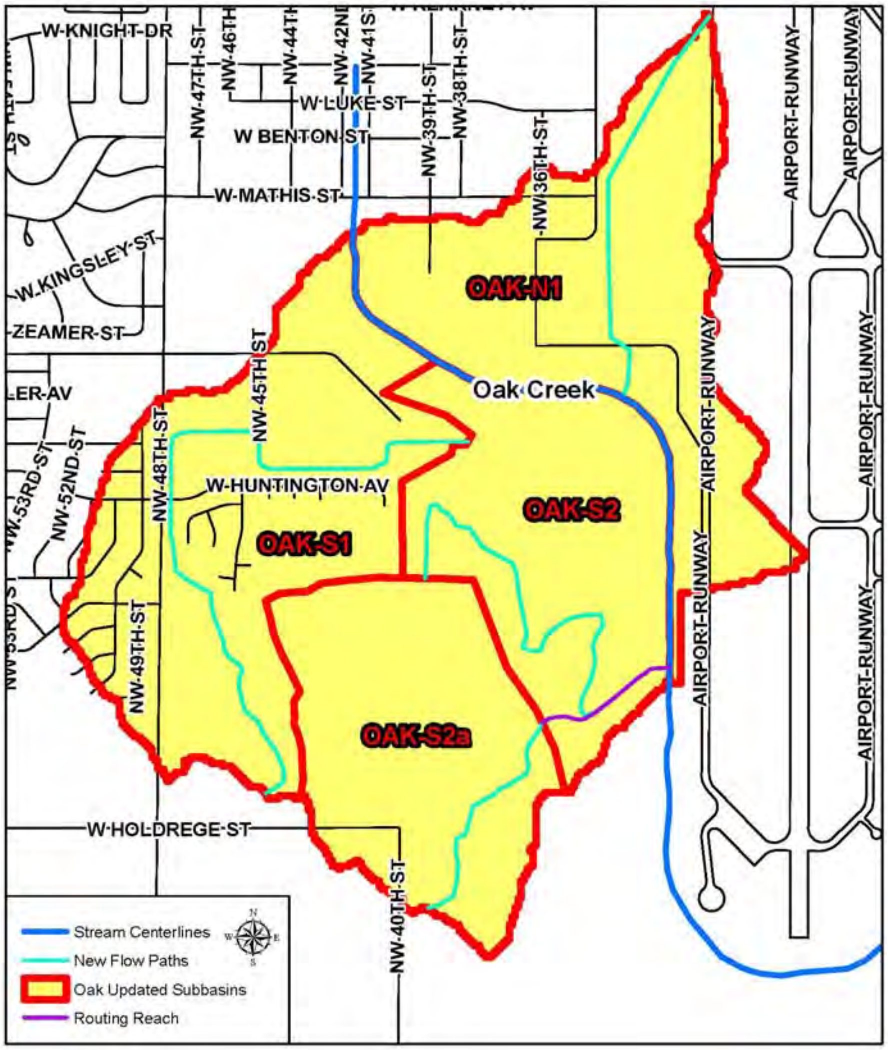


Figure 3-2 Channel Routing Reach

Travel time was calculated based on channel length and velocity for the 2-year storm. The velocity, in turn, was estimated based on channel slope and assumed flow depth and cross-sectional geometry. All of these data were developed in ArcMap. Slope data were calculated using the upstream and downstream elevations and the stream length in GIS. Cross section geometries were assigned based on review of stream geometry data developed by using GIS tools and the DEM.

3.2.10 Routing (Muskingum-Cunge)

The Muskingum-Cunge Routing method was the option used to route runoff through the subareas. Only one new routed reach was added to the model to route flow from OAK-S2a through OAK-S2. A representative trapezoidal channel cross section was developed using available contour data. The channel length and slope was determined using ArcMap and the existing topography TIN. The new routing reach is shown in Figure 3-2 and Muskingum-Cunge Routing parameters are shown in Table 3-8.

Table 3-8 Muskingum-Cunge Routing Parameters

Oak S2 Reach	Value
Reach Length (ft)	1,260
Energy Slope (ft/ft)	0.001
Bottom Width (ft)	40
Side Slope	10:01
Manning's n	0.15

3.2.11 Modeling Results

The updated HEC-HMS model was used to estimate flows for the 10-, 50-, 100-, and 500-year design events. The updated model results were then compared to previous studies. Table 3-9 presents the HEC-HMS modeling results under existing land use conditions, the results are within 5 percent of the flow values estimated during the Salt Creek DFIRM Update Project.

Table 3-9 HEC-HMS Modeling Results

Description	Source	10-Year	50-Year	100-Year	500-Year
Middle Creek					
Confluence with Salt Creek	Study Results	5,746	9,084	10,978	14,752
	Salt Creek DFIRM Update	5,690	9,002	10,890	14,630
Oak Creek					
Confluence with Salt Creek	Study Results	7,807	12,881	15,587	21,336
	Salt Creek DFIRM Update	7,807	12,881	15,587	21,336

The Oak Creek model experienced no change in peak flows because the subarea modified was of an inconsequential size. The Middle Creek subarea which was modified accounted for 5 percent of the total Middle Creek subwatershed area, while the modified Oak Creek subarea comprised only 0.6 percent of the total subwatershed area. Appendix C contains the hydrologic models in electronic format.

3.2.12 HEC-HMS Hydrograph Loading

The outlet hydrographs showing flow from each subarea developed in the HEC-HMS model were recorded to a USACE Hydrologic Engineering Center's Data Storage System (HEC-DSS) database file. This file is readable by HEC-RAS. Specifically, a HEC-RAS unsteady model "reads" hydrographs from the HEC-DSS file and uses it as input into the model. These hydrographs are specified at appropriate load points along the reach in a manner similar to flow loading in steady HEC-RAS. Table 3-10 lists all load points for the new Oak Creek and Middle Creek stream reaches.

The flows associated with a design event in the HEC-HMS model are modeled in an unsteady HEC-RAS simulation run. In addition to modeling the range of flows, the timing of the hydrographs is taken into account. Steady HEC-RAS modeling typically loads peak flows from hydrographs, which makes the assumption that peak flow occurs across all reaches at the same time in the design event. Unsteady HEC-RAS modeling is able to model the time to peak of all loaded hydrographs, and therefore produces more refined results than the steady HEC-RAS option.

Table 3-10 HEC-HMS Hydrograph Load Points for New Oak Creek and Middle Creek Reaches

	HEC-HMS Hydrologic Element	HEC-RAS Cross Section Station
Oak Creek	JR3320	34062.37
	S1	30990.72
	N1	28653.35
	JUNCTION-2	27133.61
	R3420W3420	25828.36
	R3450W3450	13068.5
	R3270W3270	2195.176
	R3390W3390	2185.176
Middle Creek	USERPOINT6	13336.84
	S1	12016.73
	S2	7900.38
	S3	6865.266
	S4	6273.604
	S5	3513.296

3.3 Hydraulics

The open channel hydraulics of Salt Creek and its major tributaries through Lincoln, NE were modeled with HEC-RAS version 3.1.3. The project team started with the unsteady HEC-RAS model of Salt Creek developed by CDM, under a separate contract. This study extended the hydraulic model through the proposed offline storage locations. This effort included updating the HEC-RAS geometry of Middle Creek and the addition of a new hydraulic model for Oak Creek, as shown in Figure 3-3.

This study used the unsteady option as well to be consistent with the previous methodology. An unsteady HEC-RAS model accounts for channel and overbank storage. It can also model offline storage, which made it the tool of choice for this study. As previously described, an unsteady HEC-RAS model “reads” hydrographs directly from the hydrologic HEC-HMS model and uses it as input at appropriate load points along the reach.

3.3.1 Base Map Development

The LiDAR data collected in November 2003 by USGS for the Salt Creek DFIRM update was used in this project. Two new TINs were created to supplement the existing TINS from the Salt Creek DFIRM update. The TIN is a three-dimensional representation of the ground topography that was used to automate the development of input data for the hydraulic computer models. The TIN was also used in conjunction with other GIS tools to automate the floodplain delineation process.

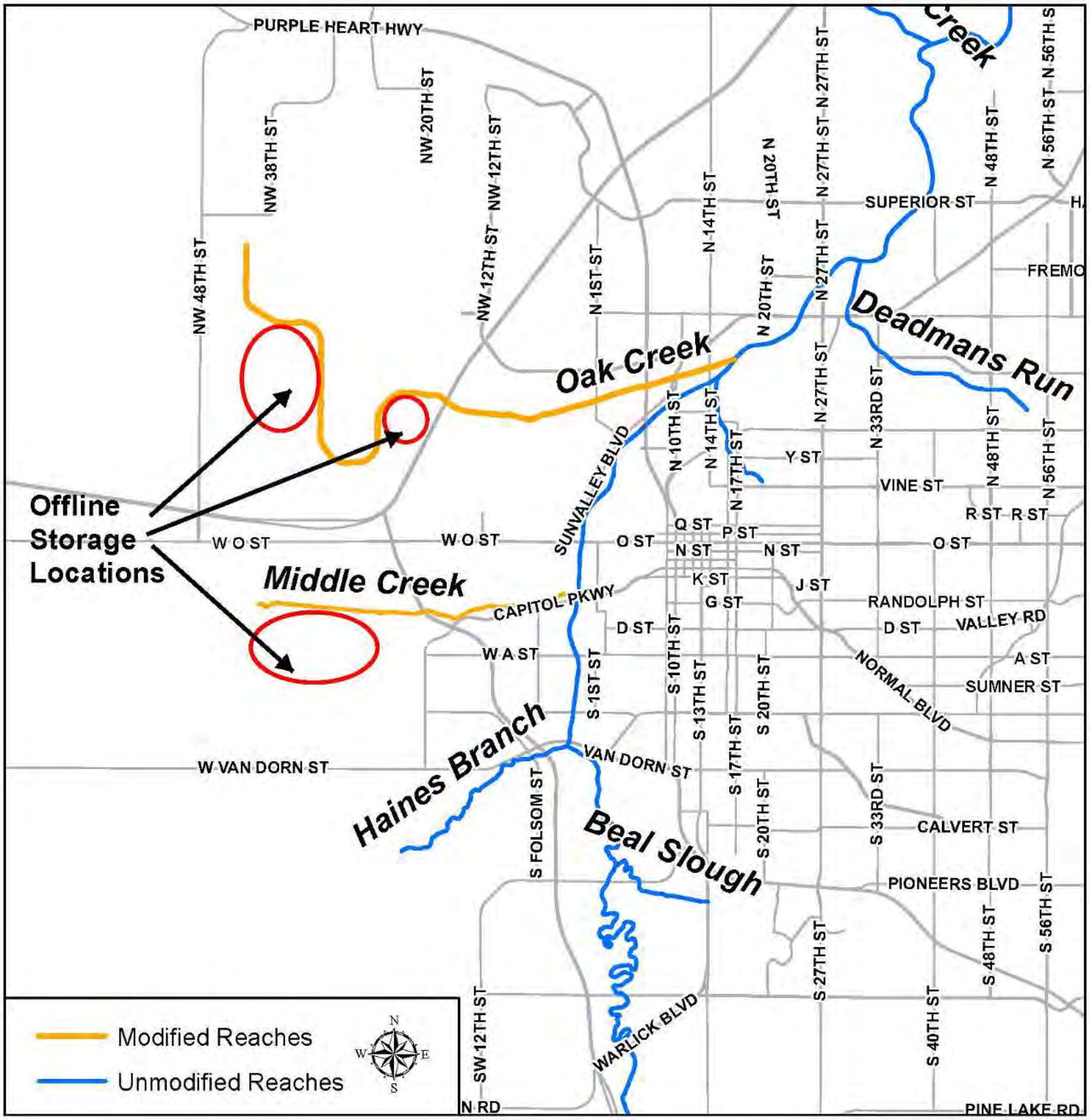


Figure 3-3 Updated HEC-RAS Reaches

3.3.2 HEC-RAS Geometry File Development

The methodology used to create HEC-RAS geometry files for the Salt Creek DFIRM Update project was also utilized to develop geometry files for both Oak Creek and Middle Creek. These geometry files took into special consideration the locations of the potential offline storage areas and because of this, the distance between cross sections was shorter in these locations. Cross section locations were created as a GIS layer that identified the location and extent of each cross section. The cross section layer was generated in ArcMap 9.2 as shown in Figure 3-4 and 3-5. Cross section cut lines were located along the stream centerline at points that represent the average geometry of the stream reach and at changes in geometry, slope, channel, overbank roughness, and discharge. Available aerial photographs and contour information were used to lay out the cross section locations.

The development of cross sections, Manning's "n" values, interpolated cross sections, ineffective areas, and structure input followed the same methodology of the previous studies. This was necessary to produce consistent results and minimize any impact the updates might have on model output.

3.3.2.1 Oak Creek Updates

In the Salt Creek *DFIRM Floodplain Model*, the Oak Creek watershed was modeled only in HEC-HMS (2.2.2) and the outlet hydrograph was loaded at the appropriate station on Salt Creek. However, for this project, a hydraulic model of Oak Creek was created which extended to upstream of Mathis Street. The outlet hydrograph from this model was then loaded to the Salt Creek Model.

The new HEC-RAS reach of Oak Creek, as shown in Figure 3-4, included seven hydraulic structures. The data source for each of these structures is summarized in Table 3-11.

Table 3-11 Oak Creek Structures

Structure Location	Source of Information
West Mathis Street	As-builts from LAA
South of Lincoln Airport	As-builts from LAA
I-80	As-builts from the City
1st Street	As-builts from the City
I-180	As-builts from the City
10th Street	Salt Creek DFIRM Update Model
14th Street	Salt Creek DFIRM Update Model

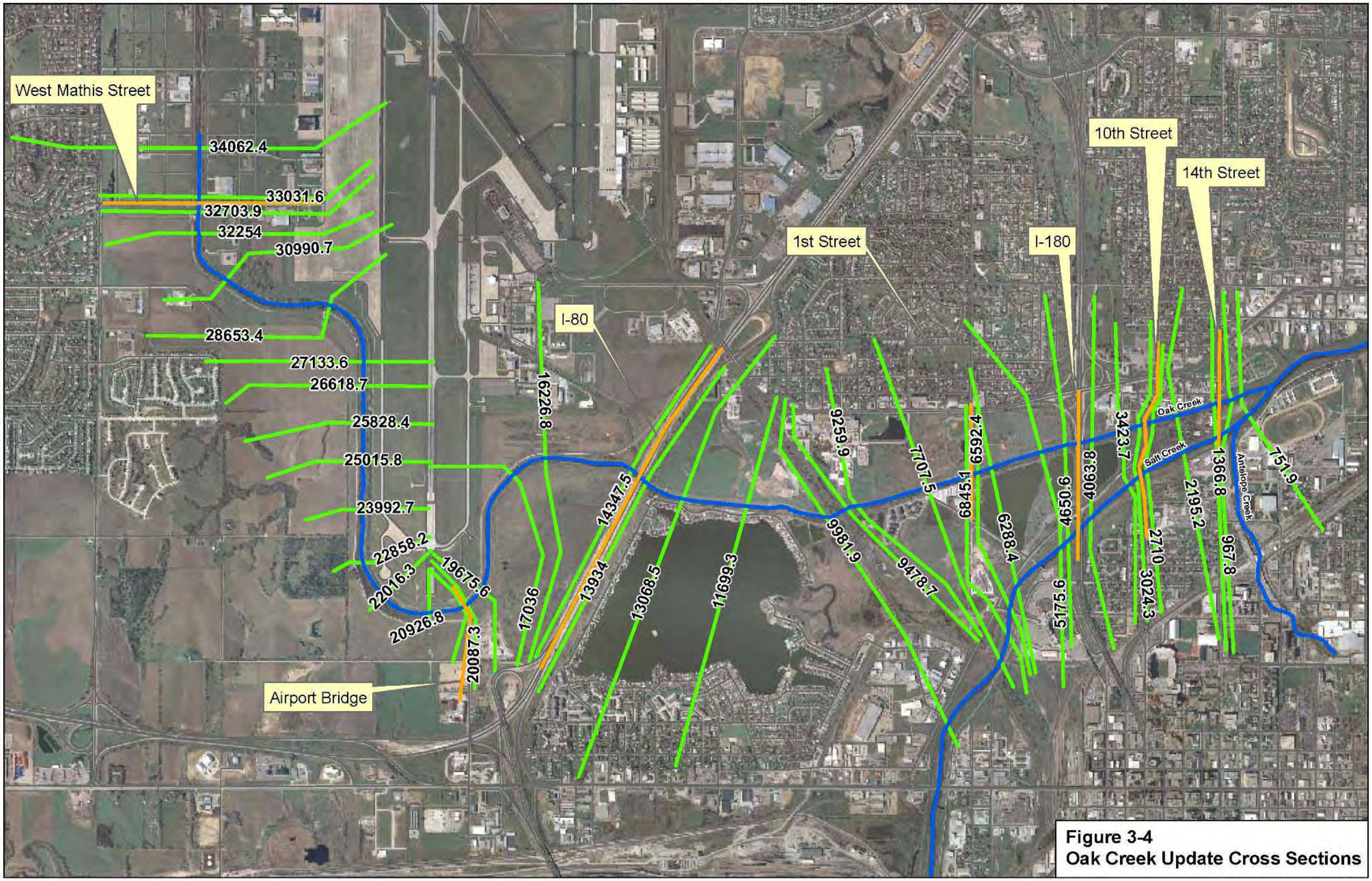


Figure 3-4
Oak Creek Update Cross Sections

The Oak Creek project area is mostly characterized by open space with some wooded areas, and some developed urban areas. The study reach extends from West Mathis Street to the confluence with Salt Creek, and is approximately 7 river miles, conveying over 260 square miles of drainage.

3.3.2.2 Middle Creek Updates

The Middle Creek geometry was updated using the same reach extents as was used in the Salt Creek DFIRM Floodplain Model. This update included the creation of new HEC-RAS cross sections and the addition of hydraulic structure data for the Homestead Expressway Bridge. Data for input of the bridge was obtained from as-builts provided by the City. The new HEC-RAS reach of Middle Creek is shown in Figure 3-5.

The project area is mostly undeveloped, and is characterized by open space with some wooded areas. The study reach extends from Southwest 40th Street to the confluence with Salt Creek, and is approximately 3 river miles, conveying over 100 square miles of drainage.

3.3.2.3 Blocked Areas

A detailed approach was used to determine areas that could effectively be “blocked” along modeled cross sections. The estimated water surface elevations (WSE) on both Middle Creek and Oak Creek were evaluated to determine the location of these areas. For example, several cross sections on Middle Creek were cut through a rail yard located north of Middle Creek. Based on the contours in this area, it was clear that water from Middle Creek does not flow through the low point on the north side of the rail yard. A modeled cross section with a blocked obstruction from this area is shown in Figure 3-6. By applying this approach, a conservative estimate of both storage and conveyance along Middle Creek and Oak Creek was achieve, which made determining the benefits of the proposed storage areas more appropriate for this study.

The HEC-RAS levee option was utilized on Oak Creek, though the levee located here is not certified. This option in HEC-RAS keeps the area behind the levee from being used as storage or conveyance. Using this option was necessary to accurately simulate conveyance through this reach.

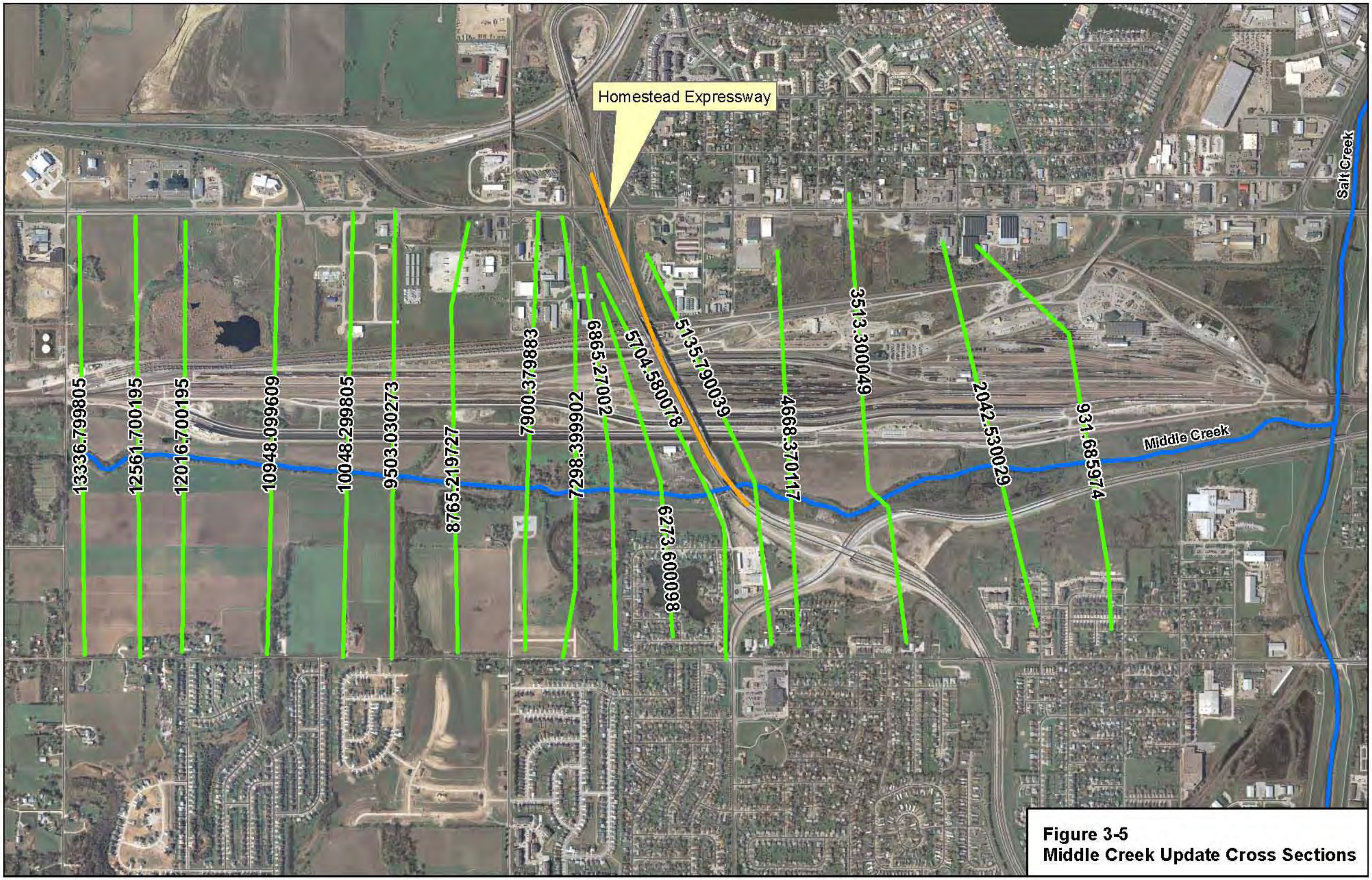


Figure 3-5
Middle Creek Update Cross Sections

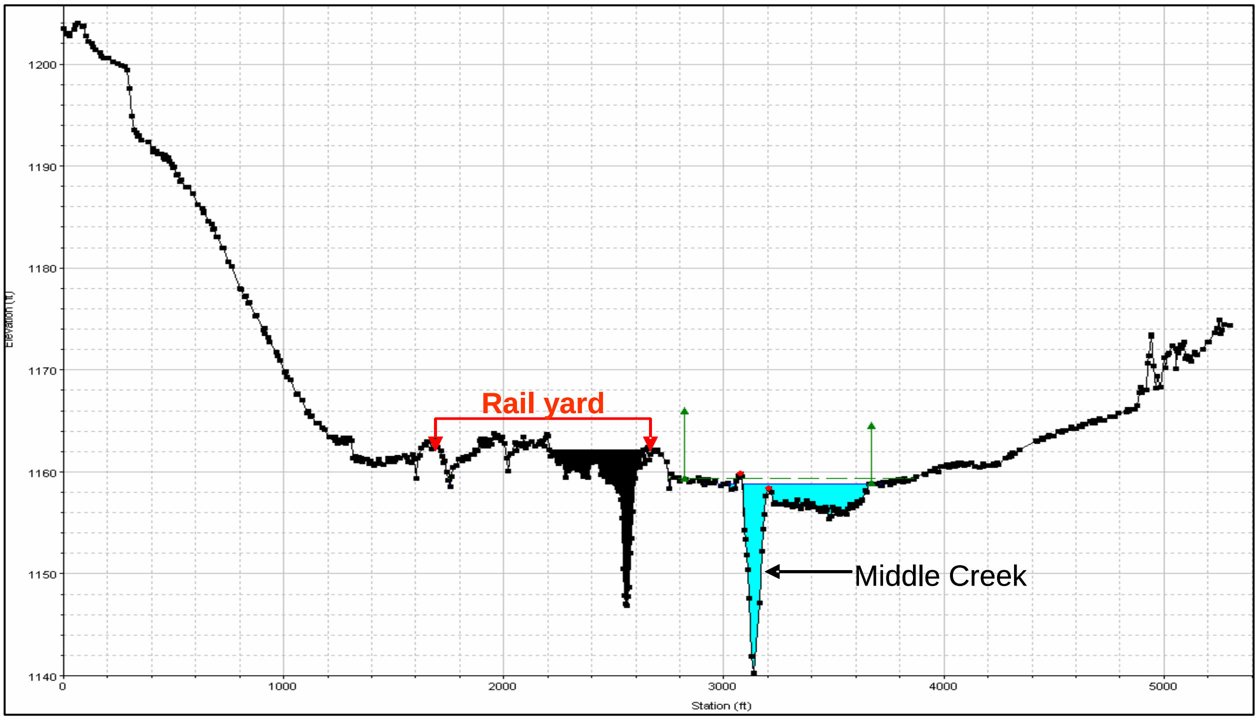


Figure 3-6 Modeled Cross Section with Blocked Obstruction

3.3.3 Unsteady Flow File Development

Inflow hydrographs for the unsteady flow file were obtained from DSS files created from the modified HEC-HMS models previously described. Initial flow conditions were developed for the updated reaches based on the starting values on the inflow hydrographs. The new downstream boundary condition for the Oak Creek model was set at normal depth and the friction slope was calculated to be 0.0005. No boundary condition for Middle Creek was necessary because it was connected to the Salt Creek model by a junction.

3.3.3.1 Comparison of Peak Discharges

After the new Oak Creek and Middle Creek reaches had been incorporated, peak discharges calculated by unsteady HEC-RAS at specified locations along Salt Creek were compared to the original Salt Creek DFIRM model results. The goal was to ensure that the change in peak discharge was less than 5 percent and the water surface elevation did not change by more than 0.5 feet. Table 3-12 presents a summary of peak discharges and corresponding peak water surface elevations along the Salt Creek study reach.

Table 3-12 Comparison of Peak Flows and Peak Water Surface Elevations

Existing DFIRM versus Study Results							
	Max WSE (ft)			Peak Flow (cfs)			
Station	DFIRM	Study Results	Difference	DFIRM	Study Results	Percent Difference	Crossing
266998.5	1,199.5	1,199.5	0	14,375	14,375	0.0	U/S end of model
186130	1,155.7	1,155.9	0.25	20,791	20,581	1.0	W South Street
173811.8	1,150.8	1,151.1	0.3	23,516	24,034	-2.2	Line Drive
162396.4	1,148.2	1,148.4	0.24	34,102	34,505	-1.2	Cornhusker Hwy
160516.7	1,147.6	1,147.8	0.22	34,149	34,467	-0.9	N 27th Avenue
154006.5	1,141.3	1,141.5	0.23	34,561	34,992	-1.2	Superior Street
137617.4	1,136.2	1,136.3	0.18	40,412	41,409	-2.5	Hwy 77/N 56th Street
132237	1,134.2	1,134.5	0.24	40,714	41,713	-2.5	70th Street

3.3.4 Methodology for Modeling Offline Storage

Since unsteady HEC-RAS was utilized in this analysis, offline storage was modeled using the HEC-RAS storage area feature. HEC-RAS storage areas require either an area and minimum elevation or an elevation volume curve. For this analysis, 3D Analyst was used to convert contours from the preliminary offline storage layout into a TIN, which was used to find the elevation volume curve. The offline storage was connected to the adjacent stream using lateral structures. These lateral structures were placed in locations that made the most sense based on water surfaces and potential inflow and outflow locations. The position of these lateral structures was refined as design was completed. Lateral structures that were used as inlets were connected to the storage area itself, while those lateral structures used only for outlets were connected to the most appropriate HEC-RAS cross section for drainage.

In order to avoid overestimating storage and conveyance, HEC RAS blocked obstructions were used to remove overbank storage and conveyance from any cross section that was located within an offline storage site, as shown in Figure 3-7.

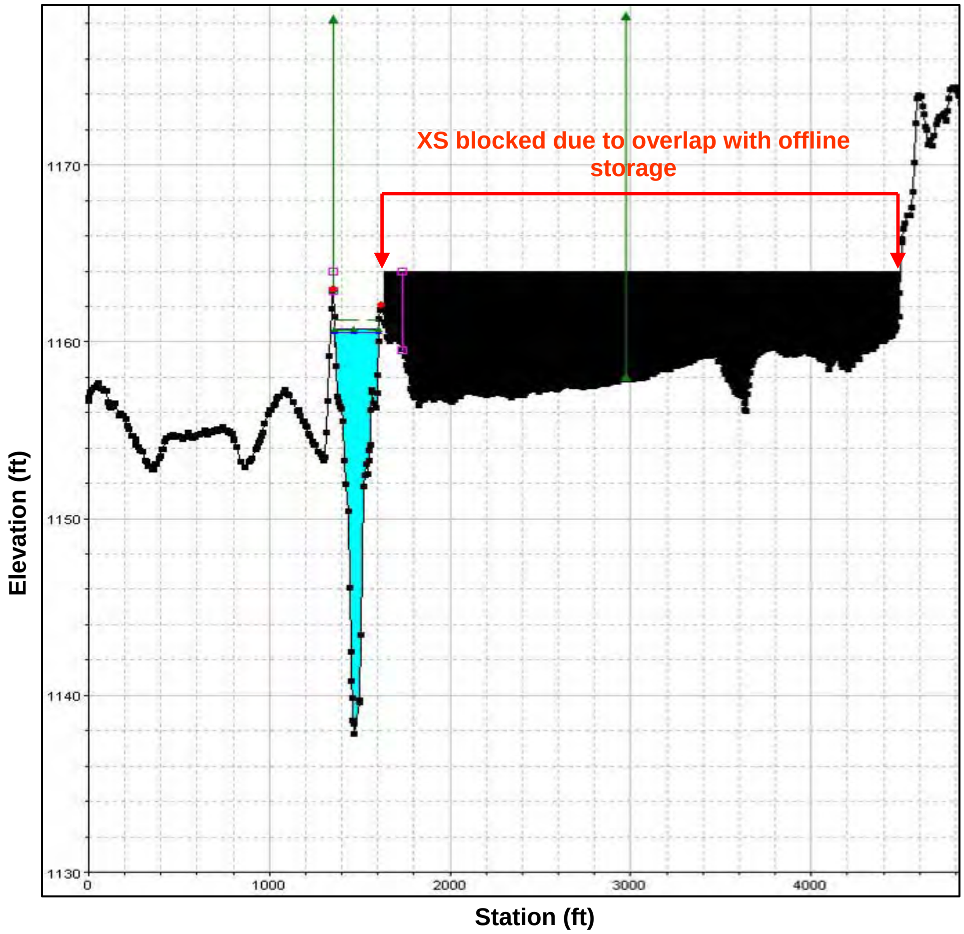


Figure 3-7 Cross Section of HEC RAS Blocked Obstruction

3.4 Analysis of Wilderness Park Flood Attenuation

Flood attenuation due to overbank storage currently provided by Wilderness Park was evaluated. This was accomplished by removing overbank storage in cross sections within Wilderness Park using the "Unsteady Encroach" option. Two scenarios were run and compared:

- Scenario 1: FEMA floodway encroachment stations developed for the Salt Creek DFIRM project were applied at all HEC-RAS cross sections in Wilderness Park. These stations are represented by the color blue on Figure 3-8.

- Scenario 2: Encroachment stations were set 50 feet from the left and right channel bank stations. This resulted in an average top width of approximately 210 feet, and a maximum top width no greater than 300 feet. These encroachment stations are represented by the color green on Figure 3-8.

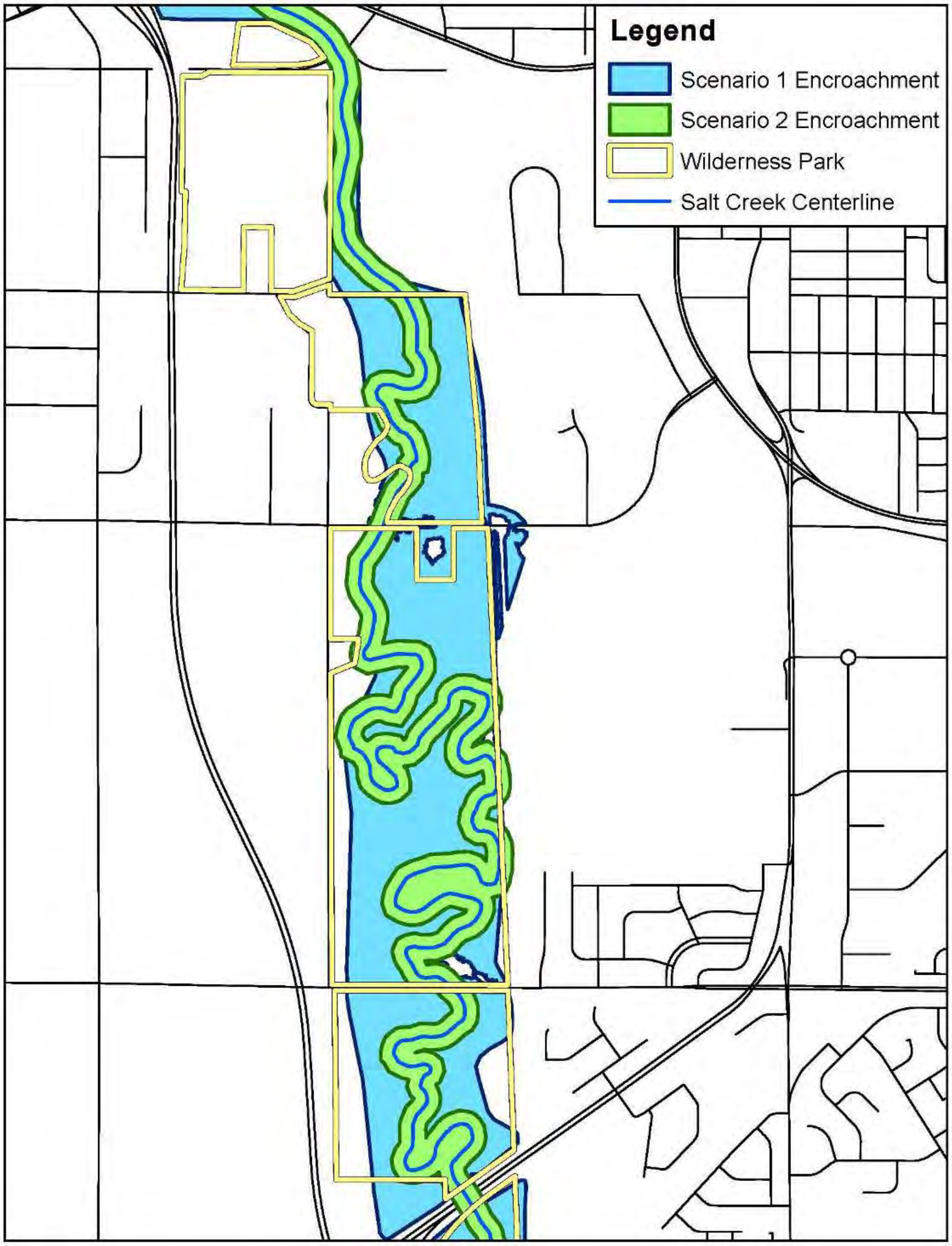


Figure 3-8 Wilderness Park Flood Attenuation Scenarios

The analysis of the output from these models included a comparison to the Salt Creek DFIRM Update model and the USACE Section 22 Report, "Salt Creek at Wilderness Park Hydrologic Study". The Section 22 report assumed a top with of no greater than 300 feet.

As shown in Tables 3-13 and 3-14 and Figure 3-9, Wilderness Park overbank storage provides a large reduction in water surface elevation in the Park and downstream to the confluence with Haines Branch, with a diminished reduction downstream. High peak flow attenuation is also seen immediately downstream of Beal Slough to the confluence with Middle Creek. This analysis shows that flood attenuation provided by Wilderness Park greatly reduces flooding in heavily urban areas of Lincoln, NE, along Salt Creek, especially downstream of the Park and upstream of Middle Creek.

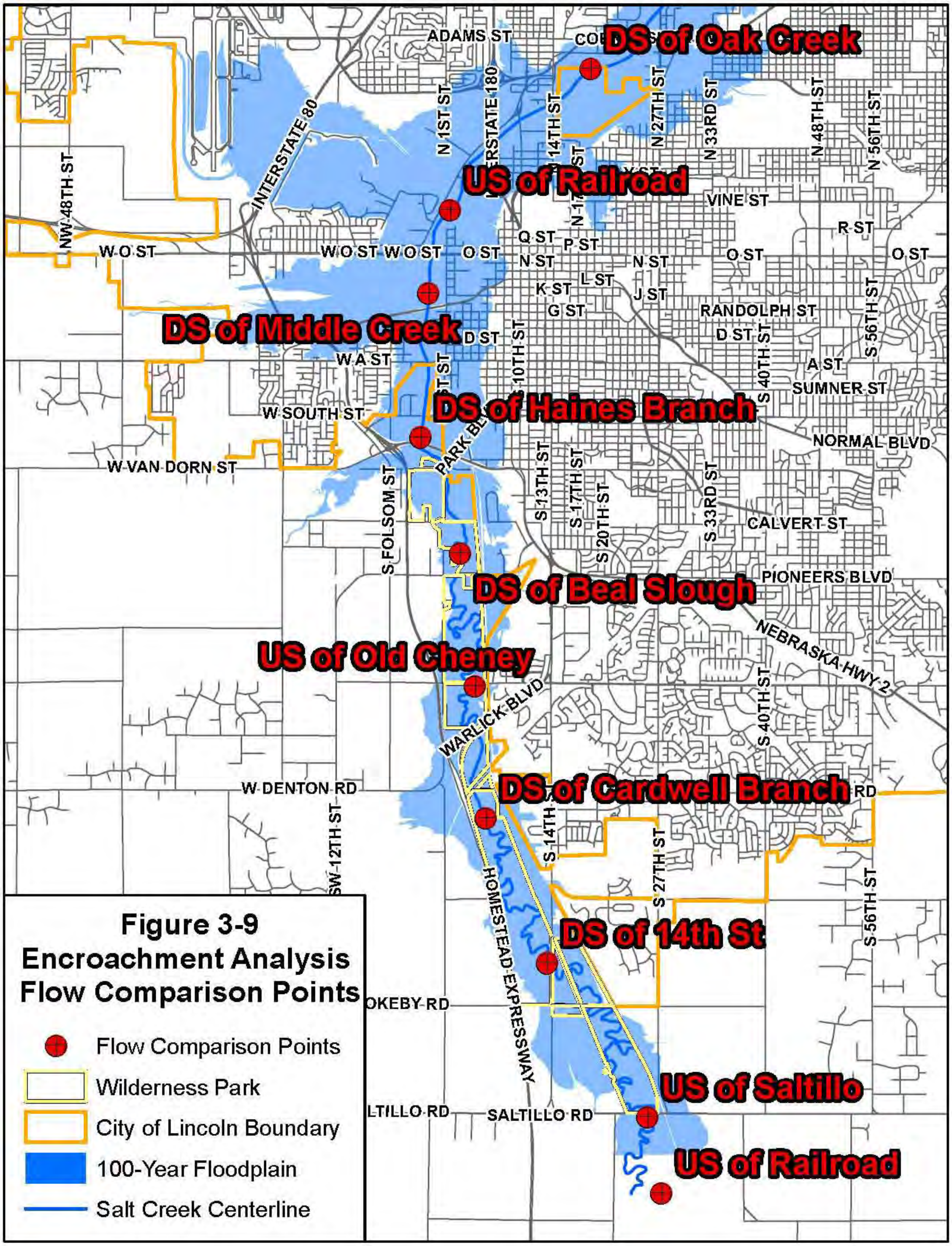
The complete results of this analysis are provided in Appendix B.

Table 3-13 Wilderness Park Analysis – 100-Year Peak Flow Comparison

	Salt Creek Storage Area Analysis					Section 22 Analysis		
Location Description	**Salt Creek DFIRM Maximum Water Surface Elevation (ft)**	**Scenario 1 Maximum Water Surface Elevation (ft)**	**Elevation Difference between Scenario 1 & DFIRM (ft)**	**Scenario 2 Maximum Water Surface Elevation (ft)**	**Elevation Difference between Scenario 2 & DFIRM (ft)**	**Section 22 Exist Model Maximum Water Surface Elevation (ft)**	**Section 22 Encroach Model Maximum Water Surface Elevation (ft)**	**Elevation Difference between Section 22 exist and encroach (ft)**
US of Railroad - Model Begins	1,200	1,200	0.7	1,208	8.7	1,205	1,209	3.6
US of Saltillo Rd	1,199	1,199	0.2	1,205	5.8	1,198	1,200	2.7
DS of 14th St	1,184	1,184	0.6	1,190	6.8	1,184	1,187	3.1
DS of Cardwell Branch	1,175	1,175	0.0	1,178	3.2	1,174	1,177	2.3
US of Old Cheney	1,166	1,166	0.5	1,172	5.5	1,167	1,171	4.0
DS of Beal Slough	1,159	1,159	0.2	1,161	1.9	1,159	1,162	2.8
DS of Haines Branch	1,156	1,156	0.0	1,156	0.2	1,157	1,159	2.6
DS of Middle Creek	1,153	1,153	0.0	1,153	0.3	1,153	1,154	1.0
US of Railroad Bridge	1,152	1,152	0.0	1,152	0.3	1,151	1,151	0.6
DS of Oak Creek	1,139	1,139	0.0	1,139	0.2	1,148	1,148	0.5

Table 3-14 Wilderness Park Analysis – 100-Year Maximum Water Surface Comparison

	Salt Creek Storage Area Analysis					Section 22 Analysis		
Location Description	**Salt Creek DFIRM Peak Flow (cfs)**	**Scenario 2 Peak Flow (cfs)**	**Percent Difference between Scenario 1 & DFIRM**	**Scenario 2 Peak Flow (cfs)**	**Percent Difference between Scenario 2 & DFIRM**	**Section 22 Exist Model Peak Flow (cfs)**	**Section 22 Encroach Model Peak Flow (cfs)**	**Percent Difference between Section 22 exist and encroach**
US of Railroad - Model Begins	14,375	14,375	0.0%	14,375	0.0%	10,093	11,233	11.3%
US of Saltillo Rd	14,401	14,321	-0.6%	14,394	-0.1%	9,915	11,128	12.2%
DS of 14th St	14,486	14,350	-0.9%	14,555	0.5%	9,900	11,292	14.1%
DS of Cardwell Branch	14,723	14,637	-0.6%	14,645	-0.5%	9,414	12,841	36.4%
US of Old Cheney	14,697	14,623	-0.5%	14,689	-0.1%	9,390	12,856	36.9%
DS of Beal Slough	14,880	15,571	4.6%	17,491	17.5%	9,434	13,153	39.4%
DS of Haines Branch	21,031	21,025	0.0%	23,576	12.1%	17,037	21,960	28.9%
DS of Middle Creek	28,005	28,028	0.1%	27,767	-0.8%	26,537	31,028	16.9%
US of Railroad Bridge	24,658	24,760	0.4%	25,034	1.5%	26,557	30,459	14.7%
DS of Oak Creek	40,410	40,514	0.3%	40,951	1.3%	38,861	42,272	8.8%


DS of Oak Creek
US of Railroad
DS of Middle Creek
DS of Haines Branch
DS of Beal Slough
US of Old Cheney
DS of Cardwell Branch
DS of 14th St
US of Saltillo
US of Railroad
ADAMS ST
INTERSTATE 80
N 1ST ST
INTERSTATE 180
N 14TH ST
N 27TH ST
N 33RD ST
N 48TH ST
N 56TH ST
NW 48TH ST
VINE ST
R ST
W O ST
W O ST
W O ST
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J ST
G ST
RANDOLPH ST
D ST
D ST
W A ST
A ST
SUMNER ST
W SOUTH ST
S 40TH ST
S 56TH ST
NORMAL BLVD
W VAN DORN ST
S FOLSOM ST
S 13TH ST
S 17TH ST
S 20TH ST
S 33RD ST
CALVERT ST
PIONEERS BLVD
NEBRASKA HWY 2
WARLICK BLVD
S 40TH ST
W DENTON RD
SW 12TH ST
S 14TH
S 27TH ST
S 56TH ST
HOMESTEAD EXPRESSWAY
OKEBY RD
SALTILLO RD
Figure 3-9
Encroachment Analysis
Flow Comparison Points
Flow Comparison Points
Wilderness Park
City of Lincoln Boundary
100-Year Floodplain
Salt Creek Centerline

Section 4
Storage Area Site Description

4.1 Introduction

Five sites were considered for offline storage, but only three were fully analyzed at a conceptual level. Figure 4-1 shows these five sites, which include:

- Middle Creek between SW 40th Street and SW 27th Street
- Oak Creek to the west of Lincoln Airport
- Oak Creek to the south of the Air National Guard Base
- Haines Branch
- Salt Creek in Wilderness Park

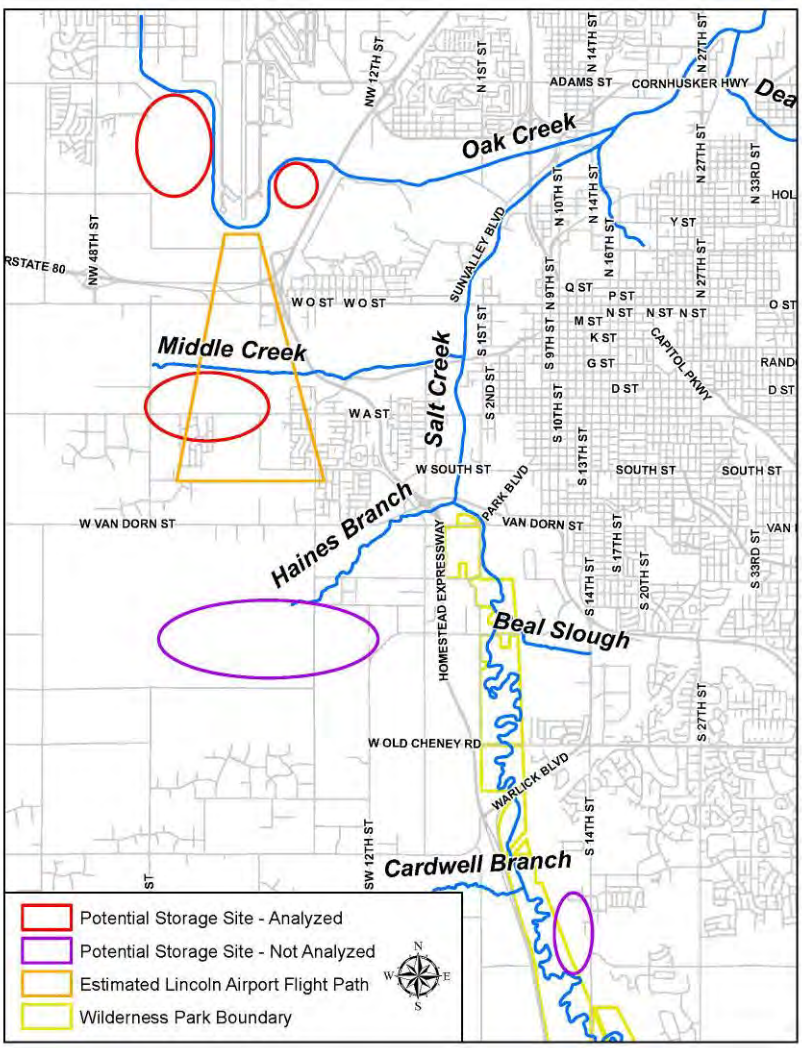

Figure 4-1 Possible Offline Storage Sites

For the storage areas on Middle Creek and Oak Creek, ArcMap was used to complete basin layout design and calculate the amount of storage available. This data was then used as input into the HEC-RAS model, as described in Section 3. Modeling results were then used to refine basin design and develop a preferred storage alternative.

4.2 Middle Creek

4.2.1 Site Description

The site analyzed along Middle Creek is generally bounded by Southwest 40th Street to the west, Southwest 27th Street to the east, West "A" Street to the south, and Middle Creek to the north. The site is currently used as agriculture, as shown in Figure 4-2. Based on reviewing aerial photographs and conducting a field investigation, no utilities were identified on the site. Field photographs for this site are provided in Appendix E.

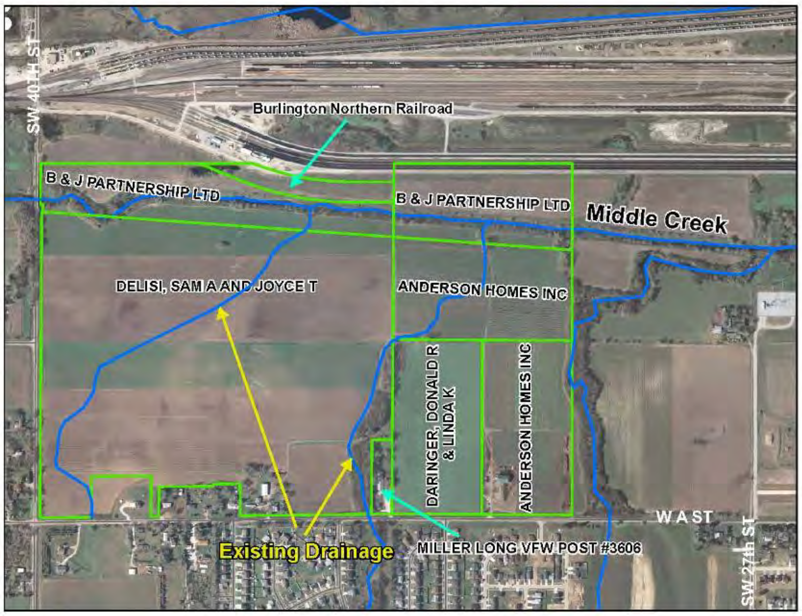

Figure 4-2 Middle Creek Offline Storage Site Existing Conditions

This site is located directly in the flight path of aircraft landing at Lincoln Airport as shown on Figure 4-1. Therefore, the basin should drain completely after a rain event to avoid attracting waterfowl and reflections from the sun, which would be distracting to pilots.

Currently, local drainage extends through the project site to Middle Creek. This local drainage conveys stormwater runoff from partially developed area to the south. Available topographic information indicates that the westernmost drainage is minor, and field investigation confirmed that only an indistinct, small swale exists. Because of this, the impact of this drainage on design was minimal. This drainage is shown in field Photo 7 in Appendix E.

The easternmost drainage on the project site is a more established channel with some vegetation. In order to allow for a storage basin on this site, this channel was rerouted to join

Middle Creek further downstream. The drainage is shown in field Photo 8 and Photo 13 in Appendix E.

Groundwater data analysis was based on previous studies described in Section 2, and the results are shown in Appendix D (Well Data Analysis Table). Because positive drainage to Middle Creek is part of the storage basin conceptual design, it was assumed by the project team that excavation below the average estimated groundwater elevation of 1,150 feet was acceptable.

4.2.2 Storage Basin Results

The hydrograph for the 100-year event on Middle Creek at the confluence with Salt Creek is shown in Figure 4-3. Preliminary analysis of offline detention along Middle Creek showed favorable results to reducing the peak flow downstream along Salt Creek. Further refinement of the storage alternatives was warranted (see Chapter 5) at this site. The hydrograph in Figure 4-3 represents the final conceptual storage basin design for Middle Creek, as detailed in Chapter 5.

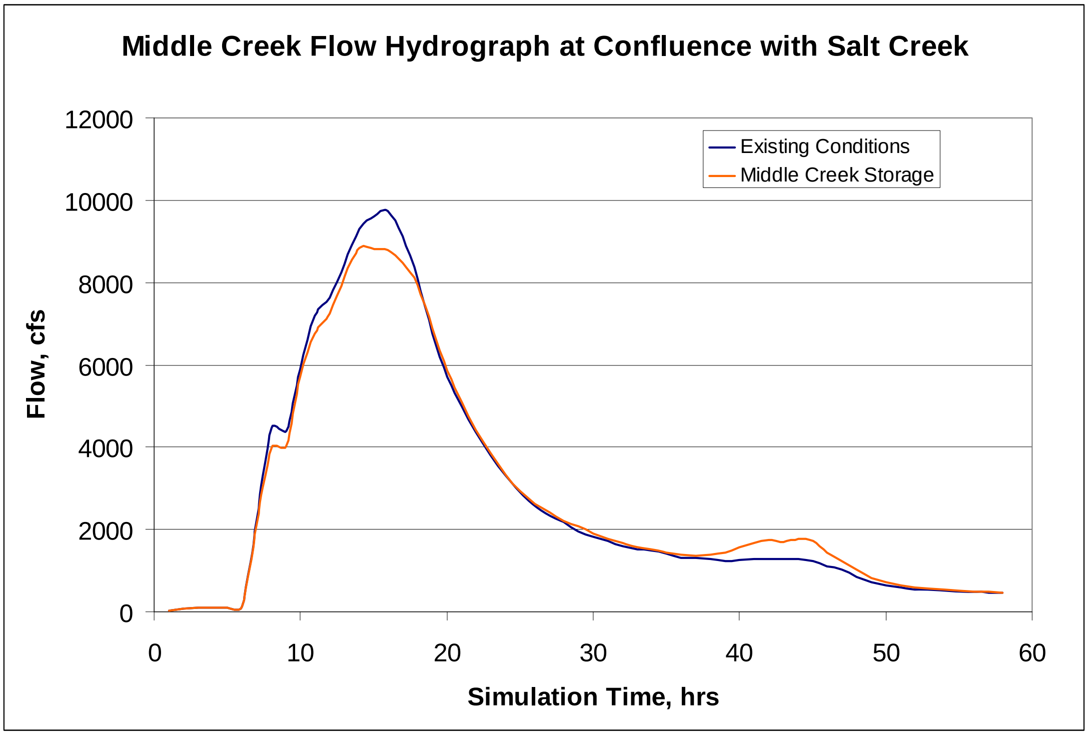

Figure 4-3 Middle Creek Hydrograph

4.3 Oak Creek

Two sites on Oak Creek were considered for storage. The first, located to the west of Lincoln Airport, was designated the "Oak Upstream Site", and the second, located to the south of the Air National Guard Base, was designated the "Oak Downstream Site".

Oak Creek through these sites has a levee system in the overbanks of both sides of the creek. However, the levees do not currently meet FEMA requirements for flood protection but were considered as a part of this analysis.

4.3.1 Site Description - Oak Upstream Site

This site is generally bounded by Oak Creek to the north, Lincoln Airport to the east, and Northwest 41st Street to the west. The site is currently used as agriculture, as shown in Figure 4-4. There is existing overhead power lines on this site, as shown in maps received from the Lincoln Airport Authority, located in Appendix F. Field photographs for this site are provided in Appendix E.

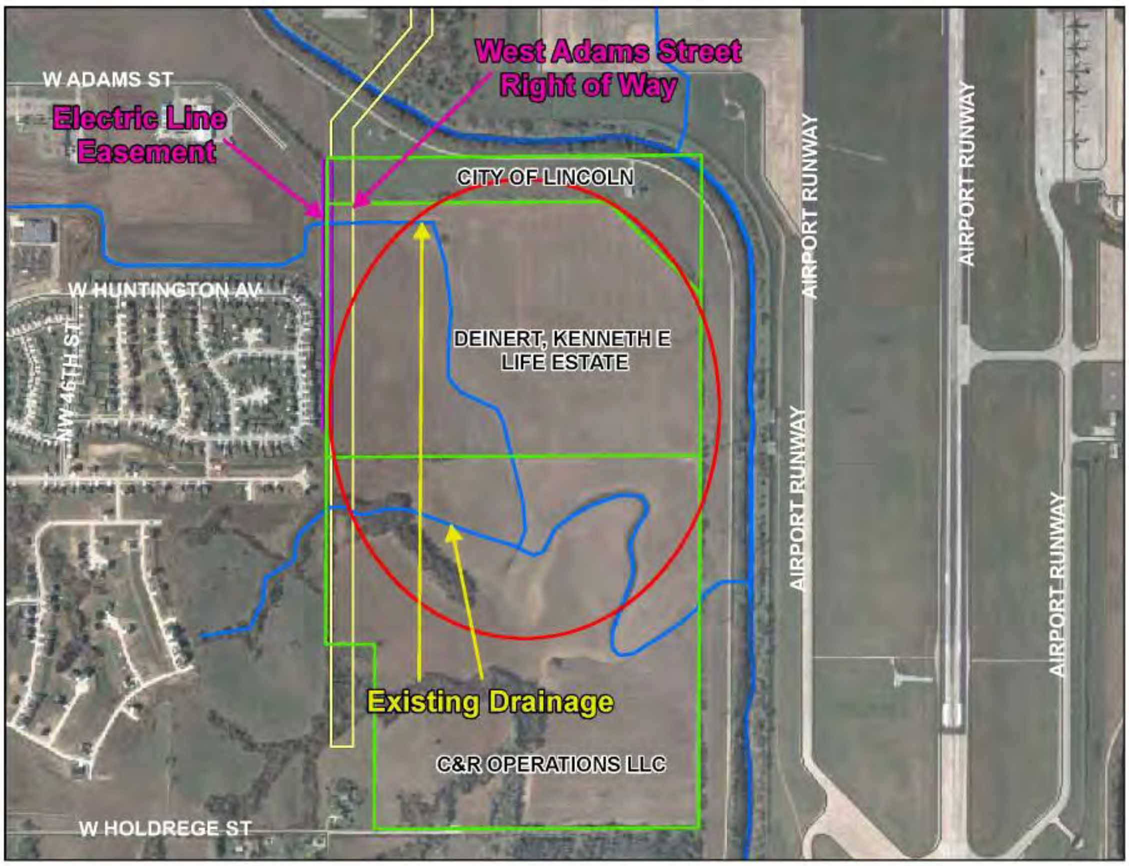

Figure 4-4 Oak Creek Upstream Offline Storage Site Existing Conditions

As with the storage basins on Middle Creek, the basin should drain completely after a rain event because of proximity to the airport runways.

Currently, local drainage extends through the project site to Oak Creek. This local drainage conveys stormwater runoff from partially developed area to the west. Hydrologic analysis of these local drainage areas indicated that this drainage is significant; however, the peak runoff rates occur much earlier than the peak discharge of Oak Creek. Therefore, the local drainage impact on the storage basin was minimal, and the local drainage was rerouted through the proposed storage basins as part of the conceptual design.

Groundwater data analysis was based on previous studies described in Section 2, and the results are shown in Appendix D (Well Data Analysis Table). Because positive drainage to the creek is part of the storage basin conceptual design, it was assumed by the project team that excavation below the average groundwater level 1,148 feet was acceptable.

City planning documents (Airport West Subarea Plan, Feb 2005) indicated that West Adams Street is planned as a North-South thoroughfare with its alignment running through the proposed basin site. To accommodate this plan, a 150 foot right-of-way space was provided on the western-most portion of the site. Another 60 foot portion immediately west of the West Adams Street proposed right-of-way was left unaltered to account for an existing electric line alignment. These are labeled in Figure 4-4 in magenta.

The FEMA floodplain map for Oak Creek in this area indicated that the floodway boundary is located in the right overbank, rather than in the channel. Because of this, the proposed storage basin boundaries were carefully delineated to avoid significant impact to the upstream water surface elevations.

4.3.2 Site Description - Oak Downstream Site

This site is generally bounded by Lincoln Airport to the north and west, Oak Creek to the south, and I-80 to the east. It is characterized by undeveloped open space, as shown in Figure 4-5. Field photographs for this site are provided in Appendix E.

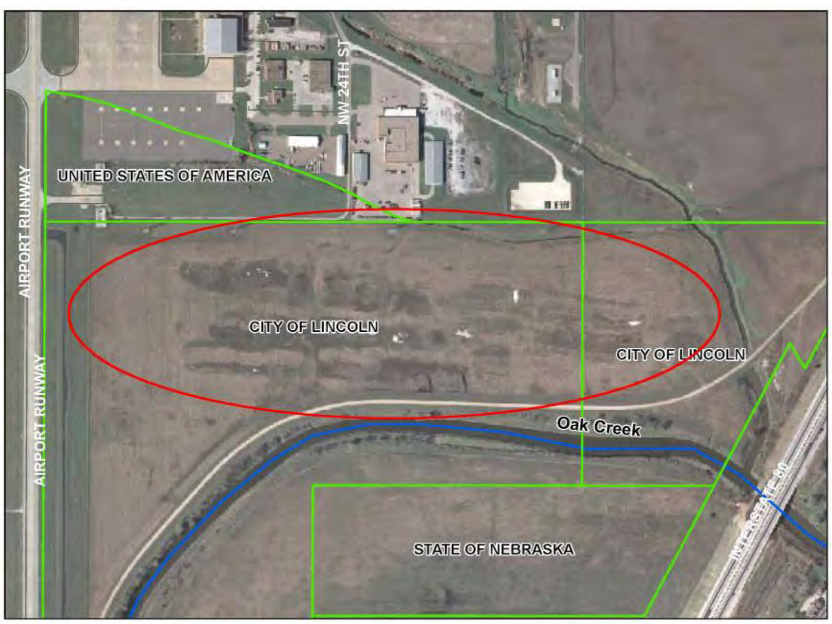

Figure 4-5 Oak Creek Downstream Offline Storage Site Existing Conditions

The site does not have local drainage through the proposed basin location but does have a significant drainage channel to the east. This drainage conveys runoff from an estimated 3.0 square mile area to the north as shown in Figure 4-6. Discharge from this channel to Oak Creek is controlled by flap gates on the stream side of the levee which prevents Oak Creek flow from backing up and flooding the site. No utilities were indicated by reviewing aerial photographs and conducting a field investigation.

As with the other storage basins, the basin should be able to drain completely after a rainfall event. This site has been previously studied for offline storage in June, 2004 by HDR Engineering Inc. The storage basin boundaries used in the report were expanded in this study, and the bottom slope of the basin changed to 2 percent.

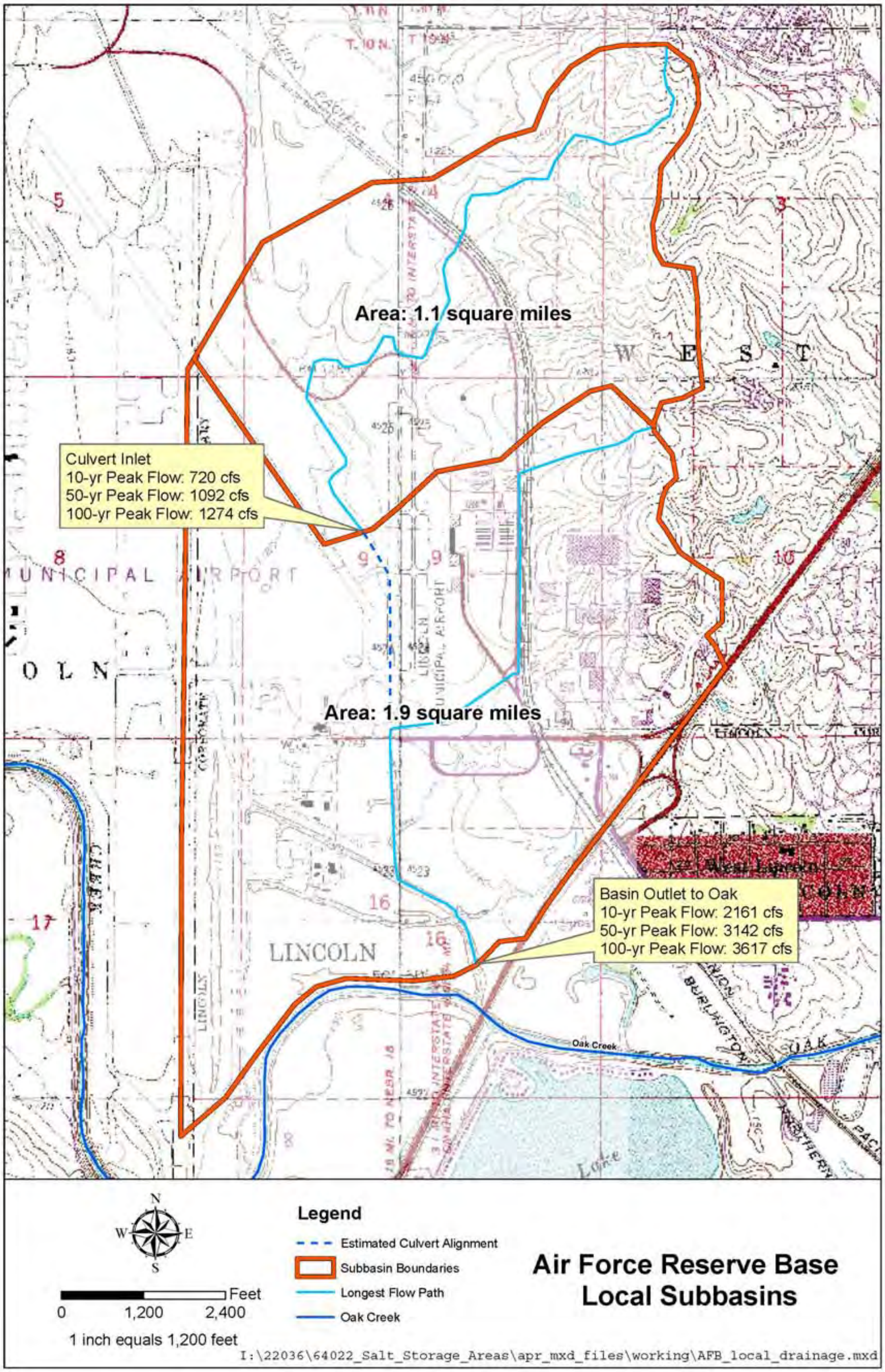

Figure 4-6 Air Force Reserve Base Local Subbasins

4.3.3 Oak Creek Storage Basin Results

The flow and stage hydrographs at the Oak Creek upstream site (Figure 4-7) exhibit a "dual peak" where the flow and elevation of the water surface during an extreme event peak twice. The dual peak causes a basin at this site to tend to fill significantly during the first peak, reducing the amount of storage available when the second, higher peak occurs. The dual peak limited the effectiveness of an offline storage basin at both the upstream and downstream sites on Oak Creek.

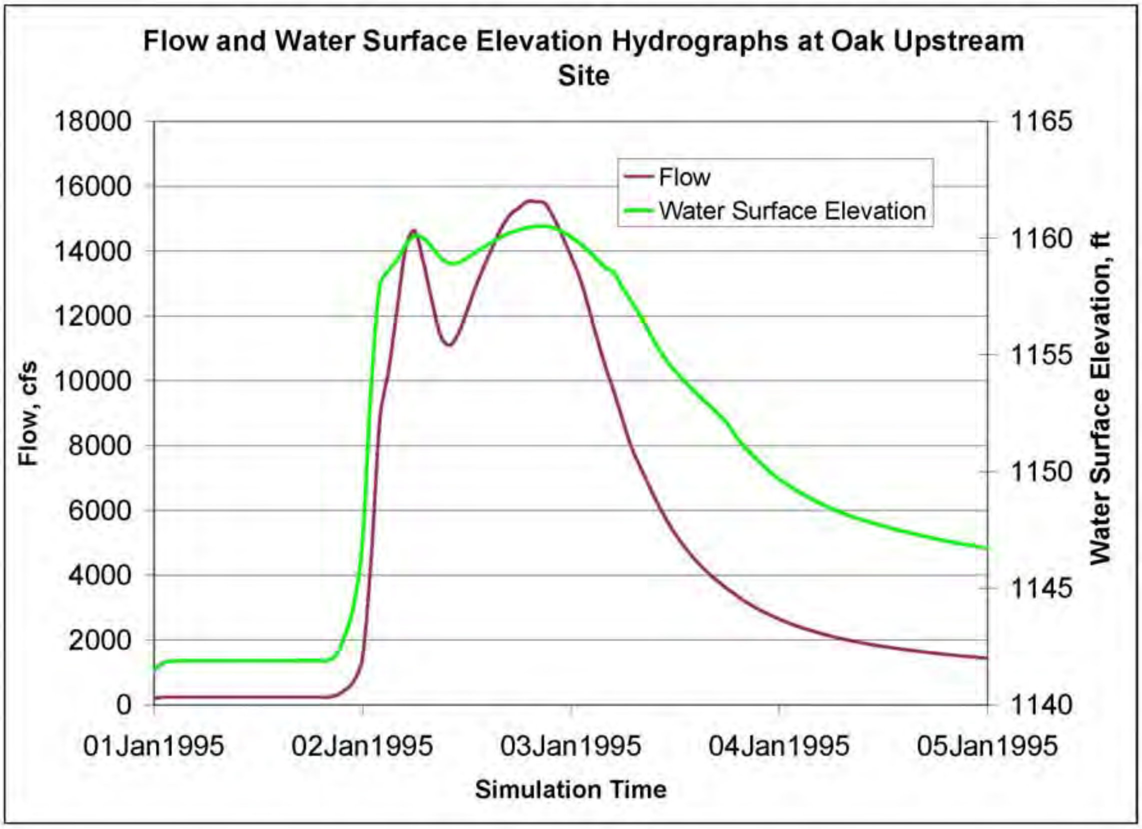

Figure 4-7 Flow and Water Surface Hydrograph at Upstream Oak Site

The hydrograph for the 100-year event on Oak Creek at the confluence with Salt Creek is shown in Figure 4-8. As with Middle Creek, preliminary analysis showed favorable results to reducing the peak flow downstream along Salt Creek. The location of the Oak Creek confluence is in close proximity downstream of the Middle Creek outlet on Salt Creek, and a combined benefit was observed with offline storage on both tributaries, as shown in Figure 4-9. Oak Creek storage sites were further analyzed, and a final conceptual level storage basin design was completed, as described in Section 5. The hydrograph in Figure 4-9 represents the cumulative results of storage basin conceptual designs for both sites on Oak Creek at the confluence with Salt Creek.

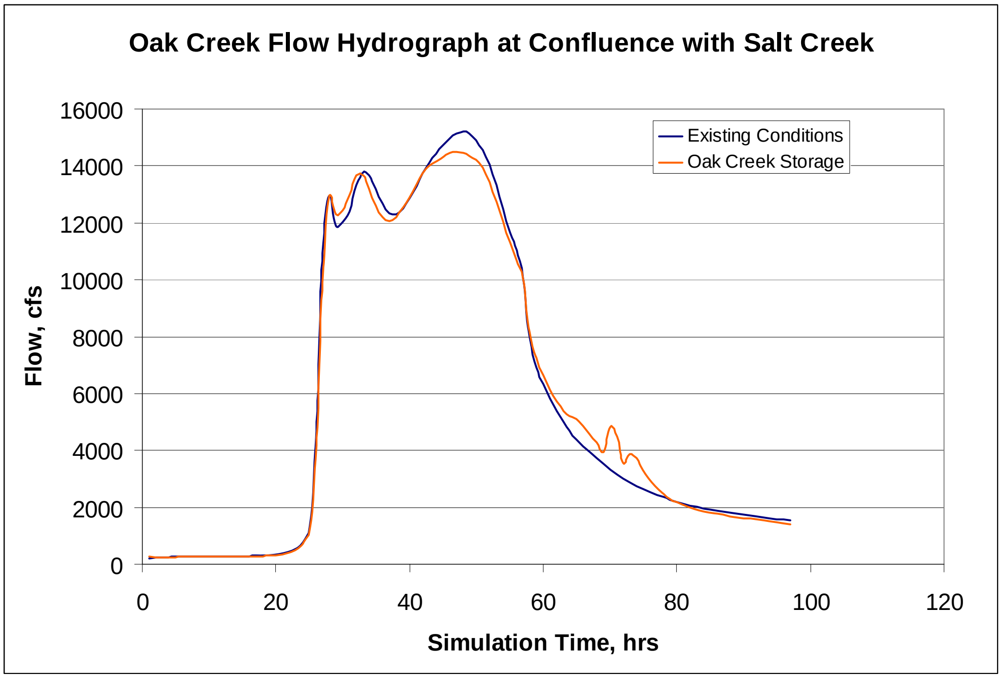

Figure 4-8 Oak Creek Hydrograph With and Without Offline Storage

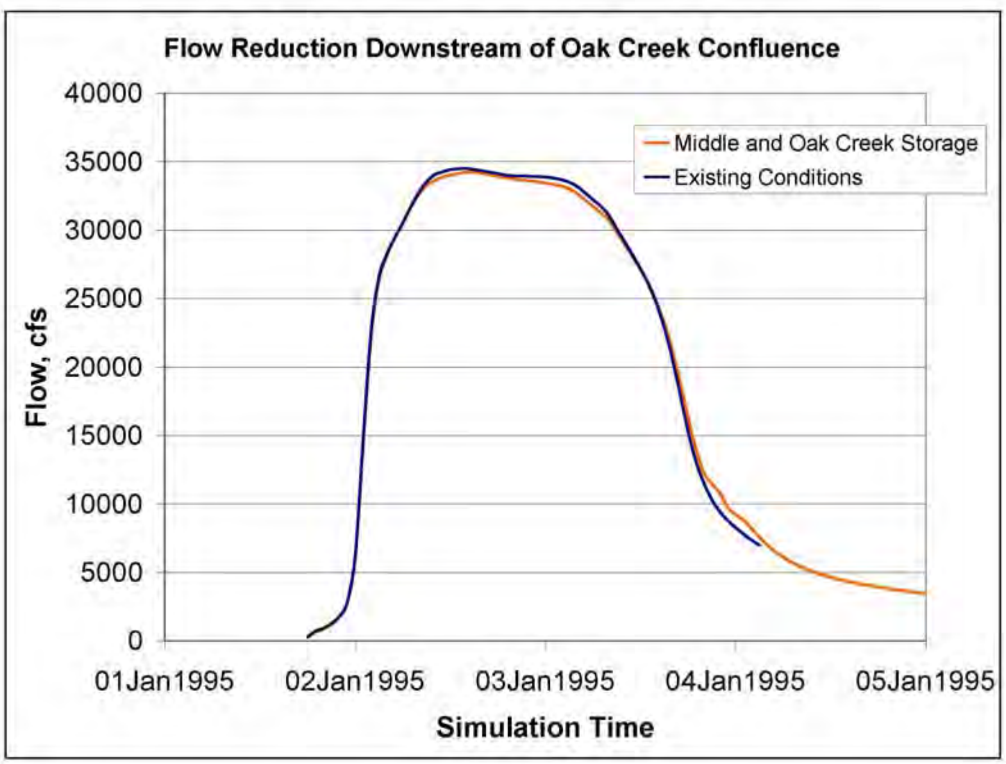

Figure 4-9 Salt Creek Flow Hydrograph Downstream of Oak Creek Confluence

4.4 Wilderness Park

4.4.1 Site Description

Wilderness Park is characterized by dense wooded area with few large opens spaces. Several sites for offline storage were considered within Wilderness Park, and the open space located to the west of Yankee Hill Road and South 14th Street, shown in Figure 4-10, was determined to be the best available option. No utilities exist at this site, but a bike path running on an old railroad embankment exists. Local drainage from the east does flow through this site, but this drainage was not analyzed for the preliminary site analysis.

Figure 4-10 Wilderness Park Offline Storage Site

For the preliminary analysis, an initial basin design layout was completed as previously described and the elevation-volume curve input into the HEC-RAS model.

4.4.2 Storage Basin Results

The preliminary analysis of offline storage in Wilderness Park showed that an offline storage basin at this site would fill early in an extreme storm event, due to "dual peak" runoff hydrograph. Figure 4-11 shows the flow and water surface elevation hydrographs at the Wilderness Park storage site under existing conditions. The dual discharge peak causes a basin at this site to fill significantly during the first peak, reducing the amount of storage available when the second, higher discharge peak occurs. The effect of the dual peak at this site made an offline storage basin at this site ineffective to attenuate peak flows downstream on Salt Creek.

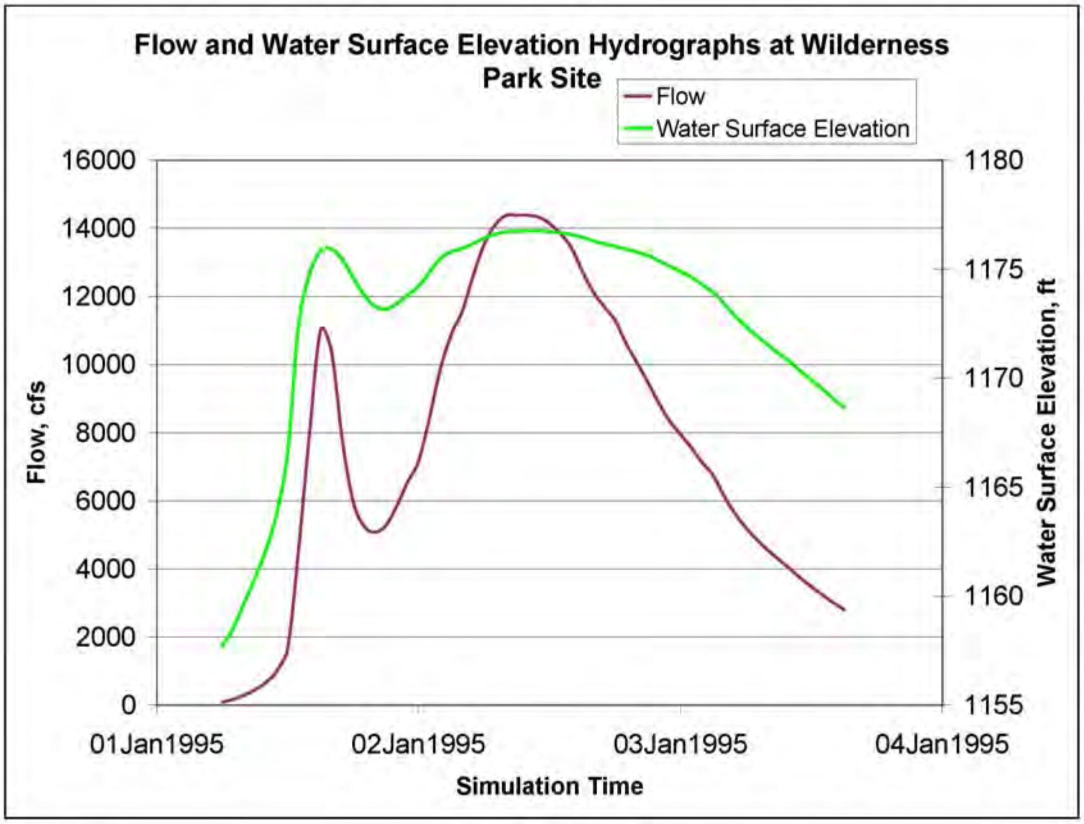

Figure 4-11 Flow and Water Surface Hydrograph for Wilderness Park Site

The hydrograph immediately downstream of the Wilderness Park offline storage versus the existing conditions hydrograph is shown in Figure 4-12. As shown in Figure 4-12, the first discharge peak fills the offline detention basin leaving no flood storage for the second discharge peak.

It was further determined that expanding the offline detention would incur a higher cost both environmentally, as riparian vegetation would have to be removed, and monetarily. A benefit/cost ratio of greater than one for an offline storage basin at this site is very unlikely. Therefore, no further evaluation of offline storage alternatives was completed within the Wilderness Park area.

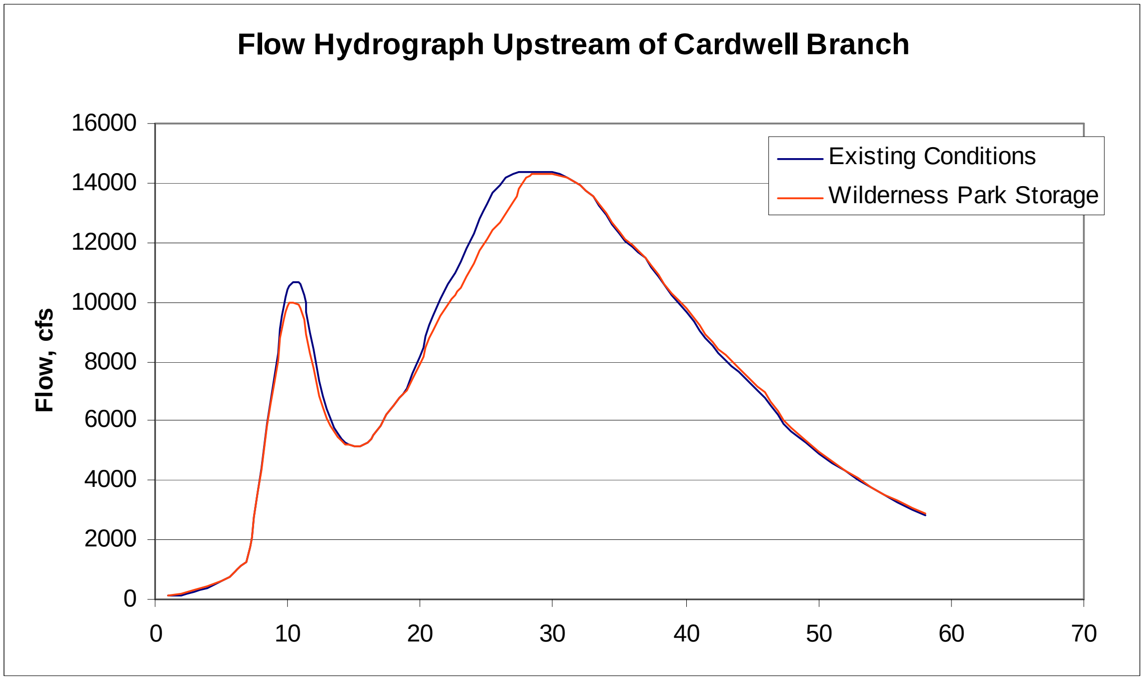

Figure 4-12 Salt Creek Hydrograph Upstream Cardwell Branch Confluence

4.5 Haines Branch

4.5.1 Site Description

Offline storage was considered on Haines Branch between SW 56th Street and the confluence with Salt Creek. This area is characterized by undeveloped, agricultural land as shown on Figure 4-13. There is an active railroad that runs along Haines Branch to the confluence which limits the possible area for an offline detention site.

4.5.2 Storage Basin Results

The preliminary analysis of offline storage alternatives for this location resulted in no technically feasible sites because of existing topography, local drainage, and the active railroad. Therefore no further analysis was completed for storage alternatives along Haines Branch.

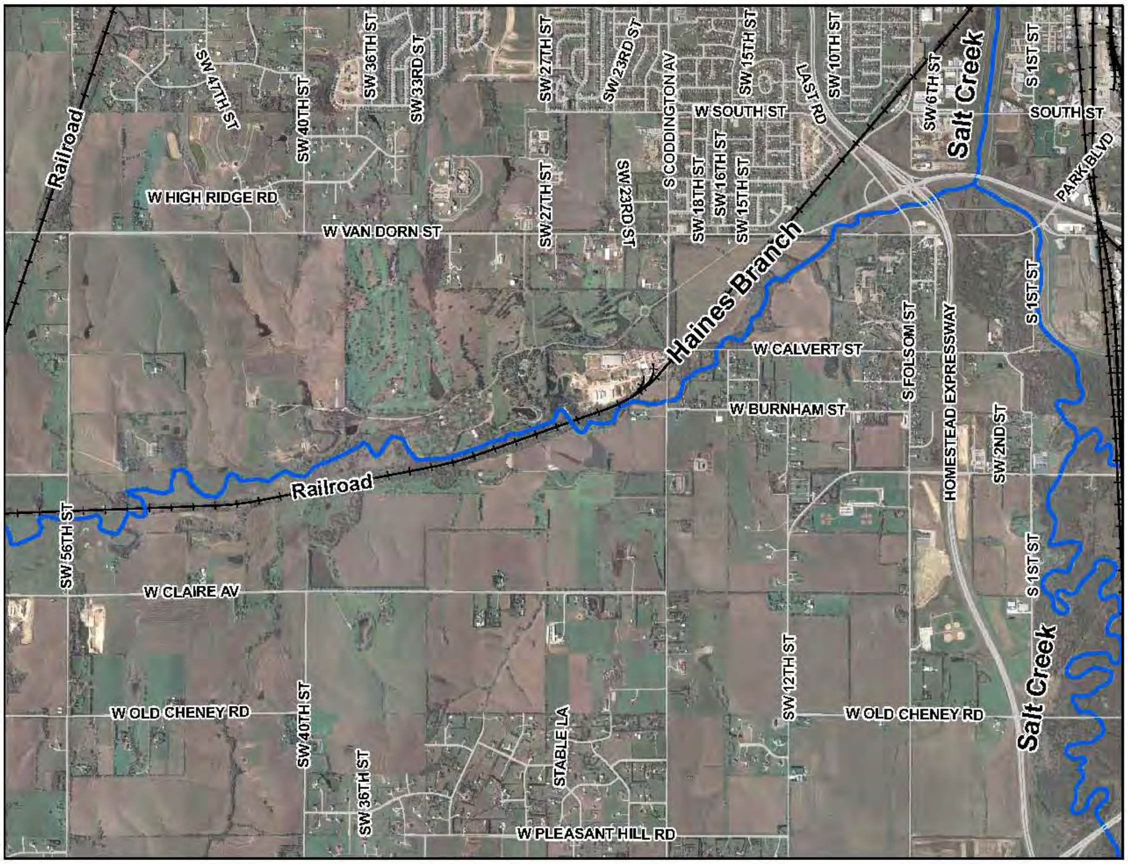

Figure 4-13 Aerial View of Haines Branch Area

Section 5
Storage Area Conceptual Design

5.1 Introduction

The results of the hydrologic, hydraulic, and storage area site evaluation discussed in the previous sections of this report formed the foundation for developing conceptual storage basin designs. The conceptual design depends on local drainage, existing FEMA floodways, and the City of Lincoln design criteria for storage facilities as stated in the City's Drainage Criteria Manual.

5.2 Background

The storage area site evaluation identified two of the four proposed locations (Middle Creek and Oak Creek sites) as being the most effective storage areas. The initial site evaluation found that these sites ultimately have a significant impact reducing local flooding, as well as flooding along Salt Creek. One of the two identified sites is along Middle Creek, south of A Street, between SW 27th and SW 40th Streets. The second identified site is on Oak Creek, near the airport and includes an upstream and downstream storage area. The Oak Creek upstream storage area is located west of the airport runway and south of Lincoln Air Park. The downstream Oak Creek area is south of the Air National Guard base. Figure 5-1 shows site selections for conceptual design.

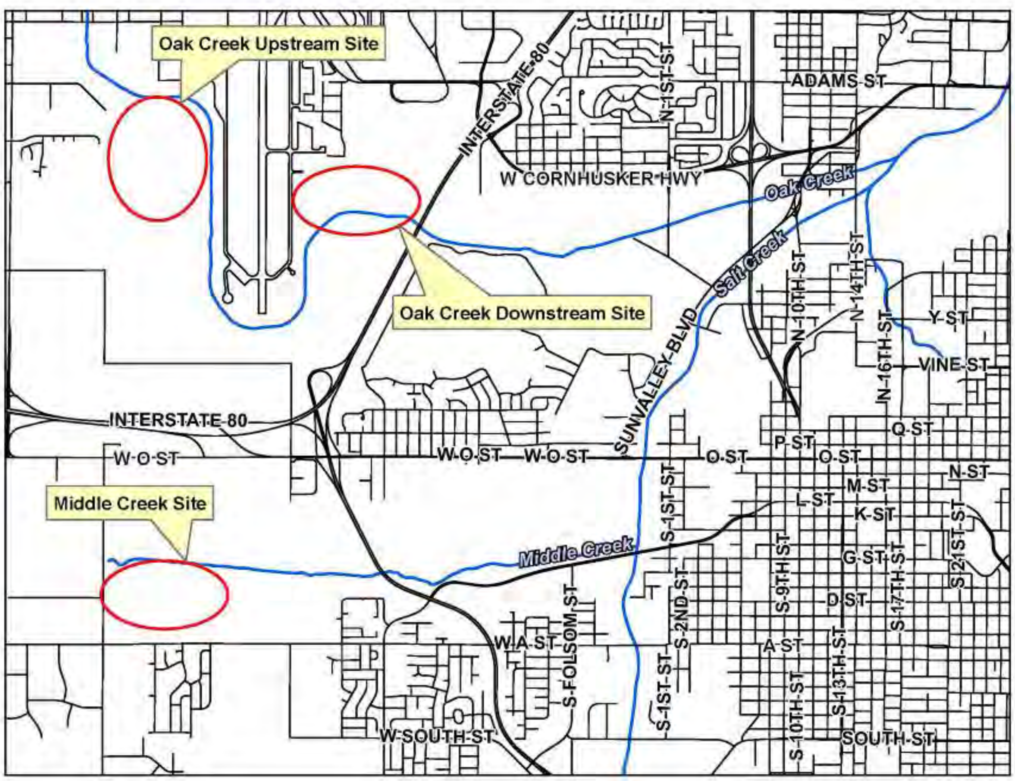

Figure 5-1 Offline Storage Sites Analyzed

For all these sites, local drainage and local drainage routing were taken into account. Local drainage needed to be routed around or through the proposed storage basins in such a manner that storage volume in the basins was not reduced from local runoff. In the City of Lincoln, drainage that is rerouted must be replaced with twice the original length. Also, it is important to consider existing floodways. Locating storage areas within the floodway results in a loss of conveyance area and will leads to water surface elevation and flow problems upstream of the intended storage areas.

As far as storage facility design, the City of Lincoln Drainage Criteria Manual states:

> *The bottom area of storage facilities shall be graded toward the outlet to prevent standing water conditions. A minimum 2 percent bottom slope is required on unpaved areas. A low flow or pilot channel constructed across the facility bottom from the inlet to the outlet is required to convey low flows, and prevent standing water conditions.*

The Middle Creek and upstream Oak Creek storage sites are near residential and developing residential areas. Considering this, the design incorporates some recreational areas, where possible. In order to incorporate recreational areas, some exception was made to the 2 percent minimum bottom slope.

5.3 Conceptual Design

The main goal of the storage area evaluation was to develop storage areas that reduce future flood damages along Salt Creek based on the 10-, 50-, 100-, and 500-year storm events. An iterative process was used to balance the storage basin design versus the cost/benefit analysis of the design. The goal was to maximize the storage volume at the minimum cost.

5.3.1 Preliminary Design

ArcMap was employed for storage layout for preliminary and final conceptual design. This was accomplished by laying out contours and using 3D Analyst to convert the contours into a Triangular Irregular Network (TIN). This TIN was then used to find an elevation volume curve, which will be described in more detail below.

During this process, CDM completed a site visit to gain a better understanding of the site layout, as well as to make sure that all utilities were accounted for. Appendix E contains the site visit photos.

5.3.1.1 Middle Creek

Initially, the Middle Creek storage area was modeled as a single basin. The storage was then designed outward from the culvert inlet using a 2 percent bottom slope, with side slopes no steeper than 4:1 (horizontal to vertical). The bottom slope of 2 percent allowed for proper drainage of water during an event; however, it did not allow for all available land to be used for storage. In order to increase the volume of storage, two hydraulically connected basins were designed. This allowed storage to expand along Middle Creek with an East Middle Creek and West Middle Creek storage basin as shown on Figure 5-2. Several options for conveying flow between the basins were considered, and culverts were found to be the most cost-effective solution. As refinements were made to the storage basin themselves, consideration was also given to the best method for filling and draining these basins.

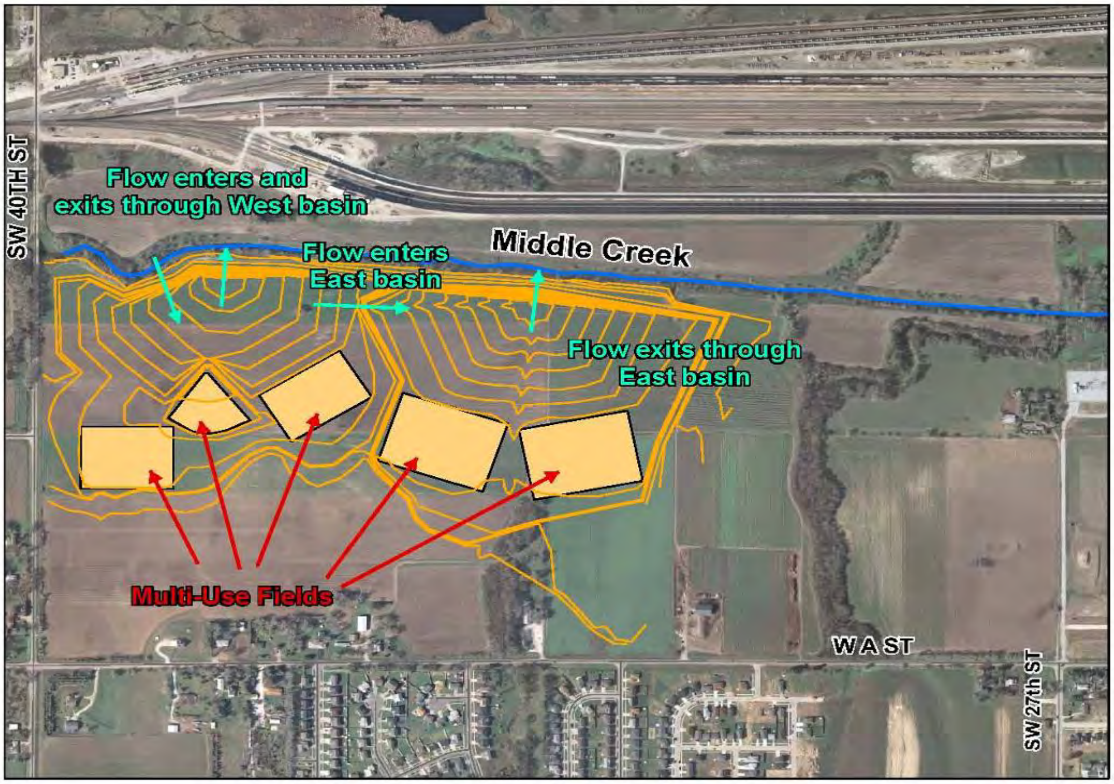

Figure 5-2 Middle Creek Offline Storage Fill and Drain Operation

Initially, weir inlets were modeled to gain an initial understanding of basin function. However, weir inlets did not allow the basin to reach the full storage capacity. Alternatively, gates were modeled for inlet and outlet structures. In the unsteady HEC-RAS model, gates are controlled by water surface elevations. In reality, these gates will be culverts with spring tension flap gates controlled by the pressure head between the creek and the basin. The conceptual design allows for the possibility of the inclusion of five multi-use fields to utilize the site area during dry conditions.

5.3.1.2 Oak Creek -Upstream

The Oak Creek design followed a similar process to that of Middle Creek. The storage was at first designed outward from the culvert inlet using a 2 percent slope for the bottom slope, with side slopes no steeper than 4:1 (horizontal to vertical). The bottom slope of 2 percent allowed for proper drainage of water during an event; however, as with the Middle Creek storage basins, it did not allow for all available land to be used for storage. In order to increase the volume of storage, two hydraulically connected basins were designed as well as a third, separate basin. This allowed storage to expand along Oak Creek, producing a Northwest (NW) upstream Oak Creek storage basin, a Northeast (NE) upstream Oak Creek storage basin, and a South (S) upstream Oak Creek storage basin, as shown in Figure 5-3. Several options for conveying flow between the basins were considered, and culverts were found to be the most cost-effective solution.

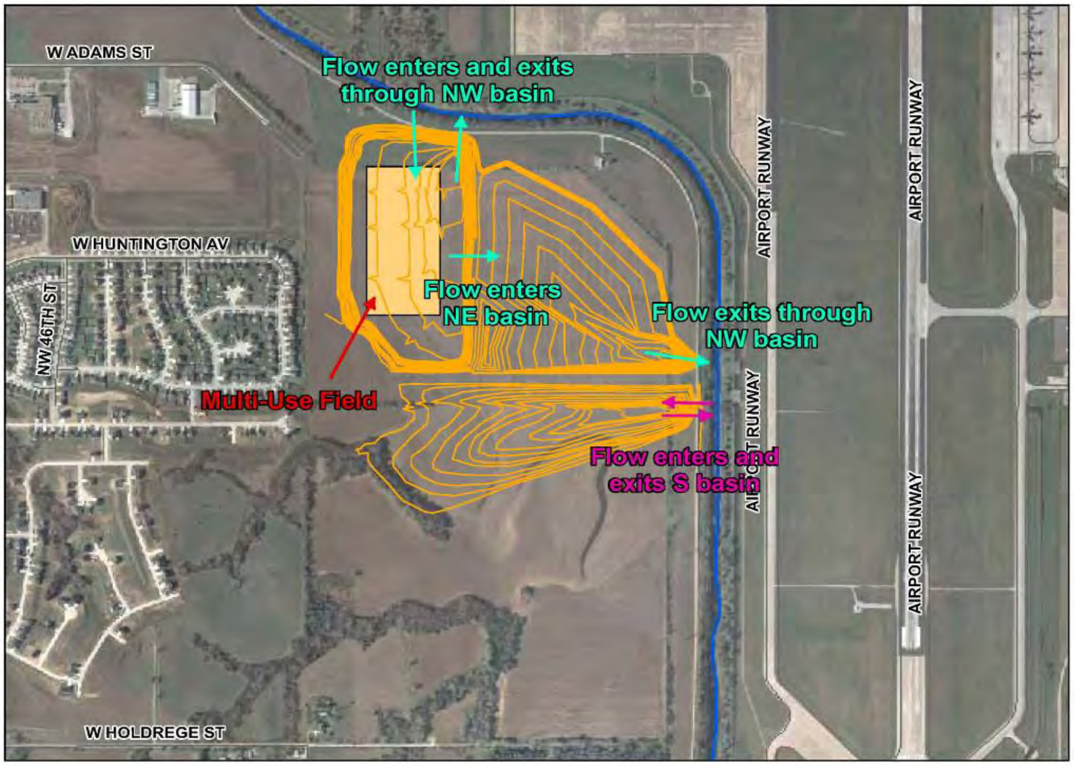

Figure 5-3 Upstream Oak Creek Offline Storage Fill and Drain Operation

The site is currently open space in agricultural production. The site contains above ground powerlines identified during field investigation and by utility maps. The utility maps provided by the LAA are provided in Appendix F. An abandoned radar station is located in the northeast corner of the Oak Creek upstream storage area; however, the Project team was informed that it will be removed in the near future.

5.3.1.3 Oak Creek - Downstream

At the downstream Oak Creek storage area, no additional utilities were discovered. The Project Team recommended that the storage area at this site be expanded compared to the previous design developed by HDR. This expansion created a west basin and an east basin, as shown in Figure 5-4. This was necessary to maximize the flood benefit by providing more storage than previously designed.

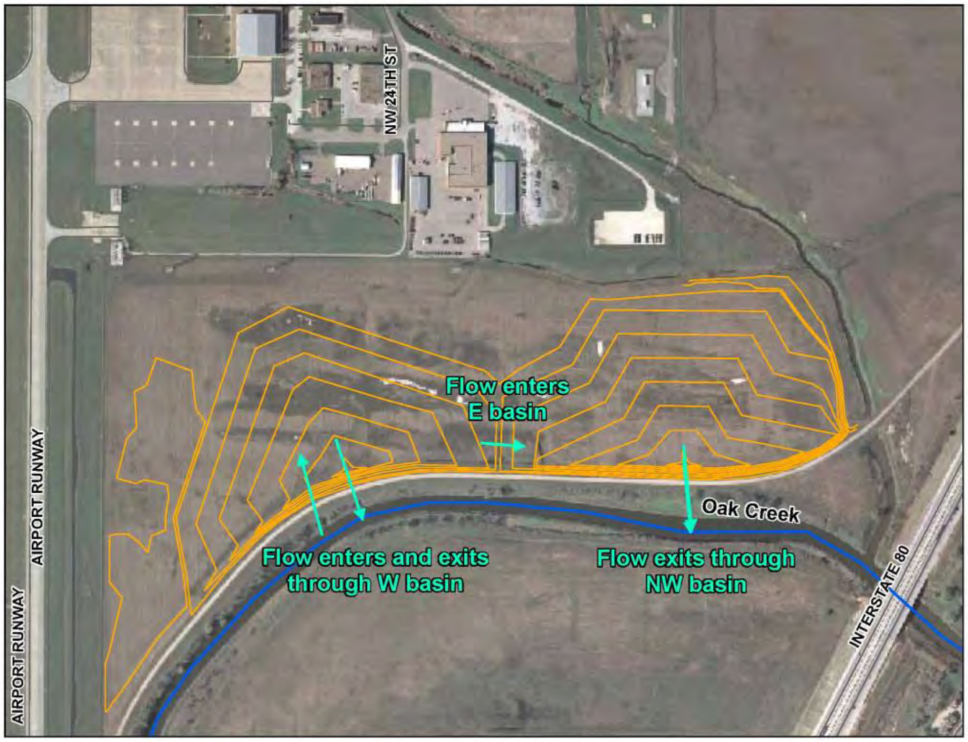

Figure 5-4 Downstream Oak Creek Fill and Drain Operation

5.3.2 Conceptual Design

5.3.2.1 Middle Creek

Based upon the considerations stated in the previous section, the final conceptual design for Middle Creek is shown in Figure 5-2, with additional details provided in Appendix G. The Middle Creek storage area consists of two storage cells, east (E) and west (W), connected by 7 – 3-foot x 4-foot concrete box culverts at an invert elevation of 1,158 feet. The W storage cell is divided such that it has an upper and lower storage area. The City indicated a desire for multi-use fields to be located in the basins so as to more fully utilize the site under dry conditions. These fields were included and designed with a 1 percent slope and underdrains to allow the fields to fully drain after an event. The W storage cell upper storage area includes two multi-use fields and a baseball diamond and drains into the lower storage through a 4-foot corrugated metal pipe (CMP) culvert. From the lower west cell water drains into the E cell and back into Middle Creek. The E storage cell also includes two multi-use fields.

As previously mentioned, ArcMap was used to process TIN data, from which the elevation volume curve was developed. An elevation volume curve describes the relationship between the elevation of the water surface in the basin and the storage volume of the basin at a given elevation. This curve was used as input into the HEC-RAS model and is provided in Table 5-1.

Table 5-1 Middle Creek Offline Storage Elevation Volume Curves

W offline storage		E offline storage	
Elevation	Volume (ac-ft)	Elevation	Volume (ac-ft)
1144	0	1144	0
1146	0	1146	0.2
1148	0.3	1148	2.2
1150	1.9	1150	7.6
1152	6.4	1152	18
1154	16	1154	35
1156	31.7	1156	60.3
1158	56.6	1158	100.6
1160	93.4	1160	163.7
1162	148.7	1162	245.2
1164	222.9	1164	334.1

Inlet and outlet culverts were designed with gates to allow flow from Middle Creek into the basin only after a predetermined head on the gates from the creek had been reached, as shown in Figure 5-5. The gates then closed as the Middle Creek flood wave passed downstream, trapping the water in the basin.

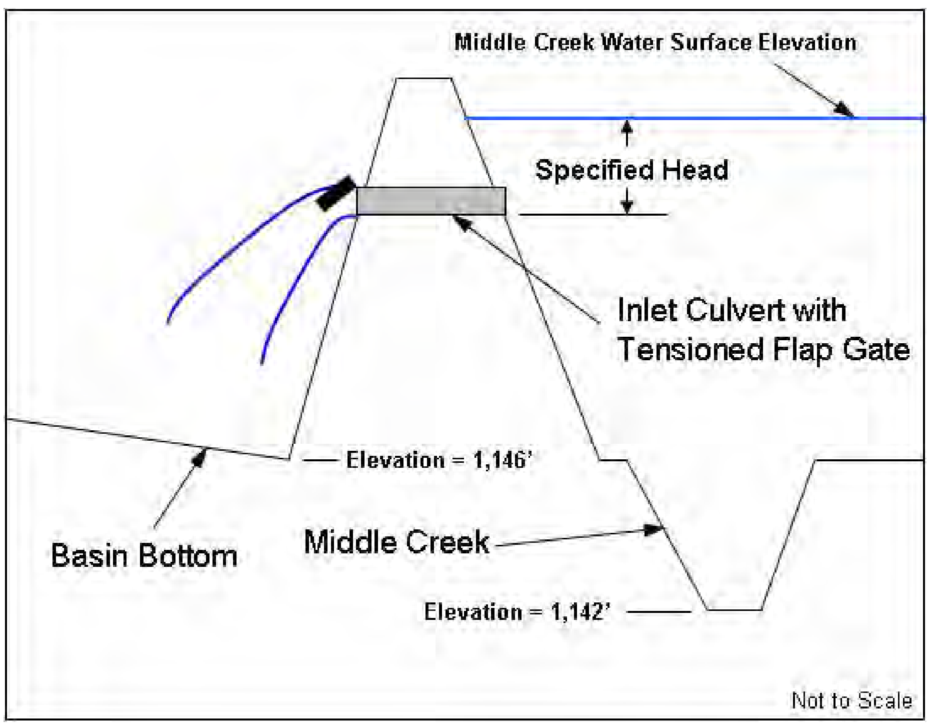

Figure 5-5 Middle Creek Inlet Tension Control

In a similar manner, outlet culverts with tensioned flap gates on the creek side end of the structure were used to control flow out of the storage basin. These were located above the basin bottom elevation to allow the basin to gradually drain as the water surface elevation in Middle Creek recedes, as shown in Figure 5-6.

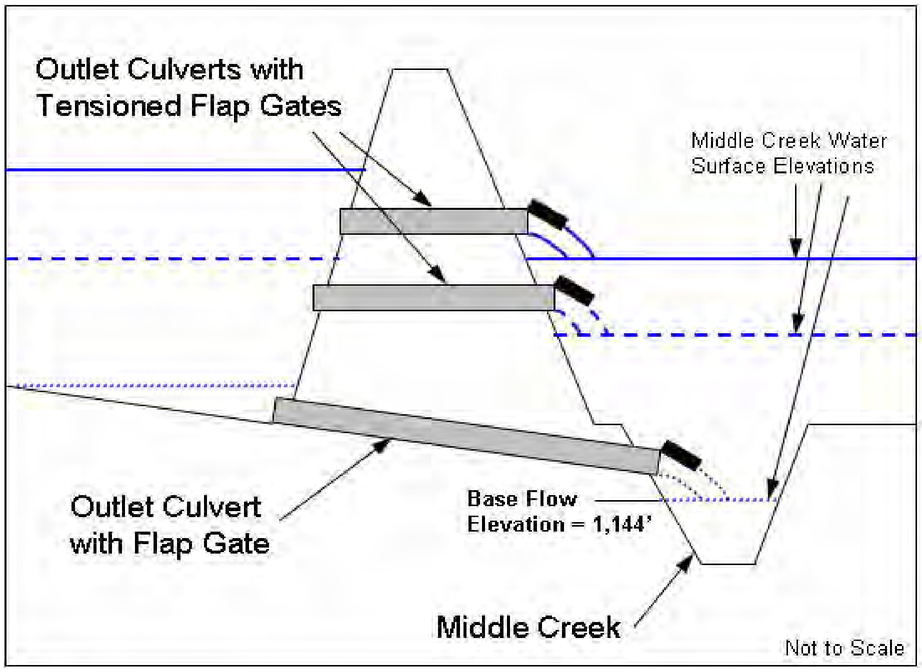

Figure 5-6 Middle Creek Outlet Tension Control

These inlet and outlet culverts were simulated in unsteady HEC-RAS using gates which were opened and closed during the model run at specified Middle Creek water surface elevations. These elevations and gate input data pertinent to Middle Creek are shown in Tables 5-2 and 5-3.

Table 5-2 Middle Creek Modeled Inlet Gates

HEC-RAS Station	Invert (ft)	Number	Height (ft)	Width (ft)	Open Elevation (ft)	Close Elevation (ft)
12900	1162.0	8	4	20	1146.0	1164.0
	1150.0	4	4	10	1146.0	1159.6
12300	1159.0	6	4	15	1146.0	1162.3

Table 5-3 Middle Creek Modeled Outlet Gates

HEC-RAS Station	Invert (ft)	Number	Height (ft)	Width (ft)	Open Elevation (ft)	Close Elevation (ft)
12000	1148.0	1	6	10	1146.0	1147.0
	1154.0	1	6	10	1152.0	1153.0
10400	1148.0	1	6	10	1146.0	1147.0
	1154.0	1	6	10	1152.0	1153.0

The West Middle Creek basin contained inlet gates and outlet gates and culverts, and the East Middle Creek basin contained only outlet gates and culverts. With this design, the West basin fills first, and when the water surface reaches the invert of the culverts between the basins, the East basin begins to fill. This fill and drain operation is shown in Figure 5-2.

Total estimated construction costs associated with the storage basins at the Middle Creek site are given in Table 5-4. A more detailed estimate is given in Appendix H.

Table 5-4 Middle Creek Storage Basins Construction Costs

Property Acquisition=	**$5,160,000**
Construction Subtotal=	**$5,900,000**
General Conditions, Overhead Profit, Insurance, Utility Relocation 28%	$1,652,000
Construction with Percent Allowances Subtotal=	**$7,552,000**
Contingency 20%	$1,510,400
Probable Cost Estimate=	**$9,062,400**
Engineering / Permitting / Survey / Geotech 12%	$1,087,500
Project Subtotal	$10,149,900
Total Conceptual Cost Estimate=	**$15,400,000**

5.3.2.2 Oak Creek Upstream

Optimizing storage on Oak Creek presented some additional challenges. The final conceptual design for Oak Creek is shown in Figure 5-3, and additional detail is provided in Appendix G. The upstream storage area site had the aforementioned utilities running through it. Therefore, this location was divided into three separate storage basins. Two storage cells are located next to each other and are referred to as the northeast (NE) and northwest (NW) basins, while the third basin is south (S) of these.

A relatively large portion of the available upstream storage site was located in the existing FEMA floodway. Due to this floodway encroachment, modeled water surface elevations upstream of the project site were greater than existing water surface elevations. In order to mitigate this problem while maintaining the offline storage benefits, the extent of the NE storage basin was reduced and levees were modeled along Oak Creek from Mathis Street to Interstate 80, as shown in Figure 5-7. The exception to the levee system is just downstream of Mathis Street on the right overbank, where an agricultural field exists that is inundated during large events. The available overbank storage of this floodprone area was assumed in the evaluation of the storage basins, which helped mitigate modifications to the floodway downstream. For modeling purposes, the levees were set to an elevation which allowed 4-feet of freeboard.

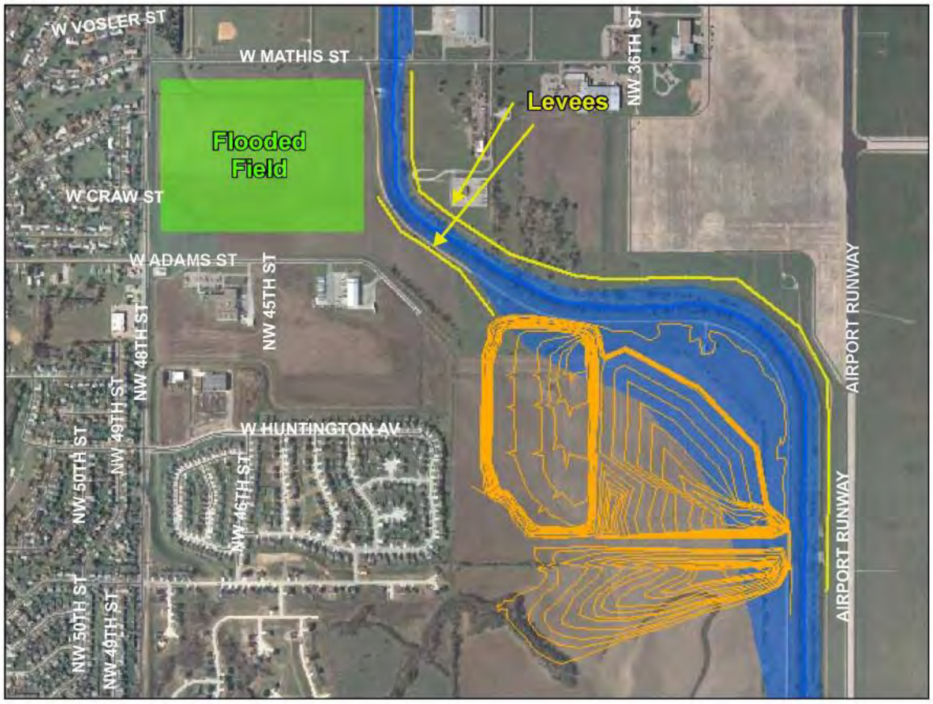

Figure 5-7. Oak Creek Floodway and Conceptual Design

The NE and NW storage cells have a greater storage volume than the S storage cell. The elevation-volume curve for each is shown in Table 5-5.

Table 5-5 Upstream Oak Creek Offline Storage Elevation Volume Curves

Upstream NE offline storage		Upstream NW offline storage		Upstream S offline storage	
Elevation	**Volume (ac-ft)[1]**	**Elevation**	**Volume (ac-ft)**	**Elevation**	**Volume (ac-ft)**
1140	0.0	1140	0.0	1140	0.0
1142	0.1	1142	0.1	1142	0.2
1144	0.5	1144	3.3	1144	2.2
1146	1.1	1146	11.9	1146	5.9
1148	2.0	1148	31.2	1148	11.7
1150	9.9	1150	67.2	1150	21.3
1152	23.5	1152	121.6	1152	36.8
1154	45.6	1154	184.7	1154	58.0
1156	78.5	1156	249.8	1156	84.6
1158	125.0	1158	317.0	1158	118.5
1160	187.8	1160	386.7	1160	161.4
1162	262.1	1162	462.8	1162	216.0
1164	343.3	1164	545.0	1164	288.8

[1] Storage volumes listed below elevation 1,154 feet are available storage values

The NE storage cell fills from the NW storage cell. These storage cells are connected by 3-foot x 4-foot concrete box culverts at elevation 1,154 feet.

Inlet structures included both weirs and culverts with tensioned flap gates, and outlet structures used were culverts with tensioned flap gates. Flap gates were employed on the basin-side end of inlet culverts to control the timing of flow into the storage basin. They were designed as being tensioned flap gates to allow flow from Oak Creek into the basin only after a predetermined head on the gates from the creek had been reached, as shown in Figure 5-8. Conceptual design details are provided in Appendix G. The gates then closed as the Oak Creek flood wave passed downstream, trapping the water in the basin. For unsteady HEC-RAS modeling purposes, complexity of the Oak Creek hydrograph, and in order to fully utilize these storage areas, the culverts were modeled using gates which were opened and closed during the model run at specified Oak Creek water surface elevations, as well as storage area water surface elevations.

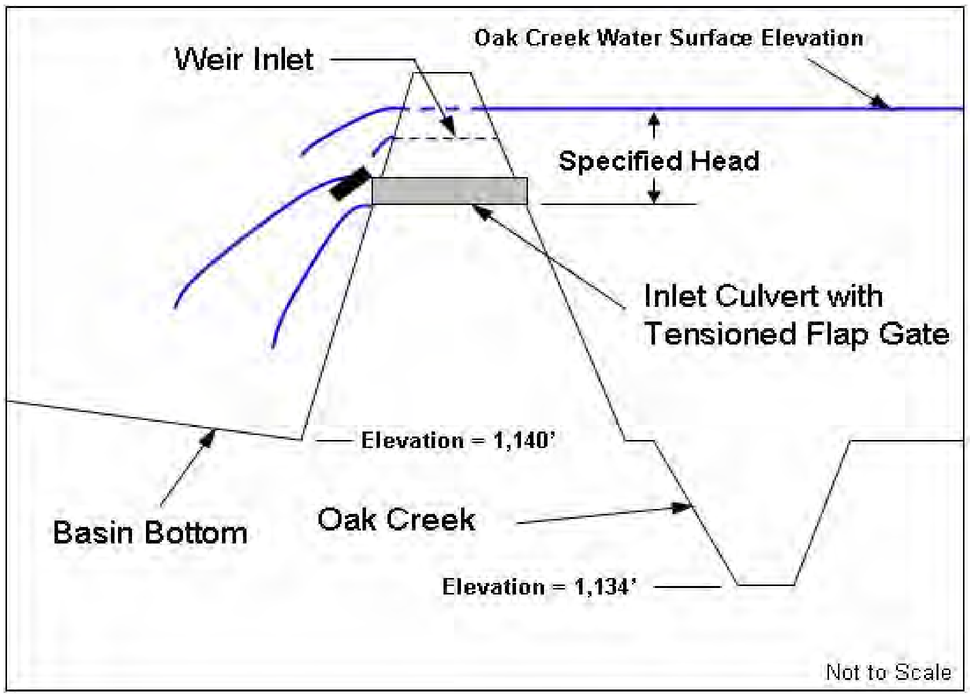

Figure 5-8 Oak Creek Inlet Tension Control

In a similar manner, outlet culverts with tensioned flap gates on the creek side end of the structure were used to control flow out of the storage basin (Figure 5-9).

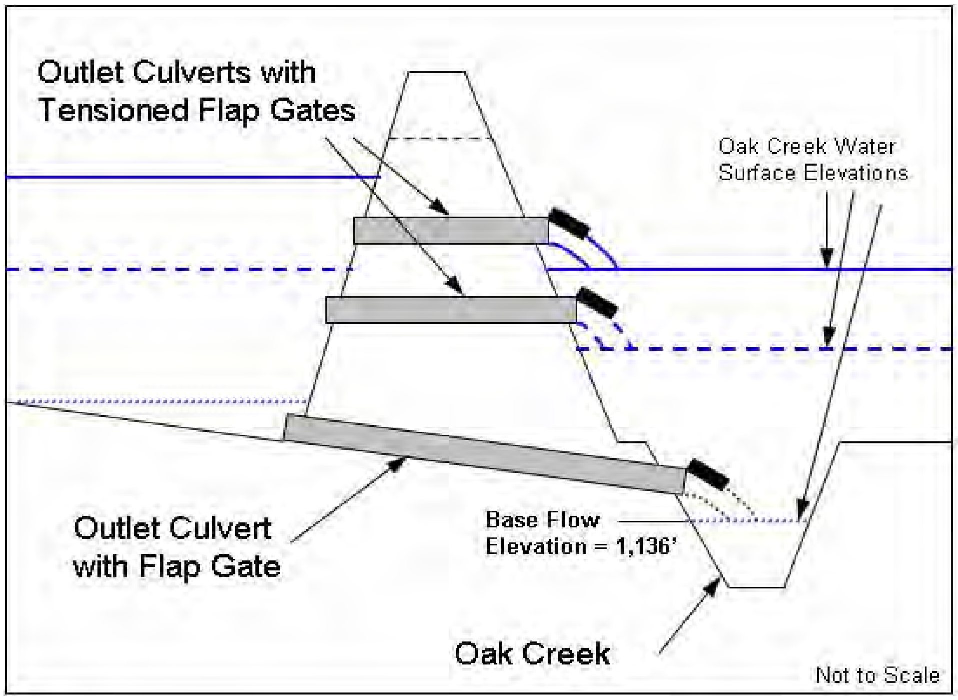

Figure 5-9 Oak Creek Outlet Tension Control

The NW basin has a 150-foot wide weir inlet at invert 1,161 feet and includes inlet gates. The NE and NW storage cells each empty through an outlet gate with an outlet invert of 1,158 feet. The S storage cell fills through a 100-foot inlet weir, as well as inlet gates. This function is show in Figure 5-3. Detailed gate dimensions and inverts used to model the Oak Creek upstream storage area are shown in Tables 5-6 and 5-7. A multi-use field was also included as part of the design in the NW storage area. This field was designed with a 1 percent slope and underdrains to allow the fields to fully drain after an event.

Table 5-6 Oak Creek Upstream Modeled Inlet Gates

HEC-RAS Station	Invert (ft)	Number	Height (ft)	Width (ft)	Open Elevation (ft)	Close Elevation (ft)
30200 (weir 1161 ft)	1158.0	1	2	20	1161.0	1160.5
	1153.0	1	2	20	1160.0	1159.5
25858 (weir 1158 ft)	1157.0	1	1	75	1154.0	1159.0
	1155.5	1	1	30	1150.0	1154.0
	1152.0	1	1	30	1158.1	1187.5
	1138.0	1	2	10	1127.0	1127.5

Table 5-7 Oak Creek Upstream Modeled Outlet Gates

HEC-RAS Station	Invert (ft)	Number	Height (ft)	Width (ft)	Open Elevation (ft)	Close Elevation (ft)
30200	1140.0	1	2	16	1130.0	1130.1
26222	1140.0	1	4	20	1130.0	1131.0
25858	1138.0	1	2	10	1127.0	1127.5

The South basin contained both inlet and outlet gates and operated independently of the North basins. Included in the inlet gate design were gates which allow flow into the basin for the 10-, 50-, and 100-year design storms.

Total estimated construction costs associated with the storage basins at the upstream Oak Creek site are given in Table 5-8. A more detailed estimate is given in Appendix H.

Table 5-8 Oak Creek Upstream Storage Basins Construction Costs

Property Acquisition=	**$3,025,000**
Construction Subtotal=	**$8,744,912**
General Conditions, Overhead Profit, Insurance, Utility Relocation 28%	$2,448,500
Construction with Percent Allowances Subtotal=	**$11,193,412**
Contingency 20%	**$2,238,700**
Probable Cost Estimate=	**$13,432,112**
Engineering / Permitting / Survey / Geotech 12%	**$1,611,800**
Project Subtotal	**$15,043,900**
Total Conceptual Cost Estimate with Property Acquisition =	**$18,200,000**

5.3.2.3 Oak Creek Downstream

The downstream storage area was also divided into two cells, east and west. The elevation volume curves are shown in Table 5-9.

Table 5-9 Downstream Oak Creek Offline Storage Elevation Volume Curves

Downstream West offline storage		Downstream East offline storage	
Elevation	**Volume (ac-ft)**	**Elevation**	**Volume (ac-ft)**
1140	0.0	1140	0.0
1142	0.7	1142	0.8
1144	3.3	1144	4.3
1146	7.7	1146	13.3
1148	16.5	1148	29.5
1150	33.0	1150	53.8
1152	59.0	1152	86.9
1154	95.4	1154	127.7

These offline storage sites are relatively small compared to the upstream sites. The west cell has a 60-foot inlet weir with invert 1151.5 feet and a 60-foot inlet gate. Inlet gate and weir operation is shown in Figure 5-8, and outlet gate operation is shown in Figure 5-9. Basin bottom and base flow water surface elevations for the downstream site are similar to the elevations for the upstream site.

The east cell is filled by flow from the west cell through five 3-foot x 4-foot concrete box culverts. Both cells drain separately through outlet gates. The fill and drain operation is shown in Figure 5-4, and additional detail is provided in Appendix G. Detailed gate dimensions and inverts used to model the Oak Creek downstream storage area are shown in Tables 5-10 and 5-11.

Table 5-10 Oak Creek Downstream Modeled Inlet Gates

HEC-RAS Station	Invert (ft)	Number	Height (ft)	Width (ft)	Open Elevation (ft)	Close Elevation (ft)
17000	1151.5	1	1	60	1151.0	1150.0
	1148.5	1	2	30	1148.5	1151.5
	1147.0	1	1	30	1148.0	1152.0

Table 5-11 Oak Creek Downstream Modeled Outlet Gates

HEC-RAS Station	Invert (ft)	Number	Height (ft)	Width (ft)	Open Elevation (ft)	Close Elevation (ft)
17000	1138.0	1	2	10	1130.0	1131.0
16000	1138.0	1	2	10	1130.5	1131.0

Total estimated construction costs associated with the storage basins at downstream Oak Creek site are given in Table 5-12. A more detailed estimate is given in Appendix H.

Table 5-12 Oak Creek Downstream Storage Basins Construction Costs

Construction Subtotal=	**$2,903,400**
General Conditions, Overhead Profit, Insurance, Utility Relocation 28%	$813,000
Construction with Percent Allowances Subtotal=	**$3,716,400**
Contingency 20%	$743,300
Probable Cost Estimate=	**$4,459,700**
Engineering / Permitting / Survey / Geotech 12%	$535,200
Project Subtotal	$4,994,900
Total Conceptual Cost Estimate=	**$5,000,000**

5.4 Spoils Locations

Due the large amount of excavation necessary, removal and disposal of excess cut (spoils) is one of the biggest costs. The project team identified locations which could store the spoils in close proximity to the offline storage sites. These locations were either government- or Lincoln Airport Authority-owned. They were analyzed by drawing new contours at each site representing maximum feasible fill, based on engineering judgment. Fill elevations were not allowed above one foot of the average maximum height of surrounding roadways. Existing drainage conditions were taken into account, and the resulting contours minimize changes to these conditions.

Shown in Figure 5-10 are the estimated amounts of excess cut from each storage basin, the location of site which could store the excess cut, and the estimated amount of excess cut that each site can store. As shown in Figure 5-10, potential fill sites are available within 1-mile of the excavation sites. This assumption was used in developing the cost estimates that are presented above.

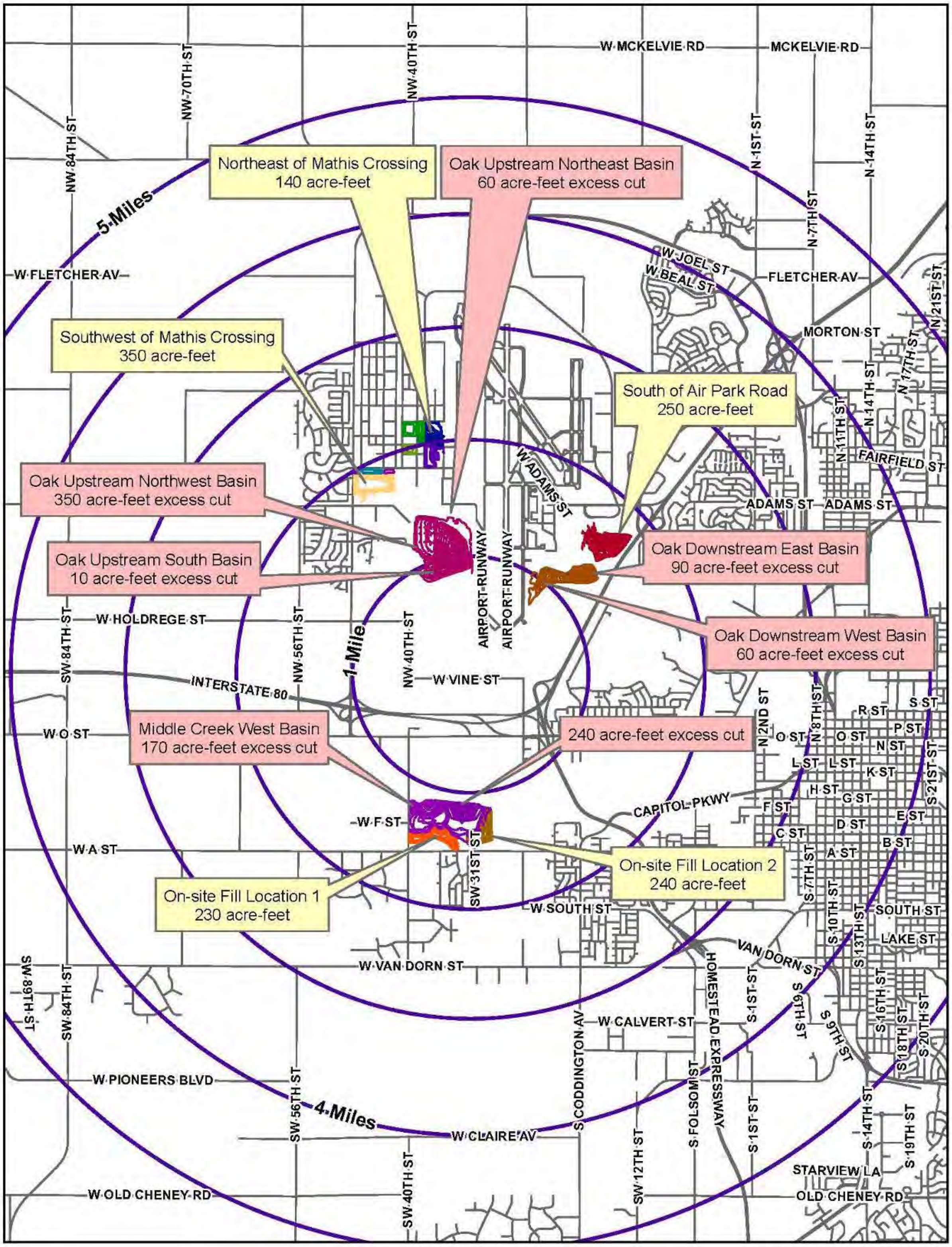

Figure 5-10 Identified Potential Fill Locations

Section 6
Benefit-Cost Analysis

6.1 Introduction

For the preferred storage alternatives, a benefit-cost analysis (BCA) was conducted to evaluate the economic feasibility of implementation. The economic evaluation was conducted using a benefit-cost ratio (BCR) approach based on FEMA procedures.

The FEMA BCR procedure consists of determining whether the cost of the mitigation project today will result in sufficient flood damage reduction in the future to justify the capital investment of the project. If the benefit is determined to be greater than the estimated project cost, then the project is considered justified. However, if the benefit is less than the project cost, then the project is not considered cost-effective. Thus, the BCR, which is calculated by dividing the benefits by the costs, should have a value of 1.0 or greater. The following section describes the process used to perform the FEMA BCR analysis.

6.2 Benefit-Cost Analysis Approach

The methods outlined in the FEMA BCA toolkit can be used for flood hazards by using frequency-damage relationships that are established from the hydraulic modeling, floodplain mapping, and application of GIS toolsets. The benefits for any project can be estimated by determining the amount of reduced damages as a result of constructing the project. The flood damage types are categorized into four main categories, as summarized in Table 6-1.

Table 6-1 Categories of Avoided Damages

<table>
<tr><th>Category</th><th colspan="3">Damage Types</th></tr>
<tr><td>Physical Damages</td><td colspan="2">▪ Buildings
▪ Contents
▪ Infrastructure
▪ Landscaping</td><td>▪ Site Contamination
▪ Vehicles
▪ Equipment
▪ Streambank/bed erosion</td></tr>
<tr><td>Loss-of-Function Costs</td><td colspan="2">▪ Displacement costs for temporary quarters
▪ Loss of rental income
▪ Loss of business income
▪ Lost wages</td><td>▪ Disruption time for residents
▪ Loss of public services
▪ Economic impact of loss of utility services
▪ Economic impact of road/bridge closures</td></tr>
<tr><td>Emergency Management Costs</td><td colspan="2">▪ Flood insurance premiums
▪ Emergency operations center costs
▪ Evacuation or rescue costs
▪ Security costs</td><td>▪ Temporary protective measure costs
▪ Debris removal and cleanup costs
▪ Other management costs</td></tr>
<tr><td>Casualties</td><td>▪ Deaths</td><td>▪ Injuries</td><td>▪ Illnesses</td></tr>
</table>

The majority of losses suffered during a severe flood are physical damages to building structures and their associated interior contents. The process of estimating physical damages is fairly straightforward using automated GIS tools to estimate the severity of flooding associated with the various flood return intervals (i.e., 10-, 50-, and 100-year design storms). Conversely, the process of estimating loss of function, emergency costs, and casualties requires significant economic research, analysis, and assumptions. For this study, the goal was to develop a preliminary BCR based solely on physical damages since the data for this category was readily available, and because the projects are still at conceptual level where detailed economic and emergency management information is not available. In general, for projects with a BCR above 0.75 when assuming only physical damages, it is likely that the final BCR will be above 1.0 after the damages from the other remaining categories (loss of function, emergency costs, and casualties) are estimated. For example, the reduction in flood insurance premiums (emergency management costs), which would occur if the buildings were removed from the floodplain, could be a substantial benefit to the property owners and contribute to an increase in the BCR.

The BCR was based on the total project cost and associated physical damages benefits from the Preferred Alternative.

6.3 Benefit-Cost Ratio Calculation Process

In general, a five-step process is used to calculate the BCR, which is summarized in Table 6-2.

Table 6-2 Benefit-Cost Ratio Procedures

Step	Description
1	The total CIP cost at present value is estimated.
2	Damages under existing conditions are estimated. The total annualized cost at present value is calculated based on the different design storm event frequencies.
3	Damages after implementation of the recommended projects are estimated. The total annualized cost at present value is calculated based on different design storm event frequencies.
4	Benefits are defined as the damage before projects (Step 2) subtracted by the damages after projects (Step 3).
5	BCR is equal to the benefits divided by the project cost (Step 4/Step 5).

The BCR calculation process for the Preferred Alternative using the steps outlined above is discussed on the following pages.

Step 1: Total Capital Improvement Project Cost

The total conceptual cost for the Preferred Alternative as described in Section 5, including five offline storage basins on Oak Creek and two on Middle Creek, with a total estimated cost of $37.8 million. The associated costs for each site are listed in Appendix H.

Steps 2 and 3: Calculation of Flood Damages

The process of estimating flood damages before the project (existing conditions) and after the project is calculated using the same procedures. As discussed above, only physical damages were estimated for this analysis.

Physical damages to buildings, their contents, and streets were calculated as follows:

- The depth of flooding for each individual building structure and street segment was determined separately for the 10-, 50-, and 100-year storm events. The depths were calculated using ArcGIS by applying individual storm frequency depth grids to digitized building structures and street segments. These depths versus flooding depths under existing conditions are given in Appendix I.

- A monetary value for the building was obtained based on Lancaster County assessor information, supplied by the City of Lincoln. The monetary value of contents was assumed to be 30 percent of the total building value. The street replacement monetary value was estimated using $60 per square yard.

- FEMA depth damage curves were applied for buildings (Figure 6-1), contents (Figure 6-2), and streets (Figure 6-3) to obtain a percentage of total value damaged for each respective storm event. The total monetary value was then multiplied by the percentage of damage to obtain a total damage for each individual building, contents, and street segment. The total physical damage for each storm event was calculated as the sum of all individual damages.

- The total annualized cost at present value for the 10-, 50-, and 100-year monetary damages for buildings, contents, and street repairs were calculated.

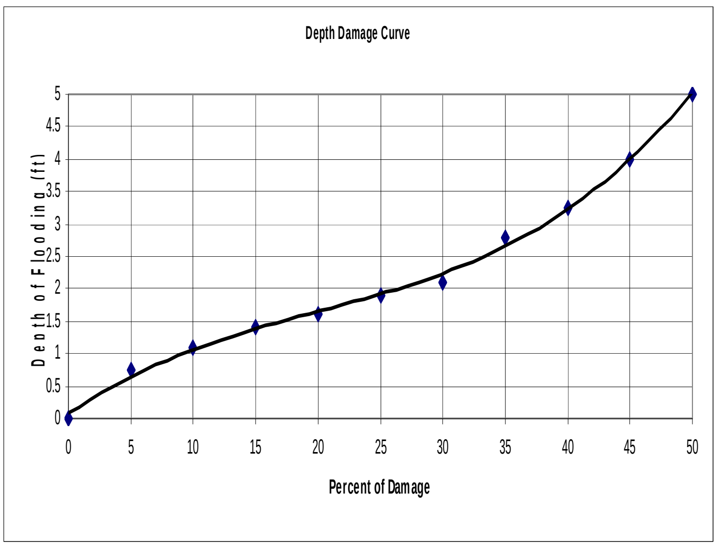

Figure 6-1 FEMA Building Depth-Damage Curve

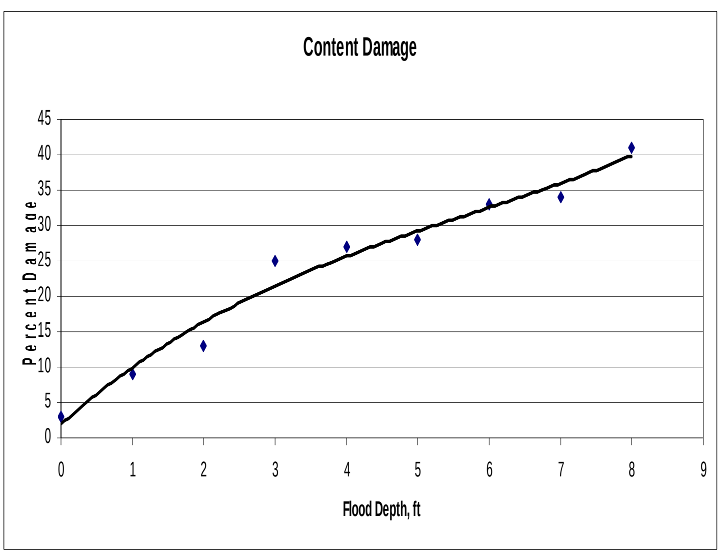

Figure 6-2 FEMA Contents Depth-Damage Curve

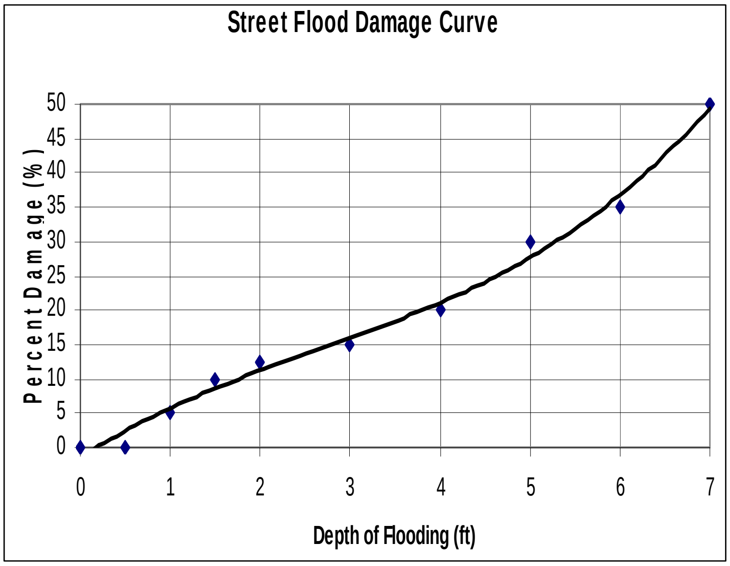

Figure 6-3 Street Flooding Depth-Damage Curve
(Based on previous Lincoln, NE flood damage replacements)

The estimated flood damages before the projects (existing conditions) and after the projects are summarized in Tables 6-3 and 6-4, respectively. The total damages from the 100-year event include damages to the airport estimated in the Oak Creek Levee Study, completed by HWS Consulting Group, Inc. The complete FEMA Benefit-Cost analysis damage forms are provided in Appendix J.

Table 6-3 Total Physical Damages *Before* Projects

Flood Frequency Events (Years)	Buildings	Contents	Streets	Total Damages and Losses
10	$19,000,000	$7,000,000	$400,000	$26,400,000
50	$94,000,000	$39,000,000	$4,000,000	$140,000,000
100	$166,000,000	$64,000,000	$7,000,000	$240,600,000
		Total Annualized Damages		$7,200,000

Table 6-4 Total Physical Damages *After* Projects

Flood Frequency Events (Years)	Buildings	Contents	Streets	Total Damages and Losses
10	$16,000,000	$5,000,000	$300,000	$21,300,000
50	$88,000,000	$33,000,000	$3,000,000	$124,000,000
100	$149,000,000	$60,000,000	$7,000,000	$216,000,000
		Total Annualized Damages		$6,200,000

Step 4: Calculation of Benefits

The benefit is defined as the avoided physical damages after project compared to that of existing conditions. Subtracting the total annualized damages of existing conditions from the total annualized damages after implementing the preferred alternative, the total benefit equals approximately $0.8 million. Before calculating BCR, the benefit must be converted to present value dollars. Using the current Water Resources Institute discount rate of 4 $^{7/8}$ percent and a project life of 50 years, the present value of $0.8 million equals $17.9 million.

Step 5: Calculation of Benefit-Cost Ratio

BCR is calculated by dividing the present value benefit ($17.4 million) with the present value cost ($39.2 million), which equals 0.44.

6.4 Conclusions

In summary, a BCR value of 1.0 or above is desirable to justify the economic feasibility of constructing these large-scale offline storage basins. For the preferred storage alternative a preliminary BCR value of 0.44 was estimated based solely on physical damages. Typically, if the BCR ratio is above 0.75 when only assuming physical damages, then the BCR will exceed 1.0 when the other three categories (loss of function, emergency management, and casualties) are factored into the calculations. Therefore, at this conceptual stage of the project formulation process, the preferred alternative does not appear to be economically viable.

However, the proposed storage basins along Oak Creek may be viable when considering the levee improvements that the Lincoln Airport Authority is considering. Further study is needed, but it appears favorable that excavated material from the storage basins could be used to improve the levee system to meet FEMA standards.

Appendix A

Previous Studies

Section 205 Reports (Location 1 & 2 Storage Area Feasibility Study)

Section 205 Feasibility Study Salt Creek, Lincoln, NE: Problem Identification Phase Documentation, March 1994

Section 205 Feasibility Study Salt Creek, Lincoln, NE: Plan Formulation Phase Evaluations of Structural Alternatives Documentation – USACE Omaha District, July 1996

Studies

Geotechnical Engineering Report – Oak Creek Levee Study Lincoln Municipal Airport Lincoln NE, HWS Consulting Group Inc., December 4, 2006

Ground Penetrating Radar Survey: Salt Creek Levee System Lincoln, NE – Golder Associates, July 1987

Salt Creek Levees at Lincoln, NE Reconnaissance Report – USACE Omaha District, October 1990

Hydrologic Analysis: Salt Creek at Lincoln, NE Feasibility Study Final Draft – USACE Omaha District, October 1993

Salt Creek Feasibility Study Hydraulic Analysis - ?????, December 1993

Middle Creek and Oak Creek Flood Storage Detention Area Pre-Feasibility Study – HWS Consulting Group Inc, January 1996

Salt Creek at Wilderness Park Hydrologic Study – US Army Corps of Engineers (USACE), June 1999

Deadmans Run, Beal Slough, and Salt Creek and Lincoln, NE Floodplain Analyses – USACE, February 2003

Hydraulic Report: Oak Creek Bridge – Speece-Lewis, Inc Consulting Engineers, March 30, 1995.

Salt Creek DFIRM Report – CDM, 2007

Design

Sheet 00c-21 (detention basin northwest of I-80 Oak Creek crossing) of the Contract Documents for Oak Creek Channel Improvements – HDR, June 2004

Design Memorandums on Salt Creek Detention Ponds (Middle Creek and Oak Creek) – transmitted by Scott Franklin, USACE, October 11, 1995

Meetings/Communication

Pre-Council Meeting Minutes for Salt Creek Study, July 17, 1995

Follow-Up Letter to Pre-Council Meeting Minutes – Lincoln City Council, August 3, 1995

Policy/Funding

Nebraska Resources Development Fund Guidelines

Nebraska Resource Development Fund Forms – Official Nebraska Government Website (http://www.dnr.state.ne.us/rdfund/rdfundforms.html)

State of Nebraska Administrative Plan for the Hazard Mitigation Grant Program for FEMA 1674-DR-NE and FEMA 1706-DR-NE Disaster Declarations – Nebraska Emergency Management Agency

Appendix B

Wilderness Park Output

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
266999	1199.6	1200.2	0.7	1208.2	8.7
266811	1199.5	1200.2	0.7	1208.1	8.6
266623	1199.4	1200.1	0.7	1207.9	8.5
266436	1199.3	1200.1	0.7	1207.8	8.4
266248	1199.3	1200.0	0.7	1207.7	8.4
266061	1199.2	1199.9	0.7	1207.5	8.3
265874	1199.2	1199.9	0.7	1207.5	8.2
265683	1199.2	1199.9	0.7	1207.4	8.1
265493	1199.2	1199.9	0.7	1207.3	8.1
265303	1199.2	1199.9	0.7	1207.1	7.9
265113	1199.2	1199.9	0.7	1207.0	7.8
264923	1199.2	1199.9	0.7	1206.8	7.6
264733	1199.2	1199.9	0.7	1206.7	7.5
264543	1199.2	1199.9	0.7	1206.6	7.4
264353	1199.2	1199.8	0.7	1206.5	7.3
264163	1199.2	1199.8	0.7	1206.4	7.3
263973	1199.1	1199.8	0.7	1206.3	7.2
263783	1199.1	1199.8	0.7	1206.2	7.1
263593	1199.1	1199.8	0.7	1206.1	7.0
263404	1199.1	1199.8	0.6	1206.1	6.9
263216	1199.1	1199.8	0.7	1206.0	6.9
263029	1199.1	1199.8	0.7	1206.0	6.9
262841	1199.1	1199.8	0.6	1205.9	6.8
262653	1199.1	1199.7	0.6	1205.9	6.8
262465	1199.1	1199.7	0.6	1205.9	6.8
262278	1199.1	1199.7	0.6	1206.1	7.0
261887	1199.1	1199.7	0.6	1206.1	7.0
261706	1199.1	1199.7	0.6	1205.8	6.8
261526	1199.1	1199.7	0.6	1205.7	6.7
261346	1199.1	1199.7	0.6	1205.7	6.6
261166	1199.0	1199.6	0.6	1205.5	6.5
260985	1199.0	1199.6	0.6	1205.4	6.4
260805	1199.0	1199.6	0.6	1205.3	6.3
260626	1199.0	1199.6	0.5	1205.2	6.1
260439	1199.0	1199.6	0.5	1205.1	6.1
260253	1199.0	1199.5	0.5	1205.0	6.0
260067	1199.0	1199.5	0.5	1204.9	5.9
259881	1199.0	1199.5	0.5	1204.8	5.8
259695	1199.0	1199.4	0.4	1204.7	5.7
259509	1199.0	1199.4	0.4	1204.7	5.7
259323	1199.0	1199.4	0.4	1204.6	5.6
259137	1199.0	1199.4	0.4	1204.5	5.5
258952	1199.0	1199.3	0.4	1204.4	5.4

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
258756	1199.0	1199.2	0.2	1204.4	5.5
258561	1198.9	1199.1	0.2	1204.7	5.8
258471	1196.2	1196.8	0.6	1204.7	8.5
258302	1196.2	1196.8	0.5	1204.3	8.1
258133	1195.9	1196.2	0.3	1203.8	7.9
257941	1196.0	1196.5	0.5	1204.1	8.1
257749	1195.9	1196.3	0.4	1204.0	8.1
257557	1195.7	1195.9	0.2	1203.9	8.1
257365	1195.5	1195.7	0.2	1203.8	8.2
257174	1195.4	1195.8	0.4	1203.6	8.3
256982	1195.2	1195.7	0.5	1203.5	8.3
256790	1195.0	1195.5	0.5	1203.4	8.4
256598	1194.8	1195.4	0.6	1203.3	8.5
256406	1194.6	1195.3	0.7	1203.2	8.6
256214	1194.3	1195.2	0.9	1203.0	8.8
256022	1194.2	1195.0	0.8	1202.9	8.7
255831	1194.0	1194.8	0.8	1202.8	8.8
255635	1193.9	1194.7	0.8	1203.0	9.1
255440	1193.7	1194.6	0.9	1202.9	9.3
255245	1193.5	1194.5	0.9	1202.9	9.4
255049	1193.3	1194.3	1.0	1202.8	9.4
254854	1193.2	1194.2	0.9	1202.7	9.4
254659	1193.1	1194.0	0.9	1202.6	9.5
254463	1192.9	1193.9	0.9	1202.5	9.5
254268	1192.8	1193.7	0.9	1202.4	9.5
254073	1192.7	1193.5	0.9	1202.3	9.6
253877	1192.5	1193.3	0.8	1202.1	9.6
253682	1192.4	1193.2	0.8	1202.0	9.7
253487	1192.2	1193.0	0.7	1201.9	9.7
253291	1192.1	1192.9	0.8	1201.8	9.7
253096	1192.0	1192.7	0.8	1201.7	9.8
252900	1191.9	1192.7	0.8	1201.6	9.7
252706	1191.8	1192.6	0.7	1201.5	9.7
252511	1191.8	1192.6	0.8	1201.5	9.6
252316	1191.8	1192.6	0.8	1201.4	9.6
252122	1191.7	1192.5	0.8	1201.3	9.6
251928	1191.6	1192.4	0.8	1201.2	9.6
251734	1191.6	1192.4	0.8	1201.1	9.6
251540	1191.5	1192.3	0.8	1201.1	9.6
251346	1191.4	1192.2	0.8	1201.0	9.6
251152	1191.3	1192.1	0.8	1200.9	9.6
250957	1191.2	1191.9	0.7	1200.8	9.6
250764	1191.1	1191.8	0.7	1200.7	9.6

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
250569	1191.0	1191.7	0.7	1200.6	9.6
250375	1191.0	1191.6	0.7	1200.6	9.6
250181	1190.9	1191.5	0.6	1200.5	9.6
249987	1190.7	1191.3	0.6	1200.4	9.6
249793	1190.6	1191.2	0.6	1200.3	9.7
249598	1190.5	1191.1	0.5	1200.2	9.7
249405	1190.4	1190.9	0.5	1200.1	9.7
249210	1190.3	1190.7	0.5	1200.0	9.7
249016	1190.2	1190.6	0.4	1199.9	9.8
248822	1190.0	1190.5	0.4	1199.8	9.8
248628	1189.9	1190.3	0.4	1199.7	9.8
248434	1189.8	1190.2	0.4	1199.6	9.9
248240	1189.7	1190.1	0.4	1199.5	9.9
248045	1189.5	1190.0	0.4	1199.4	9.9
247851	1189.4	1189.9	0.5	1199.3	9.9
247658	1189.3	1189.8	0.5	1199.2	10.0
247463	1189.3	1189.8	0.5	1199.1	9.8
247269	1189.2	1189.8	0.6	1199.0	9.8
247074	1189.1	1189.7	0.6	1198.9	9.8
246880	1189.0	1189.6	0.6	1198.8	9.7
246686	1188.9	1189.6	0.6	1198.6	9.7
246492	1188.8	1189.5	0.7	1198.5	9.7
246298	1188.7	1189.4	0.7	1198.4	9.7
246103	1188.6	1189.3	0.7	1198.3	9.7
245909	1188.5	1189.3	0.7	1198.2	9.6
245715	1188.5	1189.2	0.7	1198.1	9.6
245521	1188.4	1189.1	0.7	1198.0	9.6
245327	1188.3	1189.0	0.7	1197.8	9.6
245132	1188.2	1188.9	0.7	1197.7	9.5
244938	1188.1	1188.8	0.7	1197.6	9.5
244744	1188.0	1188.6	0.6	1197.5	9.5
244550	1187.9	1188.6	0.7	1197.4	9.4
244356	1187.9	1188.6	0.7	1197.2	9.4
244161	1187.8	1188.5	0.7	1197.1	9.3
243967	1187.7	1188.4	0.7	1197.0	9.3
243773	1187.7	1188.3	0.7	1196.9	9.2
243579	1187.6	1188.3	0.7	1196.7	9.1
243385	1187.6	1188.2	0.6	1196.6	9.1
243191	1187.5	1188.1	0.6	1196.5	9.0
242996	1187.4	1188.0	0.6	1196.4	8.9
242802	1187.4	1188.0	0.6	1196.2	8.8
242608	1187.4	1187.9	0.6	1196.1	8.7
242414	1187.3	1187.8	0.5	1196.0	8.6

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
242220	1187.3	1187.8	0.5	1195.8	8.5
242025	1187.2	1187.7	0.5	1195.7	8.4
241831	1187.2	1187.6	0.4	1195.5	8.3
241637	1187.2	1187.6	0.4	1195.4	8.2
241443	1187.2	1187.5	0.3	1195.2	8.1
241266	1187.1	1187.4	0.3	1195.1	8.0
241089	1187.0	1187.3	0.3	1194.9	7.9
240912	1186.9	1187.2	0.3	1194.8	7.9
240735	1186.8	1187.1	0.3	1194.6	7.8
240558	1186.7	1187.1	0.4	1194.5	7.8
240382	1186.6	1187.0	0.4	1194.3	7.7
240205	1186.5	1186.9	0.4	1194.1	7.6
240028	1186.5	1186.9	0.4	1194.0	7.5
239836	1186.5	1186.9	0.4	1193.8	7.3
239645	1186.5	1186.9	0.4	1193.7	7.2
239454	1186.4	1186.8	0.4	1193.6	7.2
239262	1186.4	1186.8	0.4	1193.4	7.1
239071	1186.4	1186.8	0.4	1193.3	7.0
238880	1186.3	1186.8	0.5	1193.2	6.9
238688	1186.3	1186.7	0.5	1193.1	6.8
238497	1186.2	1186.7	0.5	1192.9	6.7
238306	1186.2	1186.7	0.5	1192.8	6.6
238114	1186.1	1186.6	0.5	1192.7	6.5
237923	1186.1	1186.6	0.5	1192.5	6.5
237732	1186.0	1186.5	0.5	1192.4	6.4
237541	1186.0	1186.5	0.5	1192.8	6.9
237415	1185.4	1185.7	0.3	1192.8	7.4
237237	1185.5	1185.7	0.3	1192.4	6.9
237060	1185.4	1185.7	0.3	1192.0	6.6
236884	1185.4	1185.6	0.2	1191.7	6.3
236707	1185.3	1185.6	0.3	1191.3	6.0
236555	1185.3	1185.5	0.2	1191.3	6.0
236404	1185.3	1185.5	0.2	1191.2	5.9
236253	1185.3	1185.5	0.2	1191.2	5.9
236058	1185.2	1185.3	0.1	1191.6	6.4
235984	1184.0	1184.7	0.7	1191.6	7.6
235979	1184.0	1184.8	0.7	1191.6	7.6
235970	1184.0	1184.9	0.8	1191.7	7.6
235947	1184.0	1184.9	0.8	1191.7	7.6
235926	1184.0	1184.8	0.7	1191.6	7.6
235883	1184.0	1184.6	0.6	1191.0	7.1
235710	1183.9	1184.5	0.6	1190.9	7.0
235538	1183.7	1184.4	0.6	1190.6	6.9

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
235366	1183.5	1184.1	0.6	1190.3	6.8
235179	1183.4	1184.0	0.5	1190.1	6.6
234992	1183.3	1183.8	0.5	1189.9	6.6
234806	1183.2	1183.7	0.5	1189.7	6.5
234619	1183.0	1183.5	0.5	1189.5	6.5
234433	1182.9	1183.3	0.4	1189.3	6.4
234246	1182.8	1183.2	0.4	1189.2	6.4
234059	1182.6	1183.0	0.4	1189.0	6.4
233873	1182.5	1182.9	0.4	1188.8	6.3
233687	1182.4	1182.7	0.4	1188.7	6.3
233500	1182.2	1182.6	0.4	1188.5	6.3
233313	1182.1	1182.5	0.4	1188.4	6.3
233127	1182.0	1182.4	0.4	1188.3	6.3
232946	1181.8	1182.2	0.4	1188.0	6.2
232765	1181.7	1182.1	0.4	1187.8	6.1
232584	1181.5	1181.9	0.4	1187.6	6.1
232402	1181.3	1181.8	0.5	1187.4	6.1
232221	1181.1	1181.6	0.5	1187.2	6.0
232040	1180.9	1181.5	0.6	1186.9	6.0
231860	1180.7	1181.3	0.6	1186.7	6.0
231667	1180.7	1181.3	0.6	1186.5	5.9
231476	1180.5	1181.2	0.7	1186.4	5.8
231284	1180.4	1181.2	0.7	1186.2	5.8
231092	1180.3	1181.1	0.8	1186.0	5.7
230900	1180.2	1181.0	0.8	1185.9	5.7
230709	1180.1	1181.0	0.9	1185.7	5.6
230516	1180.0	1180.9	0.9	1185.6	5.6
230325	1179.9	1180.7	0.8	1185.4	5.5
230134	1179.9	1180.6	0.8	1185.2	5.4
229941	1179.8	1180.5	0.7	1185.1	5.3
229749	1179.7	1180.4	0.7	1184.9	5.2
229557	1179.6	1180.3	0.7	1184.7	5.2
229365	1179.5	1180.2	0.8	1184.5	5.1
229173	1179.4	1180.1	0.7	1184.4	5.0
228981	1179.3	1180.0	0.7	1184.2	4.9
228789	1179.2	1179.9	0.7	1184.0	4.9
228597	1179.1	1179.8	0.7	1183.8	4.8
228405	1179.0	1179.7	0.7	1183.7	4.7
228213	1178.9	1179.6	0.6	1183.5	4.6
228022	1178.9	1179.4	0.5	1183.3	4.5
227844	1178.9	1179.5	0.6	1183.6	4.8
227668	1178.8	1179.4	0.6	1183.4	4.6
227491	1178.8	1179.3	0.5	1183.2	4.4

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
227315	1178.7	1179.1	0.4	1183.0	4.3
227138	1178.6	1179.0	0.3	1182.8	4.2
226962	1178.6	1178.9	0.3	1182.6	4.1
226786	1178.5	1178.7	0.2	1182.5	4.0
226697	1178.4	1178.7	0.3	1182.4	4.1
226609	1178.3	1178.6	0.3	1182.4	4.1
226520	1178.2	1178.6	0.3	1182.3	4.1
226432	1178.2	1178.5	0.3	1182.2	4.0
226344	1178.1	1178.5	0.3	1182.1	4.0
226255	1178.1	1178.4	0.3	1182.1	4.0
226167	1178.0	1178.3	0.3	1182.0	4.0
226079	1177.9	1178.3	0.4	1181.9	4.0
225990	1177.9	1178.3	0.4	1181.8	4.0
225902	1177.8	1178.2	0.5	1181.7	4.0
225814	1177.7	1178.2	0.5	1181.6	4.0
225725	1177.6	1178.1	0.5	1181.6	3.9
225637	1177.6	1178.1	0.5	1181.5	3.9
225549	1177.5	1178.0	0.5	1181.4	3.9
225460	1177.4	1178.0	0.6	1181.3	3.9
225372	1177.3	1177.9	0.6	1181.2	3.9
225284	1177.2	1177.9	0.6	1181.1	3.9
225196	1177.2	1177.8	0.7	1181.0	3.9
225107	1177.1	1177.8	0.7	1180.9	3.8
225019	1177.0	1177.7	0.7	1180.8	3.8
224931	1176.9	1177.6	0.7	1180.7	3.8
224843	1176.8	1177.5	0.7	1180.6	3.8
224717	1177.2	1177.7	0.6	1181.1	3.9
224593	1177.1	1177.7	0.6	1181.0	3.9
224468	1177.1	1177.6	0.6	1180.9	3.9
224343	1177.0	1177.6	0.6	1180.8	3.8
224218	1177.0	1177.5	0.5	1180.8	3.8
224093	1176.9	1177.4	0.5	1180.7	3.8
223968	1176.8	1177.4	0.5	1180.6	3.8
223844	1176.8	1177.3	0.5	1180.6	3.8
223718	1176.7	1177.2	0.5	1180.5	3.8
223594	1176.7	1177.2	0.5	1180.5	3.8
223469	1176.6	1177.1	0.5	1180.4	3.8
223344	1176.6	1177.0	0.5	1180.4	3.8
223219	1176.5	1177.0	0.5	1180.3	3.8
223094	1176.5	1176.9	0.5	1180.3	3.8
222969	1176.4	1176.9	0.5	1180.2	3.8
222845	1176.4	1176.8	0.5	1180.2	3.8
222719	1176.3	1176.8	0.4	1180.1	3.8

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
222595	1176.3	1176.7	0.4	1180.1	3.8
222470	1176.2	1176.7	0.4	1180.0	3.8
222346	1176.2	1176.6	0.4	1180.0	3.8
222250	1176.3	1176.8	0.5	1180.1	3.8
222156	1176.3	1176.7	0.5	1180.0	3.7
222060	1176.2	1176.7	0.4	1179.9	3.7
221966	1176.2	1176.6	0.4	1179.8	3.6
221871	1176.1	1176.5	0.4	1179.7	3.6
221776	1176.1	1176.5	0.4	1179.6	3.6
221682	1176.0	1176.4	0.4	1179.5	3.5
221587	1175.9	1176.3	0.4	1179.4	3.5
221492	1175.9	1176.2	0.3	1179.3	3.5
221397	1175.8	1176.1	0.3	1179.2	3.4
221303	1175.7	1176.1	0.3	1179.1	3.4
221208	1175.7	1176.0	0.3	1179.0	3.4
221113	1175.6	1175.9	0.3	1178.9	3.3
221019	1175.5	1175.8	0.2	1178.8	3.3
220924	1175.5	1175.6	0.2	1178.7	3.3
220829	1175.4	1175.5	0.1	1178.6	3.2
220735	1175.3	1175.3	0.0	1178.5	3.2
220107	1175.3	1175.3	0.0	1178.5	3.2
220007	1175.1	1175.2	0.0	1178.4	3.3
219907	1175.0	1175.0	0.1	1178.3	3.3
219808	1174.8	1174.9	0.1	1178.2	3.4
219709	1174.7	1174.8	0.2	1178.0	3.4
219609	1174.5	1174.7	0.2	1177.9	3.4
219510	1174.4	1174.6	0.2	1177.8	3.4
219410	1174.2	1174.4	0.2	1177.7	3.5
219311	1174.1	1174.3	0.3	1177.6	3.5
219212	1174.0	1174.2	0.3	1177.5	3.5
219113	1173.8	1174.1	0.3	1177.3	3.5
219014	1173.7	1174.0	0.3	1177.2	3.5
218860	1173.9	1174.2	0.3	1177.7	3.8
218708	1173.6	1173.9	0.3	1177.8	4.2
218591	1173.4	1173.7	0.3	1177.6	4.2
218454	1173.5	1173.8	0.3	1177.4	3.9
218317	1173.3	1173.5	0.3	1176.6	3.3
218140	1173.3	1173.5	0.2	1176.8	3.5
217964	1173.1	1173.4	0.2	1176.6	3.5
217787	1173.0	1173.3	0.3	1176.4	3.4
217612	1172.9	1173.2	0.3	1176.3	3.4
217435	1172.8	1173.0	0.2	1176.1	3.3
217259	1172.6	1172.9	0.2	1175.9	3.3

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
217082	1172.5	1172.7	0.2	1175.8	3.2
216907	1172.5	1172.5	0.1	1175.6	3.2
216730	1172.4	1172.6	0.1	1175.7	3.3
216554	1172.3	1172.5	0.2	1175.6	3.2
216379	1172.2	1172.4	0.2	1175.4	3.2
216202	1172.2	1172.3	0.1	1175.3	3.2
216026	1172.1	1172.2	0.1	1175.2	3.2
215851	1172.0	1172.2	0.2	1175.2	3.2
215709	1171.5	1171.4	0.0	1175.4	3.9
215618	1170.9	1171.1	0.2	1175.1	4.2
215522	1169.4	1169.8	0.4	1175.1	5.7
215408	1169.9	1170.3	0.4	1175.0	5.1
215288	1170.0	1170.4	0.4	1174.4	4.4
215170	1169.6	1170.1	0.5	1174.3	4.7
214982	1169.6	1170.1	0.5	1174.3	4.7
214795	1169.5	1170.0	0.5	1174.2	4.7
214608	1169.4	1169.9	0.6	1174.1	4.7
214421	1169.3	1169.9	0.6	1174.0	4.6
214234	1169.3	1169.9	0.5	1173.8	4.5
214047	1169.3	1169.8	0.5	1173.7	4.4
213860	1169.2	1169.7	0.5	1173.6	4.4
213673	1169.2	1169.6	0.4	1173.5	4.3
213486	1169.2	1169.5	0.3	1173.4	4.2
213299	1169.2	1169.4	0.3	1173.3	4.1
213111	1169.1	1169.3	0.2	1173.2	4.1
212924	1169.0	1169.2	0.2	1173.1	4.1
212738	1168.9	1169.1	0.1	1173.0	4.0
212551	1168.9	1168.9	0.0	1172.9	4.0
212364	1168.8	1168.9	0.0	1172.8	4.0
212177	1168.8	1168.8	0.0	1172.7	3.9
211991	1168.7	1168.7	0.0	1172.6	3.9
211804	1168.6	1168.6	0.0	1172.4	3.8
211618	1168.6	1168.5	0.0	1172.3	3.8
211431	1168.5	1168.4	0.0	1172.2	3.7
211244	1168.4	1168.3	-0.1	1171.9	3.5
211058	1168.3	1168.2	-0.2	1171.7	3.4
210872	1168.3	1168.0	-0.3	1171.3	3.1
210703	1168.2	1168.0	-0.3	1171.3	3.1
210534	1168.0	1167.7	-0.4	1171.6	3.5
210323	1166.0	1166.5	0.5	1171.5	5.5
210169	1165.8	1166.3	0.5	1171.1	5.2
210016	1165.7	1166.2	0.5	1170.8	5.1
209864	1165.6	1166.1	0.5	1170.4	4.8

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
209668	1165.8	1166.3	0.5	1170.5	4.7
209474	1165.7	1166.3	0.5	1170.3	4.6
209280	1165.7	1166.2	0.6	1170.1	4.5
209085	1165.6	1166.2	0.6	1170.0	4.3
208891	1165.5	1166.1	0.6	1169.8	4.2
208696	1165.5	1166.1	0.6	1169.6	4.1
208502	1165.4	1166.0	0.6	1169.4	4.0
208308	1165.3	1166.0	0.7	1169.3	4.0
208113	1165.2	1165.9	0.7	1169.1	3.9
207919	1165.2	1165.9	0.7	1168.9	3.8
207725	1165.1	1165.8	0.7	1168.8	3.7
207530	1165.0	1165.7	0.7	1168.6	3.7
207336	1164.9	1165.6	0.7	1168.5	3.6
207141	1164.8	1165.5	0.7	1168.3	3.5
206947	1164.8	1165.4	0.7	1168.2	3.4
206753	1164.7	1165.3	0.6	1168.0	3.4
206558	1164.6	1165.2	0.6	1167.9	3.3
206364	1164.6	1165.1	0.6	1167.8	3.2
206169	1164.5	1165.0	0.5	1167.6	3.1
205975	1164.4	1164.9	0.4	1167.5	3.0
205781	1164.4	1164.7	0.3	1167.4	3.0
205587	1164.4	1164.6	0.3	1167.2	2.9
205426	1164.4	1164.8	0.4	1167.4	3.0
205267	1164.3	1164.7	0.4	1167.3	3.0
205107	1164.3	1164.6	0.4	1167.1	2.9
204948	1164.2	1164.5	0.3	1167.0	2.8
204752	1164.2	1164.6	0.4	1167.0	2.9
204557	1164.1	1164.5	0.4	1166.9	2.8
204361	1164.0	1164.4	0.4	1166.8	2.8
204166	1163.9	1164.4	0.5	1166.7	2.8
203971	1163.8	1164.3	0.5	1166.6	2.8
203775	1163.6	1164.2	0.6	1166.5	2.9
203580	1163.5	1164.1	0.6	1166.4	2.9
203385	1163.4	1164.0	0.6	1166.4	3.0
203189	1163.2	1163.9	0.6	1166.3	3.1
202994	1163.1	1163.8	0.7	1166.3	3.1
202799	1163.0	1163.7	0.7	1166.2	3.2
202603	1162.9	1163.6	0.7	1166.1	3.3
202408	1162.8	1163.5	0.7	1166.1	3.3
202212	1162.7	1163.4	0.7	1166.0	3.4
202017	1162.6	1163.3	0.7	1166.0	3.4
201822	1162.5	1163.2	0.8	1165.9	3.5
201626	1162.4	1163.1	0.8	1165.9	3.5

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
201431	1162.3	1163.0	0.8	1165.8	3.6
201236	1162.2	1162.9	0.7	1165.8	3.6
201040	1162.1	1162.9	0.7	1165.7	3.6
200845	1162.1	1162.8	0.7	1165.7	3.6
200650	1162.0	1162.7	0.7	1165.6	3.6
200454	1162.0	1162.6	0.6	1165.6	3.6
200259	1161.9	1162.5	0.6	1165.5	3.6
200063	1161.9	1162.4	0.6	1165.5	3.6
199868	1161.8	1162.4	0.5	1165.4	3.6
199673	1161.8	1162.3	0.5	1165.4	3.6
199477	1161.8	1162.2	0.4	1165.3	3.6
199282	1161.7	1162.1	0.4	1165.3	3.5
199087	1161.7	1162.0	0.3	1165.2	3.5
198891	1161.7	1161.9	0.2	1165.2	3.5
198696	1161.7	1161.8	0.1	1165.1	3.4
198501	1161.7	1161.7	0.1	1165.0	3.4
198301	1161.5	1161.4	-0.1	1165.0	3.4
198102	1161.4	1161.2	-0.1	1164.8	3.5
197902	1161.3	1161.2	-0.1	1164.7	3.4
197703	1161.1	1161.1	-0.1	1164.5	3.4
197504	1161.1	1161.1	0.1	1164.4	3.3
197305	1161.0	1161.1	0.1	1164.2	3.2
197105	1161.0	1161.1	0.1	1164.0	3.1
196907	1160.9	1161.0	0.1	1163.8	2.9
196738	1160.7	1160.8	0.1	1163.6	2.9
196570	1160.5	1160.7	0.1	1163.3	2.8
196402	1160.4	1160.5	0.1	1163.0	2.6
196234	1160.4	1160.5	0.1	1162.7	2.4
196067	1160.5	1160.6	0.1	1163.1	2.6
195840	1160.3	1160.4	0.1	1162.9	2.6
195684	1160.0	1160.2	0.2	1162.3	2.3
195528	1160.1	1160.3	0.2	1162.3	2.2
195302	1159.6	1159.8	0.2	1161.8	2.2
195077	1159.3	1159.5	0.2	1161.4	2.1
194853	1159.1	1159.2	0.2	1160.9	1.9
194697	1158.9	1159.1	0.1	1160.9	2.0
194542	1159.0	1159.2	0.2	1161.0	2.1
194388	1159.0	1159.2	0.2	1161.2	2.1
194200	1159.0	1159.2	0.2	1161.2	2.2
194013	1158.9	1159.1	0.2	1161.0	2.2
193826	1158.8	1159.0	0.2	1160.9	2.1
193639	1158.7	1158.9	0.2	1160.7	2.1
193451	1158.5	1158.8	0.3	1160.5	2.0

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
193264	1158.4	1158.7	0.2	1160.3	1.9
193077	1158.3	1158.6	0.2	1160.2	1.8
192890	1158.3	1158.5	0.2	1160.0	1.7
192704	1158.2	1158.4	0.2	1159.8	1.6
192548	1158.2	1158.4	0.1	1159.8	1.6
192393	1157.9	1158.1	0.1	1159.5	1.6
192239	1157.8	1157.9	0.1	1159.2	1.4
192062	1157.7	1157.7	0.1	1159.1	1.5
191886	1157.6	1157.7	0.1	1159.1	1.5
191709	1157.6	1157.7	0.1	1159.1	1.4
191533	1157.6	1157.7	0.1	1159.0	1.4
191357	1157.6	1157.7	0.1	1159.0	1.4
191181	1157.5	1157.6	0.1	1158.8	1.3
191006	1157.5	1157.5	0.0	1158.6	1.2
190831	1157.4	1157.5	0.0	1158.4	1.0
190656	1157.4	1157.4	0.0	1158.2	0.9
190481	1157.4	1157.4	0.0	1158.0	0.6
190330	1157.2	1157.3	0.0	1157.7	0.5
190181	1157.2	1157.2	0.0	1157.6	0.4
190032	1157.2	1157.3	0.0	1157.5	0.3
189882	1157.2	1157.2	0.0	1157.6	0.4
189732	1157.1	1157.2	0.0	1157.6	0.5
189583	1157.2	1157.2	0.0	1157.7	0.5
189251	1156.8	1156.8	0.0	1156.4	-0.4
189060	1156.8	1156.8	0.0	1156.2	-0.6
187598	1156.8	1156.8	0.0	1156.9	0.1
187598	1156.8	1156.8	0.0	1156.9	0.1
187513	1156.9	1156.9	0.0	1157.0	0.1
187426	1156.8	1156.8	0.0	1156.9	0.1
187307	1156.6	1156.6	0.0	1156.7	0.1
187226	1156.5	1156.5	0.0	1156.7	0.1
187145	1156.3	1156.3	0.0	1156.5	0.1
187065	1156.2	1156.2	0.0	1156.4	0.2
186981	1156.1	1156.2	0.0	1156.3	0.2
186898	1156.1	1156.1	0.0	1156.2	0.2
186814	1156.0	1156.0	0.0	1156.2	0.2
186732	1155.9	1155.9	0.0	1156.1	0.2
186641	1155.8	1155.8	0.0	1156.0	0.2
186550	1155.6	1155.7	0.0	1155.8	0.2
186460	1155.5	1155.5	0.0	1155.7	0.2
186369	1155.4	1155.4	0.0	1155.6	0.2
186278	1155.3	1155.3	0.0	1155.5	0.2
186188	1155.2	1155.3	0.0	1155.5	0.2

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
186130	1155.7	1155.7	0.0	1155.9	0.2
186093	1155.6	1155.6	0.0	1155.8	0.2
186060	1155.5	1155.5	0.0	1155.7	0.2
185998	1155.6	1155.6	0.0	1155.7	0.2
185924	1155.4	1155.4	0.0	1155.6	0.2
185850	1155.0	1155.0	0.0	1155.2	0.2
185772	1155.1	1155.2	0.0	1155.4	0.2
185694	1155.1	1155.1	0.0	1155.3	0.2
185616	1155.1	1155.1	0.0	1155.3	0.2
185539	1155.2	1155.2	0.0	1155.4	0.2
185438	1155.1	1155.1	0.0	1155.3	0.2
185339	1155.0	1155.0	0.0	1155.2	0.2
185239	1155.0	1155.0	0.0	1155.2	0.2
185140	1154.9	1154.9	0.0	1155.1	0.2
185040	1154.9	1154.9	0.0	1155.1	0.2
184940	1154.8	1154.9	0.0	1155.1	0.2
184842	1154.8	1154.8	0.0	1155.0	0.2
184743	1154.8	1154.8	0.0	1155.0	0.2
184645	1154.7	1154.7	0.0	1154.9	0.2
184547	1154.7	1154.7	0.0	1154.9	0.2
184449	1154.6	1154.7	0.0	1154.9	0.2
184351	1154.6	1154.6	0.0	1154.8	0.3
184253	1154.6	1154.6	0.0	1154.8	0.2
184155	1154.6	1154.6	0.0	1154.8	0.2
184062	1154.3	1154.3	0.0	1154.6	0.2
183970	1154.2	1154.2	0.0	1154.4	0.3
183878	1154.1	1154.1	0.0	1154.4	0.2
183786	1154.1	1154.1	0.0	1154.3	0.3
183690	1154.0	1154.1	0.0	1154.3	0.2
183595	1154.0	1154.1	0.0	1154.3	0.2
183501	1154.0	1154.1	0.0	1154.3	0.2
183353	1153.7	1153.8	0.0	1154.0	0.2
183263	1153.7	1153.7	0.0	1153.9	0.2
183210	1154.0	1154.0	0.0	1154.2	0.2
183195	1154.0	1154.0	0.0	1154.2	0.2
183176	1154.0	1154.0	0.0	1154.2	0.2
183062	1154.0	1154.0	0.0	1154.2	0.2
182990	1153.9	1153.9	0.0	1154.1	0.2
182917	1153.9	1153.9	0.0	1154.1	0.2
182846	1153.8	1153.8	0.0	1154.0	0.2
182755	1153.7	1153.7	0.0	1153.9	0.2
182664	1153.7	1153.7	0.0	1153.9	0.2
182574	1153.7	1153.7	0.0	1153.9	0.2

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
182484	1153.7	1153.7	0.0	1153.9	0.2
182393	1153.6	1153.7	0.0	1153.9	0.2
182303	1153.6	1153.7	0.0	1153.9	0.2
182212	1153.6	1153.7	0.0	1153.8	0.2
182123	1153.6	1153.7	0.0	1153.8	0.2
182028	1153.6	1153.6	0.0	1153.8	0.2
181934	1153.5	1153.6	0.0	1153.8	0.2
181840	1153.5	1153.5	0.0	1153.7	0.2
181746	1153.5	1153.5	0.0	1153.7	0.2
181653	1153.5	1153.5	0.0	1153.7	0.2
181559	1153.4	1153.4	0.0	1153.6	0.2
181465	1153.4	1153.4	0.0	1153.6	0.2
181371	1153.3	1153.4	0.0	1153.6	0.2
181278	1153.3	1153.3	0.0	1153.5	0.2
181196	1153.3	1153.3	0.0	1153.5	0.2
181116	1153.3	1153.3	0.0	1153.5	0.2
181035	1153.3	1153.3	0.0	1153.5	0.2
180956	1153.3	1153.3	0.0	1153.5	0.2
180876	1153.3	1153.4	0.0	1153.5	0.2
180797	1153.4	1153.4	0.0	1153.6	0.2
180507	1153.3	1153.3	0.0	1153.5	0.2
180507	1153.3	1153.3	0.0	1153.5	0.2
180307	1153.3	1153.3	0.0	1153.5	0.2
180306	1153.3	1153.3	0.0	1153.5	0.2
180240	1152.8	1152.8	0.0	1153.0	0.3
180108	1152.4	1152.5	0.0	1152.7	0.3
180037	1152.7	1152.7	0.0	1152.9	0.3
179894	1152.5	1152.6	0.0	1152.8	0.3
179752	1152.5	1152.6	0.0	1152.8	0.3
179594	1152.5	1152.5	0.0	1152.8	0.3
179437	1152.5	1152.5	0.0	1152.8	0.3
179280	1152.5	1152.5	0.0	1152.7	0.3
179123	1152.5	1152.5	0.0	1152.7	0.3
178955	1152.4	1152.4	0.0	1152.7	0.3
178788	1152.4	1152.4	0.0	1152.6	0.3
178620	1152.4	1152.4	0.1	1152.6	0.3
178453	1152.4	1152.4	0.0	1152.6	0.3
178347	1152.3	1152.4	0.1	1152.6	0.3
178242	1152.3	1152.4	0.1	1152.6	0.3
178057	1152.3	1152.3	0.0	1152.5	0.3
177967	1152.3	1152.3	0.0	1152.5	0.3
177894	1152.2	1152.3	0.0	1152.5	0.3
177856	1152.2	1152.3	0.0	1152.5	0.3

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
177708	1152.1	1152.2	0.0	1152.4	0.3
177558	1152.1	1152.1	0.0	1152.3	0.3
177409	1152.1	1152.1	0.0	1152.3	0.3
177260	1152.1	1152.1	0.0	1152.4	0.3
177088	1152.0	1152.1	0.0	1152.3	0.3
176917	1152.0	1152.0	0.0	1152.2	0.3
176746	1151.9	1152.0	0.0	1152.2	0.3
176575	1151.9	1151.9	0.0	1152.2	0.3
176404	1151.9	1152.0	0.0	1152.2	0.3
176310	1151.9	1152.0	0.0	1152.2	0.3
176217	1151.9	1152.0	0.0	1152.2	0.3
176124	1151.9	1152.0	0.0	1152.2	0.3
176030	1151.9	1152.0	0.0	1152.2	0.3
175937	1151.9	1152.0	0.0	1152.2	0.3
175845	1151.9	1152.0	0.0	1152.2	0.3
175746	1151.9	1151.9	0.0	1152.1	0.3
175649	1152.0	1152.0	0.0	1152.2	0.3
175551	1152.0	1152.0	0.0	1152.2	0.3
175453	1151.9	1152.0	0.0	1152.2	0.3
175356	1151.9	1152.0	0.0	1152.2	0.3
175259	1151.9	1152.0	0.0	1152.2	0.3
175203	1151.6	1151.6	0.0	1151.8	0.3
175192	1151.6	1151.6	0.0	1151.8	0.3
175063	1151.6	1151.6	0.0	1151.9	0.3
175005	1151.5	1151.6	0.0	1151.8	0.3
174947	1151.4	1151.4	0.0	1151.7	0.3
174863	1151.4	1151.4	0.0	1151.6	0.3
174843	1150.8	1150.8	0.0	1151.1	0.3
174823	1150.7	1150.8	0.0	1151.0	0.3
174678	1151.0	1151.0	0.0	1151.3	0.3
174610	1151.0	1151.1	0.0	1151.3	0.3
174543	1151.1	1151.1	0.0	1151.4	0.3
174477	1151.1	1151.2	0.0	1151.4	0.3
174387	1151.1	1151.1	0.0	1151.4	0.3
174297	1151.1	1151.1	0.0	1151.4	0.3
174207	1151.1	1151.1	0.0	1151.3	0.3
174118	1151.0	1151.1	0.0	1151.3	0.3
174041	1151.0	1151.1	0.0	1151.3	0.3
173964	1151.0	1151.0	0.0	1151.3	0.3
173888	1150.9	1151.0	0.0	1151.2	0.3
173812	1150.8	1150.9	0.0	1151.1	0.3
173757	1150.8	1150.9	0.0	1151.1	0.3
173725	1150.8	1150.9	0.0	1151.1	0.3

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
173569	1150.8	1150.8	0.0	1151.1	0.3
173468	1150.7	1150.8	0.0	1151.0	0.3
173368	1150.7	1150.8	0.0	1151.0	0.3
173267	1150.7	1150.8	0.0	1151.0	0.3
173167	1150.7	1150.8	0.0	1151.0	0.3
173067	1150.7	1150.8	0.0	1151.0	0.3
172967	1150.7	1150.7	0.0	1151.0	0.3
172878	1150.7	1150.7	0.0	1150.9	0.3
172790	1150.6	1150.7	0.1	1150.9	0.3
172701	1150.6	1150.6	0.0	1150.9	0.3
172613	1150.5	1150.6	0.0	1150.8	0.3
172450	1150.3	1150.3	0.0	1150.6	0.3
172359	1150.3	1150.3	0.0	1150.6	0.3
172270	1150.3	1150.3	0.0	1150.6	0.3
172180	1150.3	1150.3	0.0	1150.6	0.3
172094	1150.4	1150.4	0.0	1150.7	0.3
172009	1150.4	1150.4	0.0	1150.7	0.3
171923	1150.4	1150.4	0.0	1150.7	0.3
171838	1150.4	1150.4	0.0	1150.7	0.3
171753	1150.4	1150.4	0.0	1150.7	0.3
171676	1150.4	1150.4	0.0	1150.7	0.3
171599	1150.4	1150.4	0.0	1150.7	0.3
171387	1150.3	1150.4	0.0	1150.6	0.3
171274	1150.4	1150.4	0.0	1150.7	0.3
171193	1150.4	1150.4	0.0	1150.7	0.3
171103	1150.3	1150.4	0.0	1150.6	0.3
171013	1150.3	1150.4	0.0	1150.7	0.3
170923	1150.3	1150.4	0.0	1150.7	0.3
170834	1150.4	1150.4	0.0	1150.7	0.3
170742	1150.4	1150.4	0.0	1150.7	0.3
170650	1150.3	1150.4	0.0	1150.7	0.3
170558	1150.3	1150.4	0.0	1150.6	0.3
170466	1150.3	1150.4	0.0	1150.6	0.3
170375	1150.3	1150.4	0.0	1150.6	0.3
170297	1150.3	1150.4	0.0	1150.6	0.3
170221	1150.3	1150.4	0.0	1150.6	0.3
170144	1150.3	1150.4	0.0	1150.6	0.3
170068	1150.3	1150.3	0.0	1150.6	0.3
169969	1150.3	1150.3	0.0	1150.6	0.3
169870	1150.3	1150.3	0.0	1150.6	0.3
169773	1150.3	1150.3	0.0	1150.6	0.3
169487	1150.3	1150.3	0.0	1150.6	0.3
169406	1150.2	1150.3	0.0	1150.5	0.3

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
169326	1150.2	1150.3	0.0	1150.5	0.3
169245	1150.2	1150.3	0.0	1150.5	0.3
169165	1150.2	1150.3	0.0	1150.5	0.3
169073	1150.2	1150.2	0.0	1150.5	0.3
168980	1150.2	1150.2	0.0	1150.5	0.3
168888	1150.2	1150.2	0.0	1150.5	0.3
168795	1150.2	1150.2	0.0	1150.5	0.3
168703	1150.2	1150.2	0.0	1150.5	0.3
168611	1150.2	1150.2	0.0	1150.5	0.3
168513	1150.2	1150.2	0.0	1150.5	0.3
168415	1150.2	1150.2	0.0	1150.5	0.3
168317	1150.1	1150.2	0.0	1150.5	0.3
168220	1150.1	1150.2	0.0	1150.5	0.3
168151	1150.1	1150.2	0.0	1150.5	0.3
168083	1150.1	1150.2	0.1	1150.5	0.3
168014	1150.1	1150.2	0.1	1150.5	0.3
167919	1150.1	1150.1	0.1	1150.4	0.3
167713	1150.1	1150.1	0.1	1150.4	0.3
167613	1150.1	1150.1	0.1	1150.4	0.3
167520	1150.0	1150.1	0.1	1150.4	0.3
167427	1150.0	1150.1	0.1	1150.4	0.3
167334	1150.0	1150.1	0.1	1150.4	0.3
167241	1150.0	1150.1	0.1	1150.4	0.3
167148	1150.0	1150.1	0.1	1150.4	0.3
167074	1150.0	1150.1	0.1	1150.4	0.4
167001	1150.0	1150.1	0.1	1150.4	0.4
166926	1150.0	1150.1	0.1	1150.4	0.4
166852	1150.0	1150.1	0.1	1150.4	0.4
166779	1150.0	1150.1	0.1	1150.4	0.3
166686	1150.0	1150.1	0.1	1150.4	0.3
166594	1150.0	1150.1	0.1	1150.4	0.4
166501	1150.0	1150.1	0.1	1150.3	0.4
166409	1150.0	1150.1	0.1	1150.3	0.3
166204	1149.6	1149.7	0.0	1150.0	0.3
166000	1149.5	1149.6	0.0	1149.8	0.3
165797	1149.3	1149.4	0.0	1149.6	0.3
165601	1149.2	1149.2	0.0	1149.5	0.3
165406	1149.1	1149.2	0.0	1149.4	0.3
165210	1149.1	1149.1	0.0	1149.3	0.3
165015	1149.0	1149.0	0.0	1149.3	0.3
164819	1148.9	1148.9	0.0	1149.2	0.3
164625	1148.8	1148.8	0.0	1149.1	0.3
164442	1148.7	1148.7	0.0	1149.0	0.3

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
164261	1148.6	1148.6	0.0	1148.9	0.3
164079	1148.5	1148.5	0.0	1148.7	0.3
163898	1148.3	1148.4	0.0	1148.6	0.3
163716	1148.2	1148.2	0.0	1148.5	0.3
163524	1148.2	1148.2	0.0	1148.5	0.3
163332	1148.2	1148.2	0.0	1148.5	0.3
163141	1148.2	1148.3	0.0	1148.5	0.3
162959	1148.1	1148.2	0.0	1148.4	0.3
162778	1148.1	1148.2	0.0	1148.4	0.3
162597	1148.2	1148.2	0.0	1148.4	0.3
162496	1148.2	1148.2	0.0	1148.5	0.3
162396	1148.2	1148.2	0.0	1148.5	0.3
162111	1148.0	1148.1	0.0	1148.3	0.3
162024	1148.0	1148.0	0.0	1148.3	0.3
161938	1148.0	1148.0	0.0	1148.2	0.3
161851	1148.0	1148.0	0.0	1148.2	0.3
161764	1148.0	1148.0	0.0	1148.2	0.3
161678	1148.0	1148.0	0.0	1148.2	0.3
161583	1148.0	1148.0	0.0	1148.2	0.3
161488	1148.0	1148.0	0.0	1148.2	0.3
161393	1147.9	1148.0	0.0	1148.2	0.3
161299	1147.9	1147.9	0.0	1148.1	0.3
161206	1147.8	1147.8	0.0	1148.0	0.2
161113	1147.7	1147.8	0.0	1148.0	0.3
161019	1147.7	1147.7	0.0	1147.9	0.3
160927	1147.7	1147.7	0.0	1147.9	0.3
160834	1147.7	1147.7	0.0	1147.9	0.3
160754	1147.7	1147.7	0.0	1147.9	0.3
160675	1147.6	1147.7	0.0	1147.9	0.3
160595	1147.6	1147.7	0.0	1147.9	0.2
160517	1147.6	1147.7	0.0	1147.9	0.2
160147	1147.0	1147.0	0.0	1147.2	0.2
160000	1146.9	1146.9	0.0	1147.1	0.2
159855	1146.8	1146.9	0.0	1147.0	0.2
159709	1146.8	1146.8	0.0	1147.0	0.2
159539	1146.8	1146.9	0.0	1147.0	0.2
159371	1146.8	1146.8	0.0	1147.0	0.2
159202	1146.6	1146.7	0.0	1146.8	0.2
159010	1146.7	1146.8	0.0	1146.9	0.2
158819	1146.6	1146.6	0.0	1146.8	0.2
158628	1146.4	1146.5	0.0	1146.6	0.2
158436	1146.3	1146.3	0.0	1146.5	0.2
158245	1146.1	1146.2	0.0	1146.3	0.2

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
158053	1146.0	1146.0	0.0	1146.2	0.2
157862	1145.9	1145.9	0.0	1146.0	0.2
157671	1145.6	1145.6	0.0	1145.8	0.2
157487	1145.7	1145.7	0.0	1145.9	0.2
157304	1145.5	1145.5	0.0	1145.7	0.2
157121	1145.2	1145.2	0.0	1145.4	0.2
156938	1144.9	1144.9	0.0	1145.1	0.2
156755	1144.6	1144.6	0.0	1144.8	0.2
156573	1143.9	1144.0	0.0	1144.1	0.2
156378	1144.0	1144.1	0.0	1144.2	0.2
156183	1143.5	1143.5	0.0	1143.7	0.2
155989	1143.1	1143.1	0.0	1143.2	0.2
155795	1142.7	1142.7	0.0	1142.8	0.2
155601	1142.4	1142.4	0.0	1142.5	0.1
155414	1142.4	1142.5	0.0	1142.6	0.2
155227	1142.3	1142.3	0.0	1142.4	0.2
155041	1142.0	1142.0	0.0	1142.2	0.1
154942	1142.1	1142.1	0.0	1142.2	0.2
154843	1141.9	1142.0	0.0	1142.1	0.1
154744	1141.8	1141.8	0.0	1141.9	0.1
154645	1141.7	1141.7	0.0	1141.8	0.1
154546	1141.5	1141.5	0.0	1141.6	0.1
154447	1141.3	1141.4	0.0	1141.5	0.1
154348	1141.2	1141.2	0.0	1141.3	0.1
154249	1141.0	1141.0	0.0	1141.1	0.1
154168	1141.1	1141.1	0.0	1141.2	0.1
154087	1141.2	1141.2	0.0	1141.3	0.1
154007	1141.3	1141.3	0.0	1141.4	0.1
153542	1140.8	1140.8	0.0	1140.9	0.1
153377	1140.7	1140.8	0.0	1140.9	0.1
153211	1140.6	1140.6	0.0	1140.7	0.1
153047	1140.5	1140.5	0.0	1140.6	0.1
152882	1140.5	1140.5	0.0	1140.6	0.1
152689	1140.5	1140.5	0.0	1140.6	0.1
152498	1140.6	1140.6	0.0	1140.7	0.1
152305	1140.5	1140.5	0.0	1140.7	0.1
152113	1140.5	1140.5	0.0	1140.6	0.1
151921	1140.4	1140.5	0.0	1140.6	0.1
151729	1140.4	1140.4	0.0	1140.5	0.1
151537	1140.4	1140.4	0.0	1140.5	0.1
151345	1140.3	1140.3	0.0	1140.5	0.1
151157	1140.2	1140.3	0.0	1140.4	0.1
150970	1140.2	1140.2	0.0	1140.3	0.1

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
150783	1140.1	1140.2	0.0	1140.3	0.1
150595	1140.1	1140.1	0.0	1140.2	0.1
150408	1140.1	1140.1	0.0	1140.2	0.1
150221	1140.0	1140.0	0.0	1140.2	0.1
150029	1139.9	1139.9	0.0	1140.0	0.1
149838	1139.8	1139.9	0.0	1140.0	0.1
149647	1139.8	1139.8	0.0	1139.9	0.1
149456	1139.8	1139.8	0.0	1139.9	0.1
149265	1139.8	1139.8	0.0	1139.9	0.1
149080	1139.7	1139.7	0.0	1139.8	0.1
148895	1139.6	1139.6	0.0	1139.8	0.1
148710	1139.6	1139.6	0.0	1139.7	0.1
148525	1139.5	1139.5	0.0	1139.6	0.2
148341	1139.4	1139.5	0.0	1139.6	0.1
148156	1139.4	1139.4	0.0	1139.6	0.2
147971	1139.4	1139.4	0.0	1139.5	0.2
147786	1139.4	1139.4	0.0	1139.5	0.2
147602	1139.3	1139.4	0.0	1139.5	0.2
147006	1139.2	1139.2	0.0	1139.3	0.1
146807	1139.1	1139.1	0.0	1139.3	0.1
146609	1139.1	1139.1	0.0	1139.2	0.1
146410	1139.0	1139.1	0.0	1139.2	0.2
146212	1139.0	1139.0	0.0	1139.2	0.2
146013	1139.0	1139.0	0.0	1139.2	0.2
145815	1139.0	1139.0	0.0	1139.1	0.1
145617	1139.0	1139.1	0.0	1139.2	0.2
143705	1139.0	1139.1	0.0	1139.2	0.2
143608	1139.0	1139.0	0.0	1139.1	0.2
143510	1139.0	1139.0	0.0	1139.1	0.2
143413	1138.9	1138.9	0.0	1139.1	0.2
143316	1138.9	1138.9	0.0	1139.0	0.2
143218	1138.8	1138.8	0.0	1139.0	0.2
143121	1138.8	1138.8	0.0	1138.9	0.2
143024	1138.7	1138.7	0.0	1138.8	0.1
142926	1138.7	1138.7	0.0	1138.8	0.1
142829	1138.6	1138.6	0.0	1138.7	0.1
142732	1138.6	1138.6	0.0	1138.7	0.1
142635	1138.5	1138.5	0.0	1138.7	0.1
142538	1138.5	1138.5	0.0	1138.6	0.1
142440	1138.4	1138.4	0.0	1138.6	0.1
142343	1138.4	1138.4	0.0	1138.5	0.1
142246	1138.3	1138.3	0.0	1138.5	0.1
142149	1138.3	1138.3	0.0	1138.4	0.1

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
142052	1138.2	1138.3	0.0	1138.4	0.1
141954	1138.2	1138.2	0.0	1138.3	0.1
141857	1138.2	1138.2	0.0	1138.3	0.1
141760	1138.1	1138.1	0.0	1138.3	0.1
141662	1138.1	1138.1	0.0	1138.2	0.1
141565	1138.0	1138.0	0.0	1138.2	0.1
141468	1138.0	1138.0	0.0	1138.1	0.1
141370	1137.9	1138.0	0.0	1138.1	0.1
141273	1137.9	1137.9	0.0	1138.0	0.1
141176	1137.8	1137.9	0.0	1138.0	0.1
141079	1137.8	1137.8	0.0	1137.9	0.1
140982	1137.8	1137.8	0.0	1137.9	0.1
140884	1137.7	1137.7	0.0	1137.8	0.1
140787	1137.7	1137.7	0.0	1137.8	0.1
140690	1137.6	1137.6	0.0	1137.7	0.1
140594	1137.6	1137.6	0.0	1137.7	0.1
140499	1137.5	1137.5	0.0	1137.6	0.1
140403	1137.5	1137.5	0.0	1137.6	0.1
140308	1137.4	1137.4	0.0	1137.6	0.1
140212	1137.4	1137.4	0.0	1137.5	0.1
140117	1137.4	1137.4	0.0	1137.5	0.1
140021	1137.3	1137.3	0.0	1137.5	0.1
139926	1137.3	1137.3	0.0	1137.4	0.1
139830	1137.3	1137.3	0.0	1137.4	0.1
139735	1137.3	1137.3	0.0	1137.4	0.1
139640	1137.3	1137.3	0.0	1137.4	0.1
139544	1137.2	1137.2	0.0	1137.4	0.1
139449	1137.2	1137.2	0.0	1137.3	0.1
139354	1137.1	1137.2	0.0	1137.3	0.1
139259	1137.1	1137.1	0.0	1137.2	0.1
139164	1137.1	1137.1	0.0	1137.2	0.1
139069	1137.1	1137.1	0.0	1137.2	0.1
138784	1136.8	1136.8	0.0	1136.9	0.1
138715	1136.7	1136.7	0.0	1136.8	0.1
138645	1136.6	1136.7	0.0	1136.8	0.1
138576	1136.6	1136.6	0.0	1136.7	0.1
138507	1136.6	1136.6	0.0	1136.7	0.1
138437	1136.6	1136.6	0.0	1136.7	0.1
138368	1136.6	1136.6	0.0	1136.7	0.1
138299	1136.6	1136.6	0.0	1136.7	0.1
138230	1136.6	1136.6	0.0	1136.7	0.1
138142	1136.5	1136.5	0.0	1136.6	0.1
138055	1136.4	1136.4	0.0	1136.5	0.1

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
137967	1136.3	1136.3	0.0	1136.4	0.1
137879	1136.2	1136.2	0.0	1136.3	0.1
137792	1136.2	1136.2	0.0	1136.3	0.1
137705	1136.3	1136.3	0.0	1136.4	0.1
137617	1136.2	1136.2	0.0	1136.3	0.1
137285	1136.1	1136.1	0.0	1136.2	0.1
137094	1136.0	1136.0	0.0	1136.1	0.1
136904	1135.9	1135.9	0.0	1136.0	0.1
136714	1135.8	1135.8	0.0	1135.9	0.1
136524	1135.7	1135.8	0.0	1135.8	0.1
136334	1135.7	1135.7	0.0	1135.8	0.1
136144	1135.7	1135.7	0.0	1135.8	0.1
135954	1135.5	1135.6	0.0	1135.7	0.1
135775	1135.5	1135.5	0.0	1135.6	0.1
135597	1135.5	1135.6	0.0	1135.6	0.1
135418	1135.6	1135.6	0.0	1135.7	0.1
135240	1135.5	1135.5	0.0	1135.6	0.1
135061	1135.4	1135.4	0.0	1135.5	0.1
134882	1135.4	1135.4	0.0	1135.5	0.1
134707	1135.3	1135.3	0.0	1135.4	0.1
134531	1135.3	1135.3	0.0	1135.4	0.1
134356	1135.2	1135.3	0.0	1135.4	0.1
134180	1135.2	1135.2	0.0	1135.3	0.1
134005	1135.1	1135.1	0.0	1135.2	0.1
133829	1134.9	1134.9	0.0	1135.0	0.1
133654	1134.8	1134.9	0.0	1135.0	0.1
133478	1134.6	1134.6	0.0	1134.7	0.1
133294	1134.8	1134.8	0.0	1134.9	0.1
133110	1134.7	1134.7	0.0	1134.8	0.1
132927	1134.6	1134.6	0.0	1134.7	0.1
132743	1134.5	1134.5	0.0	1134.6	0.1
132559	1134.4	1134.4	0.0	1134.5	0.1
132398	1134.2	1134.2	0.0	1134.3	0.1
132237	1134.2	1134.2	0.0	1134.3	0.1
131926	1133.1	1133.1	0.0	1133.2	0.1
131734	1133.0	1133.0	0.0	1133.0	0.1
131543	1132.8	1132.8	0.0	1132.9	0.1
131352	1133.0	1133.0	0.0	1133.0	0.1
131161	1132.9	1132.9	0.0	1133.0	0.1
130970	1132.8	1132.8	0.0	1132.9	0.1
130776	1132.7	1132.7	0.0	1132.8	0.1
130583	1132.6	1132.6	0.0	1132.7	0.1
130390	1132.5	1132.5	0.0	1132.6	0.1

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
130197	1132.4	1132.4	0.0	1132.5	0.1
130004	1132.3	1132.3	0.0	1132.4	0.1
129811	1132.2	1132.2	0.0	1132.3	0.1
129618	1132.0	1132.0	0.0	1132.1	0.1
129426	1131.9	1131.9	0.0	1132.0	0.1
129232	1131.8	1131.8	0.0	1131.9	0.1
129039	1131.7	1131.7	0.0	1131.8	0.1
128846	1131.6	1131.6	0.0	1131.7	0.1
128653	1131.5	1131.5	0.0	1131.6	0.1
128460	1131.4	1131.4	0.0	1131.5	0.1
128267	1131.3	1131.3	0.0	1131.4	0.1
128074	1131.2	1131.2	0.0	1131.3	0.1
127881	1131.1	1131.1	0.0	1131.2	0.1
127688	1131.0	1131.0	0.0	1131.1	0.1
127496	1131.0	1131.0	0.0	1131.0	0.1
127315	1130.3	1130.3	0.0	1130.3	0.1
127135	1130.1	1130.1	0.0	1130.2	0.1
126955	1130.0	1130.0	0.0	1130.1	0.1
126775	1129.9	1129.9	0.0	1130.0	0.1
126594	1129.8	1129.8	0.0	1129.9	0.1
126414	1129.7	1129.7	0.0	1129.8	0.1
126234	1129.6	1129.6	0.0	1129.7	0.1
126054	1129.6	1129.6	0.0	1129.7	0.1
125875	1129.6	1129.6	0.0	1129.7	0.1
125695	1129.5	1129.5	0.0	1129.6	0.1
125515	1129.3	1129.4	0.0	1129.4	0.1
125336	1129.2	1129.2	0.0	1129.3	0.1
125156	1129.1	1129.1	0.0	1129.2	0.1
124977	1129.0	1129.0	0.0	1129.1	0.1
124882	1128.9	1128.9	0.0	1129.0	0.1
124761	1127.9	1127.9	0.0	1128.0	0.1
124607	1127.4	1127.4	0.0	1127.5	0.0
124454	1127.1	1127.1	0.0	1127.2	0.0
124301	1126.9	1126.9	0.0	1127.0	0.0
124103	1126.4	1126.4	0.0	1126.5	0.0
123909	1126.1	1126.1	0.0	1126.1	0.0
123716	1126.3	1126.3	0.0	1126.3	0.0
123522	1126.0	1126.0	0.0	1126.0	0.0
123330	1126.4	1126.4	0.0	1126.5	0.0
123218	1125.8	1125.8	0.0	1125.9	0.0
123108	1126.0	1126.0	0.0	1126.0	0.0
123056	1125.1	1125.1	0.0	1125.1	0.0
122926	1124.7	1124.7	0.0	1124.8	0.0

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
122818	1125.5	1125.5	0.0	1125.5	0.0
122627	1125.8	1125.8	0.0	1125.8	0.0
122437	1125.8	1125.8	0.0	1125.9	0.0
122247	1125.7	1125.7	0.0	1125.8	0.0
122063	1125.7	1125.7	0.0	1125.8	0.0
121883	1125.6	1125.6	0.0	1125.6	0.0
121704	1125.4	1125.4	0.0	1125.4	0.0
121524	1125.2	1125.2	0.0	1125.2	0.0
121344	1125.0	1125.0	0.0	1125.0	0.0
121164	1124.8	1124.8	0.0	1124.8	0.0
120985	1124.6	1124.6	0.0	1124.6	0.0
120806	1124.3	1124.3	0.0	1124.3	0.0
120616	1124.3	1124.3	0.0	1124.3	0.0
120427	1124.2	1124.2	0.0	1124.3	0.0
120239	1124.2	1124.2	0.0	1124.2	0.0
120050	1124.1	1124.1	0.0	1124.1	0.0
119861	1124.3	1124.3	0.0	1124.3	0.0
119672	1124.2	1124.2	0.0	1124.3	0.0
119483	1124.2	1124.2	0.0	1124.2	0.0
119294	1124.1	1124.1	0.0	1124.2	0.0
119106	1124.1	1124.1	0.0	1124.1	0.0
118922	1124.0	1124.0	0.0	1124.0	0.0
118739	1123.8	1123.8	0.0	1123.8	0.0
118556	1123.6	1123.6	0.0	1123.6	0.1
118372	1123.4	1123.4	0.0	1123.4	0.1
118189	1123.2	1123.2	0.0	1123.3	0.0
118005	1123.0	1123.0	0.0	1123.1	0.1
117823	1122.9	1122.9	0.0	1122.9	0.1
117696	1123.1	1123.1	0.0	1123.2	0.0
117624	1123.0	1123.0	0.0	1123.1	0.0
117600	1123.0	1123.0	0.0	1123.0	0.0
117580	1123.0	1123.0	0.0	1123.0	0.0
117492	1123.0	1123.0	0.0	1123.0	0.0
117231	1123.0	1123.0	0.0	1123.0	0.0
117043	1122.9	1122.9	0.0	1122.9	0.0
116856	1122.8	1122.8	0.0	1122.8	0.0
116669	1122.7	1122.7	0.0	1122.7	0.0
116481	1122.6	1122.6	0.0	1122.7	0.0
116294	1122.6	1122.6	0.0	1122.6	0.0
116106	1122.5	1122.5	0.0	1122.6	0.0
115919	1122.5	1122.5	0.0	1122.5	0.0
115732	1122.4	1122.4	0.0	1122.4	0.0
115536	1122.3	1122.3	0.0	1122.3	0.0

HEC-RAS Station	Salt Creek DFIRM Maximum Stage (ft)	Scenario 1 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 1 & DFIRM (ft)	Scenario 2 Maximum Water Surface Elevation (ft)	Elevation Difference between Scenario 2 & DFIRM (ft)
115341	1122.2	1122.2	0.0	1122.2	0.0
115145	1122.1	1122.1	0.0	1122.1	0.0
114950	1122.0	1122.0	0.0	1122.1	0.0
114755	1122.0	1122.0	0.0	1122.0	0.0

Average Increase:	0.0		2.6
Max Increase:	0.1		10.0

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
266999	14375	14375	0.00%	14375.0	0.00%
266811	14374	14372	-0.01%	14374.7	0.00%
266623	14373	14367	-0.04%	14374.5	0.01%
266436	14372	14363	-0.06%	14374.3	0.02%
266248	14370	14360	-0.07%	14374.1	0.03%
266061	14368	14356	-0.09%	14373.9	0.04%
265874	14368	14352	-0.11%	14373.7	0.04%
265683	14370	14349	-0.14%	14374.7	0.04%
265493	14371	14346	-0.18%	14375.6	0.03%
265303	14372	14343	-0.20%	14376.5	0.03%
265113	14373	14341	-0.23%	14377.5	0.03%
264923	14374	14337	-0.26%	14378.5	0.03%
264733	14376	14335	-0.28%	14379.5	0.03%
264543	14377	14334	-0.30%	14380.5	0.03%
264353	14377	14330	-0.33%	14381.5	0.03%
264163	14379	14328	-0.35%	14382.5	0.02%
263973	14380	14325	-0.38%	14383.5	0.03%
263783	14380	14323	-0.40%	14384.4	0.03%
263593	14380	14320	-0.42%	14385.3	0.03%
263404	14380	14318	-0.43%	14386.2	0.04%
263216	14381	14317	-0.45%	14387.1	0.04%
263029	14382	14318	-0.45%	14388.0	0.04%
262841	14383	14318	-0.45%	14388.8	0.04%
262653	14383	14319	-0.45%	14389.7	0.04%
262465	14384	14320	-0.44%	14390.6	0.05%
262278	14384	14321	-0.44%	14391.4	0.05%
261887	14384	14321	-0.44%	14391.4	0.05%
261706	14386	14323	-0.44%	14391.6	0.04%
261526	14387	14324	-0.44%	14392.4	0.04%
261346	14389	14324	-0.45%	14393.2	0.03%
261166	14391	14325	-0.46%	14394.0	0.02%
260985	14393	14326	-0.47%	14394.8	0.01%
260805	14394	14326	-0.47%	14395.7	0.01%
260626	14395	14326	-0.48%	14396.5	0.01%
260439	14397	14326	-0.49%	14396.3	0.00%
260253	14397	14325	-0.50%	14396.1	0.00%
260067	14396	14324	-0.50%	14396.0	0.00%
259881	14397	14324	-0.50%	14395.8	-0.01%
259695	14397	14323	-0.52%	14395.6	-0.01%
259509	14399	14322	-0.53%	14395.4	-0.02%
259323	14399	14321	-0.54%	14395.2	-0.02%
259137	14399	14321	-0.54%	14395.1	-0.02%
258952	14399	14321	-0.55%	14395.0	-0.03%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
258756	14401	14321	-0.56%	14394.8	-0.04%
258561	14401	14321	-0.56%	14393.9	-0.05%
258471	14401	14321	-0.56%	14393.9	-0.05%
258302	14401	14320	-0.56%	14393.2	-0.05%
258133	14400	14319	-0.56%	14392.9	-0.05%
257941	14399	14319	-0.56%	14392.8	-0.04%
257749	14398	14318	-0.56%	14392.6	-0.04%
257557	14398	14317	-0.56%	14392.4	-0.04%
257365	14397	14316	-0.56%	14392.3	-0.03%
257174	14397	14315	-0.57%	14392.2	-0.03%
256982	14396	14314	-0.57%	14392.0	-0.03%
256790	14396	14313	-0.57%	14391.9	-0.03%
256598	14396	14312	-0.58%	14391.8	-0.03%
256406	14395	14311	-0.58%	14391.6	-0.02%
256214	14394	14310	-0.59%	14391.4	-0.02%
256022	14394	14309	-0.59%	14391.2	-0.02%
255831	14393	14307	-0.59%	14391.1	-0.01%
255635	14392	14306	-0.60%	14390.9	-0.01%
255440	14392	14305	-0.60%	14390.8	-0.01%
255245	14391	14304	-0.61%	14390.6	0.00%
255049	14390	14302	-0.61%	14390.4	0.00%
254854	14389	14302	-0.61%	14390.2	0.01%
254659	14388	14301	-0.61%	14390.2	0.01%
254463	14388	14300	-0.61%	14390.1	0.02%
254268	14387	14299	-0.62%	14389.9	0.02%
254073	14387	14297	-0.62%	14389.8	0.02%
253877	14386	14296	-0.62%	14389.7	0.03%
253682	14384	14295	-0.62%	14389.5	0.03%
253487	14384	14294	-0.63%	14389.3	0.04%
253291	14383	14293	-0.63%	14389.1	0.04%
253096	14382	14292	-0.63%	14389.0	0.05%
252900	14380	14290	-0.63%	14388.8	0.06%
252706	14379	14289	-0.63%	14388.6	0.07%
252511	14378	14288	-0.63%	14388.5	0.07%
252316	14377	14287	-0.63%	14388.4	0.08%
252122	14377	14287	-0.63%	14388.3	0.08%
251928	14376	14285	-0.63%	14388.2	0.08%
251734	14375	14284	-0.63%	14388.2	0.09%
251540	14374	14283	-0.63%	14388.1	0.10%
251346	14373	14283	-0.63%	14388.0	0.10%
251152	14372	14282	-0.63%	14387.9	0.11%
250957	14371	14281	-0.63%	14387.7	0.12%
250764	14370	14279	-0.63%	14387.5	0.12%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
250569	14369	14278	-0.64%	14387.4	0.13%
250375	14368	14277	-0.64%	14387.4	0.13%
250181	14367	14275	-0.64%	14387.3	0.14%
249987	14366	14274	-0.64%	14387.3	0.15%
249793	14365	14273	-0.64%	14387.1	0.15%
249598	14364	14272	-0.64%	14387.0	0.16%
249405	14363	14271	-0.64%	14386.9	0.17%
249210	14362	14270	-0.64%	14386.8	0.17%
249016	14361	14269	-0.65%	14386.8	0.18%
248822	14360	14267	-0.65%	14386.7	0.19%
248628	14359	14266	-0.65%	14386.7	0.19%
248434	14358	14264	-0.65%	14386.6	0.20%
248240	14357	14263	-0.65%	14386.5	0.21%
248045	14356	14262	-0.65%	14386.5	0.21%
247851	14355	14261	-0.65%	14386.4	0.22%
247658	14354	14261	-0.65%	14386.3	0.22%
247463	14467	14365	-0.70%	14498.0	0.22%
247269	14465	14364	-0.70%	14497.8	0.23%
247074	14464	14362	-0.70%	14497.7	0.23%
246880	14463	14361	-0.71%	14497.6	0.24%
246686	14462	14360	-0.70%	14497.5	0.25%
246492	14460	14359	-0.70%	14497.3	0.26%
246298	14459	14357	-0.71%	14497.2	0.27%
246103	14457	14355	-0.71%	14497.1	0.27%
245909	14456	14353	-0.71%	14496.9	0.28%
245715	14455	14352	-0.71%	14496.7	0.29%
245521	14454	14350	-0.72%	14496.6	0.30%
245327	14452	14349	-0.72%	14496.6	0.31%
245132	14452	14348	-0.72%	14496.4	0.31%
244938	14451	14346	-0.72%	14496.2	0.32%
244744	14450	14345	-0.73%	14496.1	0.32%
244550	14449	14343	-0.74%	14495.9	0.32%
244356	14449	14341	-0.74%	14495.9	0.33%
244161	14448	14339	-0.75%	14495.8	0.33%
243967	14448	14339	-0.75%	14495.7	0.33%
243773	14447	14337	-0.76%	14495.6	0.34%
243579	14446	14335	-0.77%	14495.5	0.34%
243385	14445	14334	-0.77%	14495.4	0.35%
243191	14444	14333	-0.77%	14495.3	0.35%
242996	14443	14331	-0.78%	14495.2	0.36%
242802	14442	14330	-0.78%	14495.1	0.37%
242608	14442	14328	-0.79%	14495.0	0.37%
242414	14441	14327	-0.79%	14494.8	0.37%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
242220	14441	14326	-0.80%	14494.7	0.37%
242025	14441	14325	-0.81%	14494.7	0.37%
241831	14440	14323	-0.81%	14494.6	0.37%
241637	14440	14321	-0.82%	14494.4	0.38%
241443	14439	14319	-0.83%	14494.2	0.38%
241266	14439	14317	-0.84%	14494.0	0.38%
241089	14438	14316	-0.84%	14493.9	0.39%
240912	14437	14314	-0.85%	14493.8	0.39%
240735	14436	14312	-0.86%	14493.8	0.40%
240558	14434	14310	-0.86%	14493.6	0.41%
240382	14434	14308	-0.87%	14493.5	0.41%
240205	14433	14306	-0.88%	14493.4	0.42%
240028	14433	14306	-0.88%	14493.3	0.42%
239836	14495	14367	-0.88%	14559.4	0.44%
239645	14494	14367	-0.88%	14559.3	0.45%
239454	14494	14367	-0.87%	14559.2	0.45%
239262	14494	14367	-0.88%	14559.1	0.45%
239071	14494	14365	-0.89%	14559.0	0.45%
238880	14494	14364	-0.89%	14558.9	0.45%
238688	14493	14363	-0.90%	14558.8	0.45%
238497	14493	14362	-0.90%	14558.6	0.45%
238306	14493	14361	-0.91%	14558.5	0.45%
238114	14492	14361	-0.91%	14558.4	0.46%
237923	14492	14360	-0.91%	14558.4	0.46%
237732	14491	14359	-0.91%	14558.3	0.46%
237541	14491	14358	-0.92%	14665.3	1.20%
237415	14491	14358	-0.92%	14665.3	1.20%
237237	14491	14358	-0.92%	14557.7	0.46%
237060	14491	14357	-0.92%	14557.6	0.46%
236884	14490	14356	-0.92%	14557.5	0.47%
236707	14490	14356	-0.92%	14557.4	0.47%
236555	14489	14356	-0.92%	14557.4	0.47%
236404	14489	14355	-0.93%	14557.3	0.47%
236253	14489	14355	-0.93%	14557.2	0.47%
236058	14489	14353	-0.94%	14557.1	0.47%
235984	14489	14353	-0.94%	14557.1	0.47%
235979	14489	14353	-0.94%	14557.1	0.47%
235970	14489	14353	-0.94%	14557.0	0.47%
235947	14489	14353	-0.94%	14556.7	0.47%
235926	14489	14353	-0.94%	14556.3	0.47%
235883	14488	14352	-0.94%	14555.7	0.47%
235710	14487	14351	-0.94%	14555.5	0.47%
235538	14487	14350	-0.94%	14555.4	0.48%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
235366	14486	14350	-0.93%	14555.2	0.48%
235179	14538	14400	-0.95%	14611.7	0.50%
234992	14537	14399	-0.95%	14611.6	0.51%
234806	14535	14397	-0.95%	14611.4	0.52%
234619	14534	14396	-0.95%	14611.2	0.53%
234433	14533	14394	-0.96%	14611.0	0.54%
234246	14532	14393	-0.96%	14610.9	0.54%
234059	14531	14391	-0.96%	14610.8	0.55%
233873	14530	14390	-0.96%	14610.6	0.56%
233687	14528	14388	-0.97%	14610.4	0.56%
233500	14528	14386	-0.97%	14610.3	0.57%
233313	14526	14384	-0.98%	14610.1	0.58%
233127	14525	14383	-0.98%	14609.8	0.58%
232946	14524	14382	-0.98%	14609.6	0.59%
232765	14523	14380	-0.98%	14609.4	0.60%
232584	14522	14378	-0.99%	14609.2	0.60%
232402	14521	14377	-0.99%	14609.0	0.61%
232221	14519	14376	-0.99%	14608.8	0.62%
232040	14518	14374	-0.99%	14608.5	0.62%
231860	14517	14372	-1.00%	14608.3	0.63%
231667	14538	14392	-1.00%	14630.5	0.64%
231476	14537	14391	-1.00%	14630.2	0.64%
231284	14536	14390	-1.00%	14630.0	0.65%
231092	14535	14389	-1.01%	14629.7	0.65%
230900	14534	14388	-1.00%	14629.5	0.66%
230709	14533	14386	-1.01%	14629.2	0.66%
230516	14532	14385	-1.02%	14629.0	0.66%
230325	14532	14384	-1.02%	14628.7	0.67%
230134	14531	14382	-1.02%	14628.4	0.67%
229941	14530	14381	-1.03%	14628.0	0.67%
229749	14529	14380	-1.03%	14627.7	0.68%
229557	14528	14378	-1.03%	14627.4	0.69%
229365	14527	14378	-1.03%	14627.2	0.69%
229173	14526	14376	-1.03%	14626.9	0.70%
228981	14525	14375	-1.03%	14626.6	0.70%
228789	14524	14374	-1.03%	14626.3	0.71%
228597	14522	14373	-1.03%	14626.0	0.71%
228405	14521	14372	-1.03%	14625.7	0.72%
228213	14521	14370	-1.03%	14625.4	0.72%
228022	14520	14369	-1.04%	14625.1	0.72%
227844	14607	14458	-1.02%	14721.3	0.78%
227668	14606	14457	-1.02%	14721.0	0.79%
227491	14605	14455	-1.03%	14720.7	0.79%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
227315	14604	14454	-1.03%	14720.3	0.80%
227138	14603	14453	-1.03%	14719.9	0.80%
226962	14602	14452	-1.03%	14719.3	0.80%
226786	14602	14450	-1.04%	14718.7	0.80%
226697	14601	14450	-1.04%	14718.5	0.80%
226609	14601	14449	-1.04%	14718.2	0.80%
226520	14600	14448	-1.04%	14718.0	0.81%
226432	14600	14448	-1.04%	14717.8	0.81%
226344	14599	14447	-1.04%	14717.6	0.81%
226255	14599	14446	-1.04%	14717.3	0.81%
226167	14598	14446	-1.04%	14717.1	0.82%
226079	14598	14445	-1.04%	14716.8	0.82%
225990	14597	14444	-1.05%	14716.5	0.82%
225902	14597	14443	-1.05%	14716.3	0.82%
225814	14596	14443	-1.05%	14716.0	0.82%
225725	14595	14442	-1.05%	14715.7	0.82%
225637	14595	14441	-1.05%	14715.4	0.83%
225549	14594	14440	-1.05%	14715.1	0.83%
225460	14594	14440	-1.05%	14714.9	0.83%
225372	14593	14439	-1.05%	14714.6	0.83%
225284	14593	14438	-1.06%	14714.3	0.83%
225196	14592	14437	-1.06%	14714.0	0.83%
225107	14591	14437	-1.06%	14713.7	0.84%
225019	14591	14436	-1.06%	14713.4	0.84%
224931	14590	14435	-1.06%	14713.0	0.84%
224843	14589	14434	-1.06%	14712.7	0.85%
224717	14588	14434	-1.06%	14712.4	0.85%
224593	14588	14433	-1.06%	14712.1	0.85%
224468	14587	14432	-1.06%	14711.8	0.86%
224343	14586	14432	-1.06%	14711.4	0.86%
224218	14586	14431	-1.06%	14711.1	0.86%
224093	14585	14430	-1.06%	14710.7	0.86%
223968	14584	14430	-1.06%	14710.4	0.87%
223844	14583	14429	-1.06%	14710.1	0.87%
223718	14582	14428	-1.06%	14709.7	0.87%
223594	14582	14428	-1.06%	14709.3	0.87%
223469	14581	14427	-1.06%	14708.9	0.88%
223344	14580	14426	-1.05%	14708.6	0.88%
223219	14579	14426	-1.05%	14708.2	0.88%
223094	14579	14425	-1.05%	14707.8	0.89%
222969	14578	14424	-1.05%	14707.4	0.89%
222845	14577	14424	-1.05%	14707.0	0.89%
222719	14576	14423	-1.05%	14706.6	0.90%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
222595	14575	14422	-1.05%	14706.2	0.90%
222470	14574	14421	-1.05%	14705.8	0.90%
222346	14574	14420	-1.05%	14705.4	0.90%
222250	14577	14424	-1.05%	14709.0	0.91%
222156	14576	14424	-1.04%	14708.6	0.91%
222060	14575	14423	-1.04%	14708.2	0.91%
221966	14574	14422	-1.04%	14707.7	0.92%
221871	14573	14422	-1.04%	14707.3	0.92%
221776	14572	14422	-1.04%	14706.9	0.92%
221682	14572	14421	-1.03%	14706.4	0.92%
221587	14571	14421	-1.03%	14706.0	0.93%
221492	14570	14420	-1.03%	14705.5	0.93%
221397	14569	14419	-1.03%	14705.1	0.93%
221303	14568	14419	-1.02%	14704.6	0.94%
221208	14567	14418	-1.02%	14704.2	0.94%
221113	14566	14418	-1.02%	14703.7	0.95%
221019	14564	14417	-1.01%	14703.2	0.95%
220924	14563	14416	-1.01%	14702.7	0.96%
220829	14561	14416	-1.00%	14702.2	0.97%
220735	14560	14415	-0.99%	14701.6	0.97%
220107	14723	14637	-0.58%	14644.9	-0.53%
220007	14720	14636	-0.57%	14644.8	-0.51%
219907	14719	14635	-0.57%	14644.6	-0.50%
219808	14717	14634	-0.57%	14644.6	-0.50%
219709	14716	14633	-0.57%	14644.4	-0.49%
219609	14715	14632	-0.56%	14644.4	-0.48%
219510	14713	14630	-0.56%	14644.3	-0.47%
219410	14711	14629	-0.55%	14644.1	-0.45%
219311	14709	14628	-0.55%	14644.0	-0.44%
219212	14707	14627	-0.54%	14643.9	-0.43%
219113	14706	14627	-0.54%	14643.8	-0.42%
219014	14704	14626	-0.54%	14643.8	-0.41%
218860	14728	14648	-0.54%	14668.8	-0.40%
218708	14726	14647	-0.54%	14668.7	-0.39%
218591	14726	14647	-0.54%	14668.7	-0.39%
218454	14724	14646	-0.53%	14668.4	-0.38%
218317	14722	14645	-0.52%	14668.4	-0.36%
218140	14720	14644	-0.52%	14668.1	-0.35%
217964	14718	14642	-0.51%	14667.9	-0.34%
217787	14716	14641	-0.51%	14667.6	-0.33%
217612	14714	14640	-0.50%	14667.4	-0.32%
217435	14712	14639	-0.49%	14667.1	-0.30%
217259	14710	14637	-0.49%	14667.1	-0.29%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
217082	14707	14635	-0.49%	14666.9	-0.27%
216907	14704	14634	-0.47%	14666.7	-0.25%
216730	14702	14634	-0.46%	14667.3	-0.24%
216554	14702	14634	-0.46%	14668.1	-0.23%
216379	14701	14634	-0.46%	14668.8	-0.22%
216202	14702	14634	-0.46%	14669.7	-0.22%
216026	14701	14632	-0.47%	14670.6	-0.21%
215851	14701	14631	-0.47%	14671.4	-0.20%
215709	14700	14631	-0.47%	14671.9	-0.19%
215618	14701	14631	-0.47%	14672.5	-0.19%
215522	14701	14632	-0.47%	14672.4	-0.20%
215408	14701	14632	-0.47%	14672.4	-0.19%
215288	14700	14630	-0.48%	14673.1	-0.19%
215170	14699	14629	-0.48%	14673.8	-0.17%
214982	14698	14627	-0.48%	14673.5	-0.17%
214795	14697	14626	-0.48%	14673.4	-0.16%
214608	14696	14625	-0.48%	14673.4	-0.15%
214421	14695	14624	-0.48%	14673.3	-0.14%
214234	14694	14623	-0.48%	14673.1	-0.14%
214047	14693	14622	-0.48%	14673.0	-0.13%
213860	14692	14621	-0.48%	14672.9	-0.13%
213673	14691	14620	-0.48%	14672.7	-0.13%
213486	14691	14620	-0.48%	14672.5	-0.12%
213299	14690	14619	-0.48%	14672.3	-0.12%
213111	14689	14619	-0.48%	14672.3	-0.11%
212924	14688	14618	-0.48%	14672.0	-0.11%
212738	14687	14618	-0.47%	14671.8	-0.10%
212551	14686	14617	-0.47%	14671.6	-0.10%
212364	14688	14619	-0.47%	14673.6	-0.10%
212177	14689	14620	-0.48%	14675.6	-0.09%
211991	14691	14621	-0.48%	14677.5	-0.09%
211804	14693	14622	-0.48%	14679.4	-0.09%
211618	14694	14623	-0.49%	14681.5	-0.09%
211431	14696	14624	-0.49%	14683.5	-0.08%
211244	14697	14625	-0.49%	14685.5	-0.08%
211058	14698	14627	-0.49%	14687.5	-0.07%
210872	14700	14627	-0.49%	14689.5	-0.07%
210703	14698	14625	-0.50%	14689.4	-0.06%
210534	14697	14623	-0.50%	14688.9	-0.05%
210323	14697	14623	-0.50%	14688.9	-0.05%
210169	14696	14622	-0.50%	14688.6	-0.05%
210016	14696	14622	-0.50%	14688.4	-0.05%
209864	14696	14622	-0.50%	14688.4	-0.05%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
209668	14695	14622	-0.49%	14688.2	-0.05%
209474	14695	14622	-0.49%	14688.1	-0.04%
209280	14694	14621	-0.50%	14688.0	-0.04%
209085	14694	14620	-0.50%	14687.8	-0.04%
208891	14693	14619	-0.50%	14687.6	-0.04%
208696	14693	14619	-0.50%	14687.5	-0.03%
208502	14692	14619	-0.50%	14687.4	-0.03%
208308	14691	14618	-0.50%	14687.4	-0.03%
208113	14691	14618	-0.50%	14687.4	-0.02%
207919	14690	14617	-0.50%	14687.2	-0.02%
207725	14690	14616	-0.50%	14687.1	-0.02%
207530	14689	14616	-0.50%	14687.1	-0.01%
207336	14688	14615	-0.50%	14686.9	-0.01%
207141	14688	14614	-0.50%	14686.8	-0.01%
206947	14687	14613	-0.51%	14686.8	0.00%
206753	14687	14612	-0.51%	14686.7	0.00%
206558	14686	14611	-0.51%	14686.6	0.01%
206364	14686	14610	-0.52%	14686.4	0.01%
206169	14685	14609	-0.52%	14686.2	0.01%
205975	14684	14608	-0.52%	14686.0	0.01%
205781	14684	14607	-0.52%	14685.9	0.01%
205587	14683	14607	-0.52%	14685.8	0.02%
205426	14684	14607	-0.52%	14686.9	0.02%
205267	14684	14607	-0.52%	14687.9	0.03%
205107	14683	14607	-0.52%	14688.8	0.04%
204948	14683	14606	-0.52%	14689.7	0.04%
204752	14682	14605	-0.52%	14689.7	0.05%
204557	14682	14605	-0.52%	14689.6	0.05%
204361	14681	14605	-0.52%	14689.5	0.06%
204166	14681	14604	-0.52%	14689.3	0.06%
203971	14680	14604	-0.52%	14689.1	0.06%
203775	14679	14603	-0.52%	14689.0	0.07%
203580	14679	14602	-0.52%	14688.9	0.07%
203385	14678	14602	-0.52%	14688.9	0.07%
203189	14677	14601	-0.52%	14688.8	0.08%
202994	14677	14601	-0.52%	14688.7	0.08%
202799	14676	14600	-0.52%	14688.6	0.08%
202603	14676	14600	-0.52%	14688.5	0.09%
202408	14675	14599	-0.52%	14688.5	0.09%
202212	14674	14599	-0.52%	14688.4	0.09%
202017	14674	14598	-0.52%	14688.2	0.10%
201822	14673	14597	-0.52%	14688.1	0.10%
201626	14672	14597	-0.51%	14688.0	0.11%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
201431	14671	14596	-0.51%	14687.8	0.11%
201236	14670	14595	-0.51%	14687.6	0.12%
201040	14669	14595	-0.51%	14687.5	0.12%
200845	14668	14595	-0.50%	14687.3	0.13%
200650	14667	14594	-0.50%	14687.2	0.14%
200454	14666	14594	-0.49%	14687.1	0.14%
200259	14665	14593	-0.49%	14686.9	0.15%
200063	14663	14592	-0.48%	14686.7	0.16%
199868	14661	14592	-0.47%	14686.6	0.17%
199673	14660	14591	-0.47%	14686.5	0.18%
199477	14658	14591	-0.46%	14686.4	0.19%
199282	14657	14590	-0.46%	14686.3	0.20%
199087	14656	14590	-0.45%	14686.2	0.21%
198891	14655	14590	-0.45%	14686.2	0.21%
198696	14654	14589	-0.44%	14686.2	0.22%
198501	14653	14589	-0.43%	14686.2	0.23%
198301	14666	14603	-0.43%	14702.6	0.25%
198102	14678	14617	-0.41%	14718.9	0.28%
197902	14690	14631	-0.41%	14735.2	0.30%
197703	14702	14645	-0.39%	14751.4	0.33%
197504	14714	14659	-0.38%	14767.6	0.36%
197305	14726	14673	-0.36%	14783.9	0.39%
197105	14738	14687	-0.35%	14800.4	0.42%
196907	14750	14701	-0.33%	14816.8	0.45%
196738	14767	14719	-0.32%	14865.7	0.67%
196570	14784	14739	-0.30%	15463.1	4.60%
196402	14800	14757	-0.29%	16152.0	9.13%
196234	14817	15110	1.98%	16855.8	13.76%
196067	15065	15776	4.72%	17544.1	16.46%
195840	15065	15776	4.72%	17544.1	16.46%
195684	15022	15735	4.75%	17504.0	16.52%
195528	14981	15690	4.73%	17500.9	16.82%
195302	14949	15649	4.68%	17497.6	17.05%
195077	14914	15604	4.63%	17494.4	17.30%
194853	14880	15571	4.64%	17491.4	17.55%
194697	14878	15571	4.66%	17519.5	17.76%
194542	14839	15537	4.70%	17517.2	18.05%
194388	14800	15495	4.70%	17515.1	18.34%
194200	14797	15457	4.46%	17513.3	18.36%
194013	14793	15412	4.18%	17511.7	18.38%
193826	14788	15373	3.95%	17510.0	18.40%
193639	14784	15339	3.76%	17508.3	18.43%
193451	14779	15300	3.52%	17506.7	18.46%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
193264	14774	15258	3.27%	17505.1	18.49%
193077	14769	15219	3.05%	17503.5	18.52%
192890	14761	15181	2.84%	17502.0	18.57%
192704	14754	15141	2.62%	17500.6	18.61%
192548	14747	15136	2.64%	17556.3	19.05%
192393	14737	15130	2.67%	17612.0	19.51%
192239	14730	15126	2.69%	17667.7	19.95%
192062	14721	15043	2.19%	17665.2	20.00%
191886	14715	14950	1.60%	17662.7	20.03%
191709	14707	14846	0.94%	17660.2	20.08%
191533	14699	14765	0.46%	17658.2	20.14%
191357	14690	14760	0.48%	17656.3	20.19%
191181	14684	14758	0.51%	17705.7	20.58%
191006	14678	14756	0.53%	17755.0	20.96%
190831	14675	14753	0.53%	17804.1	21.32%
190656	14674	14751	0.52%	17853.1	21.66%
190481	14673	14748	0.52%	17902.2	22.01%
190330	14670	14748	0.53%	17900.2	22.02%
190181	14668	14748	0.54%	17898.3	22.02%
190032	14665	14751	0.58%	17896.6	22.03%
189882	14664	14753	0.61%	17895.1	22.04%
189732	14666	14755	0.61%	17893.8	22.01%
189583	14669	14757	0.60%	17891.3	21.97%
189251	14669	14757	0.60%	17891.3	21.97%
189060	14675	14761	0.59%	17889.8	21.90%
187598	21308	21270	-0.18%	24433.2	14.67%
187598	21307	21270	-0.17%	24432.3	14.67%
187513	21297	21262	-0.17%	24392.4	14.54%
187426	21294	21260	-0.16%	24383.5	14.51%
187307	21279	21246	-0.16%	24323.9	14.31%
187226	21258	21226	-0.15%	24234.7	14.00%
187145	21229	21200	-0.13%	24137.7	13.70%
187065	21193	21170	-0.11%	24029.0	13.38%
186981	21156	21137	-0.09%	23913.6	13.04%
186898	21117	21101	-0.08%	23790.7	12.66%
186814	21075	21063	-0.06%	23685.5	12.39%
186732	21031	21025	-0.03%	23575.8	12.10%
186641	20993	20992	-0.01%	23496.2	11.92%
186550	20954	20960	0.03%	23418.6	11.76%
186460	20918	20932	0.07%	23353.5	11.64%
186369	20883	20904	0.10%	23295.5	11.55%
186278	20848	20874	0.12%	23234.5	11.45%
186188	20814	20845	0.15%	23172.0	11.33%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
186130	20791	20825	0.16%	23129.9	11.25%
186093	20787	20822	0.17%	23126.9	11.26%
186060	20790	20826	0.17%	23141.7	11.31%
185998	20783	20820	0.18%	23137.1	11.33%
185924	20760	20797	0.18%	23092.2	11.23%
185850	20740	20778	0.18%	23056.0	11.17%
185772	20713	20755	0.20%	22984.0	10.97%
185694	20682	20729	0.22%	22903.5	10.74%
185616	20651	20702	0.25%	22821.3	10.51%
185539	20623	20677	0.26%	22741.7	10.28%
185438	20585	20645	0.29%	22651.2	10.03%
185339	20546	20611	0.31%	22565.6	9.83%
185239	20507	20576	0.34%	22481.6	9.63%
185140	20470	20542	0.35%	22397.1	9.42%
185040	20432	20510	0.38%	22314.8	9.22%
184940	20394	20475	0.40%	22233.5	9.02%
184842	20357	20441	0.41%	22150.9	8.81%
184743	20320	20406	0.42%	22069.3	8.61%
184645	20284	20368	0.42%	21991.0	8.42%
184547	20246	20331	0.42%	21911.3	8.22%
184449	20209	20296	0.43%	21840.5	8.07%
184351	20171	20262	0.45%	21771.0	7.93%
184253	20135	20227	0.46%	21703.9	7.79%
184155	20099	20195	0.48%	21638.2	7.66%
184062	20069	20169	0.50%	21602.2	7.64%
183970	20038	20140	0.51%	21565.9	7.63%
183878	20006	20110	0.52%	21527.3	7.60%
183786	19974	20080	0.53%	21485.8	7.57%
183690	19940	20048	0.54%	21441.5	7.53%
183595	19904	20015	0.55%	21396.9	7.50%
183501	19869	19981	0.56%	21354.8	7.48%
183353	19869	19981	0.56%	21354.8	7.48%
183263	19840	19953	0.57%	21322.3	7.47%
183210	19880	19998	0.59%	21521.6	8.26%
183195	19876	19994	0.59%	21517.6	8.26%
183176	19876	19994	0.59%	21516.7	8.26%
183062	19852	19970	0.59%	21485.2	8.23%
182990	19826	19943	0.59%	21452.2	8.20%
182917	19799	19918	0.60%	21420.8	8.19%
182846	19774	19895	0.61%	21389.6	8.17%
182755	19741	19862	0.61%	21351.4	8.16%
182664	19707	19829	0.62%	21313.7	8.16%
182574	19671	19795	0.63%	21274.5	8.15%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
182484	19631	19756	0.64%	21233.0	8.16%
182393	19588	19714	0.64%	21189.3	8.17%
182303	19544	19673	0.66%	21143.4	8.18%
182212	19500	19630	0.67%	21094.9	8.18%
182123	19456	19588	0.68%	21043.2	8.16%
182028	19410	19546	0.70%	20991.0	8.14%
181934	19363	19502	0.72%	20939.3	8.14%
181840	19315	19454	0.72%	20887.9	8.15%
181746	19264	19405	0.73%	20834.2	8.15%
181653	19213	19354	0.73%	20778.1	8.14%
181559	19162	19303	0.73%	20721.0	8.14%
181465	19109	19252	0.75%	20661.6	8.12%
181371	19053	19198	0.76%	20598.6	8.11%
181278	18995	19141	0.77%	20532.1	8.09%
181196	18943	19092	0.79%	20473.8	8.08%
181116	18890	19042	0.81%	20418.4	8.09%
181035	18835	18990	0.82%	20361.3	8.10%
180956	18781	18938	0.83%	20298.9	8.08%
180876	18746	18905	0.85%	20302.7	8.30%
180797	18694	18854	0.86%	20231.5	8.22%
180507	18694	18854	0.86%	20231.5	8.22%
180507	18693	18853	0.86%	20230.6	8.22%
180307	28045	28067	0.08%	27800.5	-0.87%
180306	28044	28066	0.08%	27800.0	-0.87%
180240	28027	28049	0.08%	27783.3	-0.87%
180108	28024	28046	0.08%	27781.6	-0.87%
180037	28005	28028	0.08%	27767.1	-0.85%
179894	27915	27943	0.10%	27696.5	-0.78%
179752	27811	27843	0.12%	27612.4	-0.72%
179594	27696	27732	0.13%	27519.4	-0.64%
179437	27567	27607	0.14%	27419.3	-0.54%
179280	27425	27471	0.17%	27303.9	-0.44%
179123	27276	27334	0.21%	27176.0	-0.37%
178955	27113	27184	0.26%	27028.1	-0.31%
178788	26949	27026	0.29%	26880.1	-0.26%
178620	26782	26854	0.27%	26734.7	-0.18%
178453	26620	26687	0.25%	26586.8	-0.12%
178347	26556	26627	0.27%	26540.4	-0.06%
178242	26462	26535	0.28%	26454.0	-0.03%
178057	26308	26387	0.30%	26321.1	0.05%
177967	26272	26351	0.30%	26287.8	0.06%
177894	26268	26348	0.30%	26284.3	0.06%
177856	26253	26333	0.31%	26270.0	0.06%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
177708	26157	26240	0.32%	26182.4	0.10%
177558	26065	26155	0.34%	26102.7	0.14%
177409	25962	26063	0.39%	26011.6	0.19%
177260	25854	25966	0.43%	25914.3	0.23%
177088	25741	25858	0.46%	25810.9	0.27%
176917	25624	25742	0.46%	25705.0	0.32%
176746	25505	25619	0.45%	25598.1	0.37%
176575	25383	25497	0.45%	25487.9	0.41%
176404	25237	25347	0.44%	25356.9	0.47%
176310	25144	25247	0.41%	25292.4	0.59%
176217	25047	25143	0.38%	25235.1	0.75%
176124	24948	25038	0.36%	25176.7	0.92%
176030	24849	24937	0.36%	25127.3	1.12%
175937	24751	24846	0.38%	25080.5	1.33%
175845	24658	24760	0.41%	25033.5	1.52%
175746	24569	24673	0.42%	24992.0	1.72%
175649	24472	24573	0.41%	24949.6	1.95%
175551	24385	24469	0.34%	24908.8	2.15%
175453	24297	24373	0.31%	24865.2	2.34%
175356	24216	24291	0.31%	24826.2	2.52%
175259	24139	24220	0.33%	24786.0	2.68%
175203	24069	24149	0.34%	24739.2	2.79%
175192	24056	24137	0.34%	24728.7	2.80%
175063	23964	24041	0.32%	24611.6	2.70%
175005	23944	24018	0.31%	24581.4	2.66%
174947	23924	23993	0.29%	24552.5	2.63%
174863	23879	23941	0.26%	24493.1	2.57%
174843	23872	23934	0.26%	24482.8	2.56%
174823	23868	23930	0.26%	24475.1	2.54%
174678	23819	23887	0.29%	24414.3	2.50%
174610	23790	23860	0.30%	24377.2	2.47%
174543	23764	23835	0.30%	24342.4	2.43%
174477	23742	23811	0.29%	24312.3	2.40%
174387	23712	23780	0.29%	24270.8	2.36%
174297	23681	23749	0.29%	24225.6	2.30%
174207	23650	23721	0.30%	24181.4	2.25%
174118	23620	23691	0.30%	24139.9	2.20%
174041	23595	23665	0.30%	24110.3	2.18%
173964	23570	23639	0.29%	24077.1	2.15%
173888	23543	23613	0.29%	24040.7	2.11%
173812	23518	23589	0.30%	24007.4	2.08%
173757	23502	23571	0.30%	23988.1	2.07%
173725	23493	23563	0.30%	23977.7	2.06%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
173569	23446	23517	0.30%	23919.7	2.02%
173468	23417	23487	0.30%	23879.5	1.98%
173368	23388	23456	0.29%	23838.1	1.93%
173267	23357	23425	0.29%	23792.9	1.87%
173167	23327	23392	0.28%	23747.8	1.80%
173067	23298	23362	0.27%	23704.4	1.74%
172967	23272	23336	0.28%	23670.4	1.71%
172878	23248	23312	0.28%	23640.9	1.69%
172790	23224	23287	0.27%	23610.0	1.66%
172701	23201	23263	0.27%	23583.5	1.65%
172613	23180	23242	0.27%	23558.0	1.63%
172450	23180	23242	0.27%	23558.0	1.63%
172359	23154	23216	0.27%	23524.6	1.60%
172270	23127	23186	0.26%	23490.6	1.57%
172180	23099	23155	0.24%	23458.8	1.56%
172094	23076	23131	0.23%	23433.1	1.55%
172009	23054	23108	0.24%	23406.6	1.53%
171923	23030	23084	0.23%	23380.4	1.52%
171838	23006	23058	0.22%	23351.1	1.50%
171753	22981	23031	0.22%	23319.9	1.47%
171676	22961	23010	0.21%	23295.9	1.46%
171599	22941	22988	0.20%	23272.3	1.45%
171387	22910	22952	0.19%	23236.3	1.42%
171274	22910	22952	0.19%	23236.3	1.43%
171193	22899	22942	0.19%	23222.9	1.42%
171103	22877	22922	0.20%	23200.8	1.42%
171013	22857	22901	0.19%	23185.1	1.44%
170923	22835	22879	0.19%	23169.2	1.46%
170834	22813	22859	0.20%	23153.0	1.49%
170742	22792	22840	0.21%	23134.3	1.50%
170650	22770	22821	0.22%	23116.2	1.52%
170558	22747	22802	0.24%	23100.5	1.55%
170466	22725	22780	0.24%	23084.2	1.58%
170375	22704	22754	0.22%	23066.6	1.60%
170297	22685	22731	0.20%	23051.7	1.61%
170221	22667	22712	0.20%	23037.3	1.63%
170144	22648	22694	0.20%	23021.5	1.65%
170068	22626	22673	0.21%	23003.0	1.66%
169969	22601	22651	0.22%	22981.2	1.68%
169870	22578	22629	0.23%	22959.0	1.69%
169773	22555	22608	0.23%	22938.2	1.70%
169487	22555	22608	0.23%	22938.2	1.70%
169406	22535	22588	0.24%	22919.6	1.71%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
169326	22513	22569	0.25%	22899.9	1.72%
169245	22493	22548	0.25%	22881.9	1.73%
169165	22473	22528	0.25%	22864.3	1.74%
169073	22452	22509	0.26%	22845.8	1.75%
168980	22432	22490	0.26%	22826.8	1.76%
168888	22412	22470	0.26%	22808.5	1.77%
168795	22392	22452	0.27%	22791.9	1.79%
168703	22372	22433	0.27%	22773.8	1.80%
168611	22353	22413	0.27%	22756.8	1.81%
168513	22333	22394	0.28%	22737.9	1.82%
168415	22313	22378	0.29%	22720.6	1.83%
168317	22294	22359	0.29%	22703.7	1.84%
168220	22276	22340	0.29%	22686.9	1.85%
168151	22263	22328	0.29%	22675.5	1.85%
168083	22251	22315	0.29%	22662.5	1.85%
168014	22238	22304	0.29%	22652.5	1.86%
167919	22221	22287	0.29%	22637.6	1.87%
167713	22221	22287	0.29%	22637.6	1.87%
167613	22208	22275	0.30%	22625.6	1.88%
167520	22194	22261	0.31%	22611.8	1.88%
167427	22178	22248	0.31%	22597.4	1.89%
167334	22163	22233	0.32%	22585.2	1.90%
167241	22149	22218	0.31%	22573.7	1.92%
167148	22135	22207	0.32%	22562.1	1.93%
167074	22288	22362	0.33%	22711.9	1.90%
167001	22278	22351	0.33%	22700.9	1.90%
166926	22268	22342	0.33%	22693.1	1.91%
166852	22259	22333	0.33%	22685.8	1.92%
166779	22250	22325	0.34%	22677.9	1.92%
166686	22243	22318	0.34%	22672.7	1.93%
166594	22233	22307	0.34%	22663.3	1.94%
166501	22222	22297	0.34%	22655.6	1.95%
166409	22212	22287	0.34%	22647.7	1.96%
166204	34375	34486	0.32%	35244.8	2.53%
166000	34364	34475	0.32%	35243.1	2.56%
165797	34352	34462	0.32%	35241.2	2.59%
165601	34325	34431	0.31%	35236.8	2.66%
165406	34295	34399	0.30%	35232.2	2.73%
165210	34263	34365	0.30%	35228.2	2.82%
165015	34229	34326	0.28%	35223.5	2.91%
164819	34195	34309	0.33%	35217.4	2.99%
164625	34160	34315	0.45%	35210.0	3.07%
164442	34126	34322	0.58%	35202.7	3.16%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
164261	34121	34329	0.61%	35195.7	3.15%
164079	34119	34337	0.64%	35188.9	3.14%
163898	34116	34345	0.67%	35183.7	3.13%
163716	34114	34353	0.70%	35178.1	3.12%
163524	34111	34360	0.73%	35171.5	3.11%
163332	34109	34368	0.76%	35165.1	3.10%
163141	34108	34377	0.79%	35159.0	3.08%
162959	34107	34385	0.82%	35152.9	3.07%
162778	34104	34393	0.85%	35147.2	3.06%
162597	34101	34399	0.87%	35143.6	3.06%
162496	34101	34402	0.88%	35142.6	3.05%
162396	34102	34405	0.89%	35141.6	3.05%
162111	34102	34405	0.89%	35141.6	3.05%
162024	34104	34408	0.89%	35139.1	3.03%
161938	34107	34412	0.90%	35136.0	3.02%
161851	34110	34415	0.90%	35133.3	3.00%
161764	34112	34419	0.90%	35130.6	2.99%
161678	34115	34422	0.90%	35126.9	2.96%
161583	34118	34426	0.90%	35122.0	2.94%
161488	34121	34431	0.91%	35116.7	2.92%
161393	34124	34434	0.91%	35112.5	2.90%
161299	34127	34435	0.90%	35108.9	2.88%
161206	34129	34437	0.90%	35104.9	2.86%
161113	34132	34441	0.90%	35100.5	2.84%
161019	34135	34445	0.91%	35100.8	2.83%
160927	34137	34449	0.91%	35103.1	2.83%
160834	34140	34453	0.92%	35105.7	2.83%
160754	34142	34455	0.92%	35108.2	2.83%
160675	34145	34459	0.92%	35110.5	2.83%
160595	34147	34460	0.92%	35113.9	2.83%
160517	34149	34462	0.92%	35114.4	2.83%
160147	34149	34462	0.92%	35114.4	2.83%
160000	34152	34466	0.92%	35119.4	2.83%
159855	34155	34470	0.92%	35123.8	2.84%
159709	34158	34473	0.92%	35127.3	2.84%
159539	34342	34625	0.83%	35276.5	2.72%
159371	34345	34630	0.83%	35280.6	2.72%
159202	34349	34635	0.83%	35285.7	2.73%
159010	34356	34644	0.84%	35293.9	2.73%
158819	34360	34649	0.84%	35300.3	2.74%
158628	34364	34654	0.84%	35305.9	2.74%
158436	34368	34660	0.85%	35310.8	2.74%
158245	34373	34666	0.85%	35315.6	2.74%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
158053	34376	34672	0.86%	35319.8	2.74%
157862	34381	34677	0.86%	35325.0	2.74%
157671	34386	34683	0.86%	35330.8	2.75%
157487	34389	34688	0.87%	35336.3	2.75%
157304	34394	34694	0.87%	35342.6	2.76%
157121	34399	34700	0.88%	35347.8	2.76%
156938	34404	34706	0.88%	35354.4	2.76%
156755	34408	34712	0.88%	35360.4	2.77%
156573	34414	34718	0.88%	35366.1	2.77%
156378	34443	34745	0.88%	35393.1	2.76%
156183	34448	34753	0.88%	35401.2	2.77%
155989	34455	34760	0.88%	35407.8	2.77%
155795	34465	34765	0.87%	35414.4	2.76%
155601	34474	34771	0.86%	35419.8	2.74%
155414	34483	34777	0.85%	35425.9	2.73%
155227	34494	34782	0.84%	35431.4	2.72%
155041	34504	34787	0.82%	35436.6	2.70%
154942	34510	34791	0.81%	35439.9	2.70%
154843	34514	34794	0.81%	35442.5	2.69%
154744	34518	34796	0.81%	35445.5	2.69%
154645	34521	34798	0.80%	35447.9	2.68%
154546	34525	34799	0.80%	35450.1	2.68%
154447	34528	34802	0.79%	35452.6	2.68%
154348	34531	34803	0.79%	35454.8	2.67%
154249	34535	34806	0.79%	35456.5	2.67%
154168	34555	34822	0.77%	35472.1	2.65%
154087	34559	34823	0.77%	35473.4	2.65%
154007	34562	34825	0.76%	35474.8	2.64%
153542	34562	34825	0.76%	35474.8	2.64%
153377	34566	34827	0.76%	35476.8	2.64%
153211	34570	34829	0.75%	35478.5	2.63%
153047	34574	34831	0.74%	35480.1	2.62%
152882	34580	34834	0.74%	35483.4	2.61%
152689	34586	34838	0.73%	35487.1	2.60%
152498	34595	34843	0.72%	35492.2	2.59%
152305	34604	34849	0.71%	35497.8	2.58%
152113	34615	34856	0.70%	35503.1	2.57%
151921	34627	34862	0.68%	35508.5	2.55%
151729	34641	34869	0.66%	35516.3	2.53%
151537	34657	34880	0.64%	35524.2	2.50%
151345	34674	34890	0.62%	35534.7	2.48%
151157	34687	34897	0.61%	35540.7	2.46%
150970	34696	34902	0.60%	35546.1	2.45%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
150783	34704	34907	0.58%	35550.4	2.44%
150595	34711	34910	0.57%	35553.3	2.43%
150408	34719	34913	0.56%	35556.1	2.41%
150221	34727	34917	0.55%	35559.0	2.40%
150029	34737	34922	0.53%	35564.7	2.38%
149838	34747	34927	0.52%	35570.1	2.37%
149647	34756	34932	0.51%	35574.4	2.36%
149456	34765	34938	0.50%	35578.7	2.34%
149265	34775	34943	0.48%	35584.0	2.33%
149080	34785	34948	0.47%	35588.3	2.31%
148895	34795	34953	0.45%	35593.2	2.29%
148710	34806	34959	0.44%	35597.6	2.28%
148525	34816	34964	0.43%	35602.7	2.26%
148341	34828	34969	0.41%	35607.6	2.24%
148156	34841	34975	0.39%	35613.5	2.22%
147971	34857	34983	0.36%	35620.1	2.19%
147786	34874	34991	0.34%	35627.8	2.16%
147602	34893	35001	0.31%	35635.3	2.13%
147006	34988	35062	0.21%	35692.3	2.01%
146807	35001	35076	0.21%	35698.3	1.99%
146609	35014	35091	0.22%	35702.8	1.97%
146410	35028	35105	0.22%	35708.0	1.94%
146212	35043	35121	0.22%	35712.4	1.91%
146013	35059	35139	0.23%	35719.3	1.88%
145815	35078	35158	0.23%	35725.6	1.85%
145617	35100	35178	0.22%	35733.8	1.80%
143705	40410	40514	0.26%	40950.5	1.34%
143608	40406	40506	0.25%	40944.6	1.33%
143510	40401	40500	0.24%	40939.2	1.33%
143413	40396	40494	0.24%	40934.5	1.33%
143316	40391	40489	0.24%	40930.6	1.34%
143218	40387	40483	0.24%	40926.6	1.34%
143121	40382	40478	0.24%	40922.2	1.34%
143024	40379	40474	0.24%	40918.3	1.34%
142926	40376	40471	0.24%	40914.7	1.33%
142829	40373	40468	0.24%	40910.8	1.33%
142732	40371	40466	0.24%	40907.0	1.33%
142635	40369	40464	0.24%	40904.0	1.33%
142538	40367	40462	0.24%	40901.6	1.33%
142440	40365	40460	0.24%	40898.6	1.32%
142343	40363	40457	0.23%	40895.5	1.32%
142246	40360	40455	0.23%	40892.9	1.32%
142149	40358	40451	0.23%	40890.6	1.32%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
142052	40356	40449	0.23%	40888.4	1.32%
141954	40354	40446	0.23%	40885.7	1.32%
141857	40352	40444	0.23%	40883.1	1.32%
141760	40351	40442	0.23%	40881.3	1.31%
141662	40350	40440	0.22%	40879.7	1.31%
141565	40349	40438	0.22%	40877.3	1.31%
141468	40348	40436	0.22%	40875.3	1.31%
141370	40347	40433	0.21%	40873.4	1.30%
141273	40346	40430	0.21%	40871.2	1.30%
141176	40345	40428	0.21%	40868.9	1.30%
141079	40344	40426	0.20%	40866.2	1.30%
140982	40342	40423	0.20%	40863.5	1.29%
140884	40341	40421	0.20%	40860.9	1.29%
140787	40340	40418	0.19%	40858.2	1.28%
140690	40339	40417	0.19%	40855.5	1.28%
140594	40361	40440	0.20%	40876.2	1.28%
140499	40360	40438	0.19%	40875.0	1.28%
140403	40358	40437	0.20%	40874.4	1.28%
140308	40358	40437	0.20%	40874.2	1.28%
140212	40357	40437	0.20%	40873.6	1.28%
140117	40357	40437	0.20%	40873.4	1.28%
140021	40356	40436	0.20%	40873.2	1.28%
139926	40356	40436	0.20%	40873.1	1.28%
139830	40356	40436	0.20%	40873.1	1.28%
139735	40356	40436	0.20%	40872.9	1.28%
139640	40355	40436	0.20%	40872.9	1.28%
139544	40355	40437	0.20%	40872.8	1.28%
139449	40355	40437	0.20%	40872.6	1.28%
139354	40354	40437	0.20%	40872.5	1.28%
139259	40354	40436	0.20%	40872.4	1.28%
139164	40354	40437	0.21%	40872.5	1.29%
139069	40353	40436	0.21%	40872.5	1.29%
138784	40357	40441	0.21%	40876.8	1.29%
138715	40361	40445	0.21%	40881.1	1.29%
138645	40365	40449	0.21%	40885.7	1.29%
138576	40369	40453	0.21%	40890.1	1.29%
138507	40373	40457	0.21%	40894.3	1.29%
138437	40377	40461	0.21%	40898.5	1.29%
138368	40382	40465	0.21%	40902.7	1.29%
138299	40386	40470	0.21%	40906.6	1.29%
138230	40390	40474	0.21%	40910.7	1.29%
138142	40392	40477	0.21%	40913.7	1.29%
138055	40395	40480	0.21%	40916.4	1.29%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
137967	40398	40483	0.21%	40919.2	1.29%
137879	40401	40486	0.21%	40921.9	1.29%
137792	40404	40489	0.21%	40924.5	1.29%
137705	40407	40492	0.21%	40927.2	1.29%
137617	40410	40495	0.21%	40930.1	1.29%
137285	40410	40495	0.21%	40930.1	1.29%
137094	40410	40494	0.21%	40928.5	1.28%
136904	40409	40493	0.21%	40927.8	1.28%
136714	40409	40490	0.20%	40926.9	1.28%
136524	40408	40486	0.19%	40922.8	1.27%
136334	40407	40480	0.18%	40917.3	1.26%
136144	40405	40475	0.17%	40911.3	1.25%
135954	40402	40470	0.17%	40904.5	1.24%
135775	40485	40552	0.16%	40986.8	1.24%
135597	40484	40547	0.16%	40980.8	1.23%
135418	40483	40542	0.15%	40973.8	1.21%
135240	40488	40546	0.14%	40970.0	1.19%
135061	40492	40553	0.15%	40977.7	1.20%
134882	40497	40561	0.16%	40986.6	1.21%
134707	40532	40598	0.16%	41024.4	1.22%
134531	40538	40608	0.17%	41033.4	1.22%
134356	40543	40618	0.18%	41042.8	1.23%
134180	40548	40627	0.19%	41050.1	1.24%
134005	40554	40635	0.20%	41056.8	1.24%
133829	40563	40642	0.19%	41064.1	1.23%
133654	40572	40649	0.19%	41072.9	1.24%
133478	40580	40657	0.19%	41080.0	1.23%
133294	40593	40667	0.18%	41090.8	1.23%
133110	40607	40678	0.18%	41101.8	1.22%
132927	40621	40690	0.17%	41115.0	1.22%
132743	40636	40704	0.17%	41127.3	1.21%
132559	40655	40720	0.16%	41142.5	1.20%
132398	40685	40752	0.16%	41172.0	1.20%
132237	40713	40781	0.17%	41200.5	1.20%
131926	40713	40781	0.17%	41200.5	1.20%
131734	40725	40796	0.17%	41216.1	1.21%
131543	40741	40811	0.17%	41234.3	1.21%
131352	40765	40834	0.17%	41258.4	1.21%
131161	40796	40862	0.16%	41288.7	1.21%
130970	40827	40892	0.16%	41318.5	1.20%
130776	40861	40923	0.15%	41349.7	1.20%
130583	40896	40956	0.15%	41381.1	1.19%
130390	40931	40987	0.14%	41413.1	1.18%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
130197	40970	41023	0.13%	41445.9	1.16%
130004	41011	41068	0.14%	41490.3	1.17%
129811	41054	41113	0.14%	41536.2	1.17%
129618	41097	41160	0.15%	41583.3	1.18%
129426	41142	41207	0.16%	41630.2	1.19%
129232	41191	41254	0.15%	41678.5	1.18%
129039	41242	41303	0.15%	41726.2	1.17%
128846	41297	41353	0.13%	41775.9	1.16%
128653	41357	41410	0.13%	41828.5	1.14%
128460	41418	41476	0.14%	41883.1	1.12%
128267	41477	41540	0.15%	41944.9	1.13%
128074	41538	41598	0.15%	42005.2	1.13%
127881	41595	41658	0.15%	42057.1	1.11%
127688	41651	41720	0.17%	42112.4	1.11%
127496	41706	41777	0.17%	42170.0	1.11%
127315	45836	45931	0.21%	46364.2	1.15%
127135	45826	45918	0.20%	46351.4	1.15%
126955	45814	45904	0.19%	46335.9	1.14%
126775	45800	45888	0.19%	46319.7	1.13%
126594	45785	45871	0.19%	46303.0	1.13%
126414	45774	45853	0.17%	46287.2	1.12%
126234	45765	45833	0.15%	46267.5	1.10%
126054	45753	45817	0.14%	46241.1	1.07%
125875	45739	45809	0.15%	46230.4	1.07%
125695	45724	45799	0.16%	46221.7	1.09%
125515	45708	45791	0.18%	46214.0	1.11%
125336	45697	45781	0.18%	46204.8	1.11%
125156	45698	45773	0.16%	46195.1	1.09%
124977	45704	45774	0.15%	46195.6	1.08%
124882	45715	45785	0.15%	46207.7	1.08%
124761	45715	45785	0.15%	46207.7	1.08%
124607	45751	45806	0.12%	46230.0	1.05%
124454	45798	45846	0.11%	46268.0	1.03%
124301	45845	45900	0.12%	46321.0	1.04%
124103	46349	46405	0.12%	46826.2	1.03%
123909	46246	46299	0.11%	46712.7	1.01%
123716	44072	44121	0.11%	44513.5	1.00%
123522	44534	44580	0.10%	44947.7	0.93%
123330	41476	41532	0.14%	41964.9	1.18%
123218	42812	42853	0.09%	43142.0	0.77%
123108	45156	45194	0.08%	45487.6	0.74%
123056	45154	45192	0.08%	45485.6	0.73%
122926	45154	45191	0.08%	45484.7	0.73%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
122818	45149	45185	0.08%	45480.3	0.73%
122627	45133	45174	0.09%	45467.7	0.74%
122437	45116	45163	0.10%	45455.0	0.75%
122247	45103	45147	0.10%	45440.4	0.75%
122063	45094	45140	0.10%	45433.1	0.75%
121883	45085	45133	0.11%	45426.3	0.76%
121704	45077	45125	0.11%	45420.2	0.76%
121524	45070	45116	0.10%	45412.1	0.76%
121344	44977	45021	0.10%	45311.6	0.74%
121164	44768	44811	0.10%	45093.6	0.73%
120985	44477	44518	0.09%	44791.6	0.71%
120806	44217	44258	0.09%	44520.8	0.69%
120616	43876	43916	0.09%	44167.6	0.67%
120427	43467	43508	0.09%	43747.8	0.65%
120239	43235	43275	0.09%	43505.1	0.63%
120050	43144	43186	0.10%	43406.4	0.61%
119861	43031	43073	0.10%	43285.2	0.59%
119672	42887	42929	0.10%	43131.6	0.57%
119483	42739	42782	0.10%	42974.9	0.55%
119294	42588	42632	0.10%	42817.2	0.54%
119106	42437	42482	0.11%	42656.6	0.52%
118922	42206	42252	0.11%	42412.9	0.49%
118739	41884	41931	0.11%	42074.7	0.45%
118556	41264	41309	0.11%	41428.3	0.40%
118372	40715	40756	0.10%	40851.4	0.34%
118189	40573	40612	0.10%	40692.2	0.29%
118005	40566	40603	0.09%	40684.0	0.29%
117823	40560	40596	0.09%	40676.2	0.29%
117696	40553	40589	0.09%	40669.1	0.29%
117624	40551	40586	0.09%	40666.5	0.29%
117600	40551	40586	0.09%	40666.0	0.28%
117580	40550	40585	0.09%	40665.7	0.29%
117492	40547	40582	0.09%	40663.3	0.29%
117231	49091	49128	0.08%	49542.2	0.92%
117043	49081	49113	0.07%	49526.0	0.91%
116856	49070	49098	0.06%	49510.3	0.90%
116669	49059	49082	0.05%	49492.6	0.88%
116481	49048	49066	0.04%	49475.2	0.87%
116294	49034	49057	0.05%	49458.1	0.86%
116106	49022	49047	0.05%	49444.0	0.86%
115919	49008	49037	0.06%	49432.4	0.87%
115732	48999	49026	0.06%	49421.4	0.86%
115536	48988	49016	0.06%	49408.3	0.86%

HEC-RAS Station	Salt Creek DFIRM Peak Flow (cfs)	Scenario 1 Peak Flow (cfs)	Percent Difference between Scenario 1 & DFIRM	Scenario 2 Peak Flow (cfs)	Percent Difference between Scenario 2 & DFIRM
115341	48978	49004	0.05%	49395.5	0.85%
115145	48970	48990	0.04%	49383.2	0.84%
114950	48963	48981	0.04%	49372.4	0.84%
114755	48957	48966	0.02%	49359.8	0.82%

Average % Decrease:	0.4%		2.46%
Max % Decrease:	0.9%		22.04%

Appendix D

Groundwater Data Analysis

LPSNRD Wells

WellID	MeasureDate	Season	DTW (ft)	Monthly Rainfall (in)	Average Monthly Rainfall (in)	Standard Deviation of Montly Rainfall (in)	Maximum Stage One Month Previous (ft)
98338	13-Apr-00	Spring	11.07	1.51	2.89	1.52	5.7
98338	29-Oct-99	Fall	10.27	0.03	1.87	1.46	1.9
98338	21-Apr-99	Spring	7.08	4.54	2.89	1.52	4.3
98339	13-Apr-00	Spring	11.95	1.51	2.89	1.52	5.7
98339	29-Oct-99	Fall	11.52	0.03	1.87	1.46	1.9
98339	21-Apr-99	Spring	4.17	4.54	2.89	1.52	4.3
98340	13-Apr-00	Spring	16.08	1.51	2.89	1.52	5.7
98340	29-Oct-99	Fall	16.55	0.03	1.87	1.46	1.9
98340	21-Apr-99	Spring	15.17	4.54	2.89	1.52	4.3
98341	13-Apr-00	Spring	11.39	1.51	2.89	1.52	5.7
98341	29-Oct-99	Fall	10.86	0.03	1.87	1.46	1.9
98341	21-Apr-99	Spring	5.37	4.54	2.89	1.52	4.3

	Middle Creek				Oak Creek		
	OW-1 Water Table Depth from Ground Surface (1163.6), ft	OW-2 Water Table Depth from Ground Surface (1161.2), ft	OW-3 Water Table Depth from Ground Surface (1165.1), ft	OW-4 Water Table Depth from Ground Surface (1155.3), ft	OW-1 Water Table Depth from Ground Surface (1157.4), ft	OW-2 Water Table Depth from Ground Surface (1154.4), ft	OW-3 Water Table Depth from Ground Surface (1184.1), ft
Mean	1153.6	1151.0	1149.0	1144.5	1141.4	1139.2	1163.8
Maximum	1152.3	1149.8	1148.5	1142.9	1140.2	1138.3	1161.6
Minimum	1155.4	1154.0	1149.8	1147.1	1143.2	1140.8	1167.0
Median	1153.2	1150.6	1148.9	1144.3	1141.3	1139.1	1163.4
Standard Deviation	1.1 feet	1.4	0.4	1.4	1.0	0.7	1.8
Mean-2*StDev	1155.8	1153.8	1149.8	1147.3	1143.4	1140.6	1167.4

Appendix E

Field Photos

Photo 1. Middle Site – 5-foot Culvert just past VFW on A Street, silted in

Photo 2. Middle Site - Box culvert, silted in

Photo 3. Middle Site - Channel nick

Photo 4. Middle Site - Culvert connecting drainage to Middle Site-3-foot CMP, ½ silted

Photo 5. Middle Site - DS face of SW 40th St. bridge

Photo 6. Middle Site - From south bank

Photo 7. Middle Site - Look US of local drainage (coming from SW 40th, heading towards SW 27th)

Photo 8. Middle Site - Looking DS from culvert in Photo 1, near VFW

Photo 9. Middle Site - Looking DS from SW 40th St. bridge

Photo 10. Middle Site - Looking from NW corner of Middle Creek

Photo 11. Middle Site - Channel meander

Photo 12. Middle Site - View of Middle Site from SW corner - 40th and A St

Photo 13. Middle Site -Looking DS at local drainage (towards Middle Creek)

Photo 14. Oak Site - Air Force Base local drainage culverts US face at levee road

Photo 15. Oak - Air Force Base local drainage culverts US face at levee road - one barrel

Photo 16. Oak - Air Force Base local drainage culverts US face at levee road

Photo 17. Oak - Gates on Air Force Base local drainage culvert outlets

Photo 18. Oak - Air Force Base local drainage looking US from levee road

Photo 19. Oak - Communication line and abandoned radar tower from Oak RB

Photo 20. Oak - Communication line from abandoned radar tower viewed from levee road

Photo 21. Oak - DS storage site looking north from levee road

Photo 22. Oak - Looking downstream from point near low flow channel

Photo 23. Oak - Looking DS from Air Force Base local drainage culverts

Photo 24. Oak - Looking DS from substations

Photo 25. Oak - Looking US from DS storage site

Photo 26. Oak - Power line towers - front tower part of known alignment, rear towers part of unidentified alignment

Photo 27. Oak - Power line towers on RB as approaching from the north.jpg

Photo 28. Oak - Small unidentified power line from RB looking southwest

Photo 29. Oak - South bend at airport looking DS from high point


Photo 30. Oak - Southwest bend at airport from RB high point - mature trees


Photo 31. Oak - Southwest bend at airport from RB high point

Photo 32. Oak - Start of power line stations on RB from the north

Photo 33. Oak - Substations from RB

Photo 34. Oak - Top of RB looking at LB at inlet gate site and person for scale

Photo 35. Oak - Top of RB looking at LB at inlet gate site

Photo 36. Oak - US face of airport bridge

Photo 37. Oak - View of RB high point from near low flow channel - person in background for scale

Appendix H

Final Conceptual Level Cost Estimates

Preliminary Construction Costs

Oak Creek Upstream Northwest and Northeast Detention Basins (2)

Brief Description of Items	*Unit*	*Estimated Quantity*	*Estimated Unit Price*	*Calculated Unit Price*	*Cost*
Unit Costs					
Property Acquisition					
- Kenneth E Deinart Life Estate (Appraised Value - $____; 104 acres total)	AC	$90.00	$20,000.00	$20,000.00	$2,250,000
Property Acquisition Subtotal					$2,250,000
Site Preperation					
- Site Clearing and Grubbing	AC	2.5	$3,000.00	$ 3,000.00	$7,500
Site Earthwork					
- Excavation	CY	770,000	$2.00	$ 2.00	$1,540,000
- Excavation Haul					
- 1 mile	CY	660,000	$4.00	$ 4.00	$2,640,000
- Temporary Dewatering					
- Wellpoint for Trench	EA	4	$57.73	$ 83.97	$300
- 300 GPM Pump, 30 days	EA	4	$2,153.70	$ 3,132.71	$15,700
- Compaction of Fill	CY	110,000	$2.50	$ 2.50	$275,000
- Riprap - Anchor Points (D50=8")	CY	1,700	$65.00	$ 68.24	$116,000
- Seeding and Plantings	SY	400,000	$1.00	$ 0.50	$200,000
- Turf Planting	SY		$8.00	$ 8.40	-
- Native & Wetland Meadow Seeding	SY		$1.00	$ 1.05	
- Local Drainage Realignment					
- Excavation assumed included in basin excavation	CY	-	-	-	-
- Excavation Haul	CY	-	-	-	-
- Rip-rap for check dams (5' long, 1' high; D50=8")	CY	100	$ 65.00	$ 68.24	$6,800
Structures					
- Inlet culverts for local drainage (3'x4' Concrete Box @ 100' Length)	EA	7	$25,000.00	$ 25,000.00	$175,000
- Flap gates	EA	7	$ 8,000.00	$ 8,658.86	$60,612
- Culverts between upstream basins (3'x4' Concrete Box @ 100' Length)	EA	6	$25,000.00	$ 25,000.00	$150,000
- Inlet gates - 3'x4' Concrete Box @ 50' Length (w flap gates -cost not included)	EA	12	$25,000.00	$ 25,000.00	$300,000
- Flap gates	EA	12	$ 8,000.00	$ 8,658.86	$103,900
- Outlet gates - 3'x4' Concrete Box @ 50' Length (w flap gates -cost not included)	EA	12	$25,000.00	$ 25,000.00	$300,000
- Flap gates	EA	12	$ 8,000.00	$ 8,658.86	$103,900
- Outlet culverts - 3'x4' Concrete Box @ 100' Length	EA	10	$25,000.00	$ 25,000.00	$250,000

Construction Subtotal=	**$7,014,012**
General Conditions 8%	$561,100
Overhead Profit and Insurance@15%	$1,052,100
Utility Relocation 5%	$350,700
Construction with Percent Allowances Subtotal=	**$8,977,912**
Contingency 20%	$1,795,600
Probable Cost Estimate=	**$10,773,512**
Engineering / Permitting / Survey / Geotech 12%	$1,292,800
Project Subtotal	$12,066,300
Total Conceptual Cost Estimate with Propery Acquisition =	**$14,400,000**
(Rounded up to the nearest $100,000)	

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Cost-Benefit Analysis\Construction Costs\Estimated Construction Costs 090508.xls

Preliminary Construction Costs

Oak Creek Detention South Basin

Brief Description of Items	***Unit***	***Estimated Quantity***	***Estimated Unit Price***	***Calculated Unit Price***	***Cost***
Unit Costs					
Property Acquisition					
- C&R Operations, LLC (Appraised Value - $____; 148 acres total)	AC	31	$1,296.72	$20,000.00	$775,000
Property Acquisition Subtotal					$775,000
Site Preperation					
- Site Clearing and Grubbing	AC	4	$3,000.00	$ 3,000.00	$12,000
Site Earthwork					
- Excavation	CY	180,000		$ 2.00	$360,000
- Excavation Haul					
- 1 mile	CY	10,000	$4.00	$ 4.00	$40,000
- Temporary Dewatering					
- Wellpoint for Trench	EA	1	$57.73	$ 83.97	$100
- 300 GPM Pump, 30 days	EA	1	$2,153.70	$ 3,132.71	$15,700
- Compaction of Fill	CY	170,000	$2.50	$ 2.50	$425,000
- Fine Grading	SY	200,000	$0.29	$ 0.29	$58,000
- Riprap Grade Control Base (D50=8")	CY	1,100	$65.00	$ 68.24	$75,100
- Riprap - Anchor Points (D50=8")	CY	1,700	$65.00	$ 68.24	$116,000
- Seeding and Plantings	SY	200,000	$1.00	$ 0.50	$100,000
Structures					
- Inlet gates - 3'x4' Concrete Box @ 50' Length (w flap gates -cost not include	EA	6	$25,000.00	$ 25,000.00	$150,000
- Flap gates	EA	6	$ 8,000.00	$ 8,658.86	$52,000
- Outlet gates - 3'x4' Concrete Box @ 50' Length (w flap gates -cost not includ	EA	6	$25,000.00	$ 25,000.00	$150,000
- Flap gates	EA	6	$ 8,000.00	$ 8,658.86	$52,000
- Outlet culverts - 3'x4' Concrete Box @ 100' Length	EA	5	$25,000.00	$ 25,000.00	$125,000

Construction Subtotal=		**$1,730,900**
	General Conditions 8%	$138,500
	Overhead Profit and Insurance@15%	$259,600
	Utility Relocation 5%	$86,500
Construction with Percent Allowances Subtotal=		**$2,215,500**
	Contingency 20%	$443,100
Probable Cost Estimate=		**$2,658,600**
	Engineering / Permitting / Survey / Geotech 12%	$319,000
Project Subtotal		$2,977,600
Total Conceptual Cost Estimate with Propery Acquisition =		**$3,800,000**
(Rounded up to the nearest $100,000)		

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Preliminary Construction Costs

Oak Creek Downstream Detention Basins (2)

Brief Description of Items	*Unit*	*Estimated Quantity*	*Estimated Unit Price*	*Calculated Unit Price*	*Cost*
Unit Costs					
Site Preperation					
- Site Clearing and Grubbing	AC	4	$3,000.00	$ 3,000.00	$12,000
Site Earthwork					
- Excavation	CY	240,000	$2.00	$ 2.00	$480,000
- Excavation Haul					
- 1 mile	CY	230,000	$4.00	$ 4.00	$920,000
- Temporary Dewatering					
- Wellpoint for Trench	EA	2	$57.73	$ 83.97	$200
- 300 GPM Pump, 30 days	EA	2	$2,153.70	$ 3,132.71	$15,700
- Compaction of Fill	CY	10,000	$2.50	$ 2.50	$25,000
- Fine Grading	SY	200,000	$0.29	$ 0.29	$58,000
- Riprap Grade Control Base (D50=8")	CY	6,000	$65.00	$ 68.24	$409,400
- Riprap - Anchor Points (D50=8")	CY	3,300	$65.00	$ 68.24	$225,200
- Seeding and Plantings					
- Basin sites	SY	200,000	$1.00	$ 0.50	$100,000
- Fill site	SY	210,000	$1.00	$ 0.50	$105,000
Structures					
- Temporary Crossing over Local Drainage					
- 60" CMP @ 25' Length	EA	4	$2,148.75	$ 3,125.51	$12,500.00
- Culverts between basins (3'x4' Concrete Box @ 100' Length)	EA	5	$25,000.00	$ 25,000.00	$125,000
- Inlet gates - 3'x4' Concrete Box @ 50' Length (w flap gates -cost not include	EA	5	$25,000.00	$ 25,000.00	$125,000
- Flap gates	EA	5	$ 8,000.00	$ 8,658.86	$43,300
- Outlet gates - 3'x4' Concrete Box @ 50' Length (w flap gates -cost not includ	EA	4	$25,000.00	$ 25,000.00	$100,000
- Flap gates	EA	4	$ 8,000.00	$ 8,658.86	$34,600
- Outlet culverts - 3'x4' Concrete Box @ 100' Length	EA	5	$25,000.00	$ 25,000.00	$125,000

Construction Subtotal=		**$2,903,400**
	General Conditions 8%	$232,300
	Overhead Profit and Insurance@15%	$435,500
	Utility Relocation 5%	$145,200
Construction with Percent Allowances Subtotal=		**$3,716,400**
	Contingency 20%	$743,300
Probable Cost Estimate=		**$4,459,700**
	Engineering / Permitting / Survey / Geotech 12%	$535,200
Project Subtotal		$4,994,900
Total Conceptual Cost Estimate=		**$5,000,000**
(Rounded up to the nearest $100,000)		

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Preliminary Construction Costs

Middle Creek Detention Basins (2)

Brief Description of Items	***Unit***	***Estimated Quantity***	***Estimated Unit Price***	***Calculated Unit Price***	***Cost***
Unit Costs					
Property Acquisition					
- Sam and Joyce Delisi (Appraised Value - $____; 120 acres total)	AC	105	$ 30,000.00	$ 30,000.00	$ 3,150,000.00
- B&J Partnership (Appraised Value - $____; 20 acres total)	AC	5	$ 30,000.00	$ 30,000.00	$ 150,000.00
- Anderson Homes, Inc (Appraised Value - $____; 22 acres total)	AC	22	$ 30,000.00	$ 30,000.00	$ 660,000.00
- Anderson Homes, Inc (Appraised Value - $____; 20 acres total)	AC	20	$ 30,000.00	$ 30,000.00	$ 600,000.00
- Donald and Linda Daringer (Appraised Value - $____; 20 acres total)	AC	20	$ 30,000.00	$ 30,000.00	$ 600,000.00
Property Acquisition Subtotal					$ 5,160,000.00
Site Preperation					
- Site Clearing and Grubbing	AC	5	$ 3,000.00	$ 3,149.40	$ 15,000.00
Site Earthwork					
- Excavation	CY	680,000	$2.00	$2.00	$1,360,000
- Onsite Excavation Relocation	CY	660,000	$2.00	$ 2.00	$1,320,000
- Temporary Dewatering					
- Wellpoint for Trench	EA	2	$ 57.73	$83.97	$200
- 300 GPM Pump, 30 days	EA	2	$ 2,153.70	$3,132.71	$6,300
- Compaction of Fill	CY	20,000	$ 2.50	$2.50	$50,000
- Fine Grading	SY	450,000	$ 0.29	$0.29	$130,500
- Riprap Grade Control Base (D50=8")	CY	1,600	$ 65.00	$68.24	$104,000
- Riprap - Anchor Points (D50=8")	CY	3,300	$65.00	$ 68.24	$225,200
- Seeding and Plantings	SY	728,000	$ 1.00	$ 0.50	$364,000
- Local Drainage Realignment					
- Excavation (Assume 14 sq ft trapezoidal channel)	CY	2,100	$ 2.00	$ 2.00	$4,200
- Excavation Haul	CY	2,100	$ 10.00	$ 10.00	$21,000
- Turf Reinforced Matrix (side slopes only - 6.3 sq ft per channel-foot)	LF	4,000	$ 18.74	$ 18.74	$75,000
- Rip-rap for check dams (5' long, 1' high; D50=8")	CY	6,000	$ 65.00	$68.24	$409,400
Structures					
- Culverts between upstream basins (3'x4' Concrete Box @ 100' Length)	EA	7	$25,000.00	$ 25,000.00	$175,000.00
- Inlet gates - 3'x4' Concrete Box @ 50' Length (w flap gates -cost not include	EA	30	$25,000.00	$ 25,000.00	$750,000.00
- Flap gates	EA	30	$ 8,000.00	$ 8,658.86	$259,800.00
- Outlet gates - 3'x4' Concrete Box @ 50' Length (w flap gates -cost not includ	EA	12	$25,000.00	$ 25,000.00	$300,000.00
- Flap gates	EA	12	$ 8,000.00	$ 8,658.86	$104,000.00
- Outlet culverts - 3'x4' Concrete Box @ 100' Length	EA	10	$25,000.00	$ 25,000.00	$250,000.00

Construction Subtotal=		**$5,900,000**
	General Conditions 8%	$472,000
	Overhead Profit and Insurance@15%	$885,000
	Utility Relocation 5%	$295,000
Construction with Percent Allowances Subtotal=		**$7,552,000**
	Contingency 20%	$1,510,400
Probable Cost Estimate=		**$9,062,400**
	Engineering / Permitting / Survey / Geotech 12%	$1,087,500
Project Subtotal		$10,149,900
Total Conceptual Cost Estimate with Propery Acquisition = (Rounded up to the nearest $100,000)		**$15,400,000**

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Appendix I

Comparison of Flooding Depths

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
5253	4.4	4.4	0.0
5317	0.6	0.6	0.0
5412	2.9	2.8	0.0
6043	1.3	1.3	0.0
6816	0.1	0.1	0.0
7226	0.3	0.3	0.0
7992	1.5	1.5	0.0
9880	1.0	1.0	0.0
10523	3.3	3.3	0.0
10544	3.3	3.3	0.0
10557	1.8	1.8	0.0
10562	0.2	0.2	0.0
10571	0.4	0.4	0.0
11011	0.7	0.7	0.0
11758	3.3	3.3	0.0
11837	5.0	5.0	0.0
11840	0.2	0.2	0.0
12065	0.2	0.1	0.0
12934	2.4	2.4	0.0
13187	2.1	2.1	0.0
13188	0.6	0.6	0.0
13215	1.7	1.6	0.1
13356	1.6	1.6	0.0
13601	0.1	0.0	0.0
13609	4.7	4.7	0.0
13724	1.9	1.8	0.0
13727	2.2	2.1	0.0
13729	3.1	3.1	0.0
13730	3.7	3.7	0.0
13762	4.0	4.0	0.0
13826	3.7	3.7	0.0
13842	0.9	0.9	0.0
13843	2.1	2.0	0.0
13863	0.4	0.4	0.0
13873	2.0	2.0	0.0
13944	2.4	2.4	0.0
13996	1.1	1.1	0.0
14034	0.1	0.1	0.0
14039	1.0	1.0	0.0
14088	2.4	2.4	0.0
14100	1.5	1.5	0.0
14101	1.7	1.6	0.0
14104	2.6	2.5	0.0
14112	1.3	1.3	0.0
14113	0.6	0.5	0.0
14116	2.8	2.7	0.0

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
14211	0.2	0.1	0.1
14223	1.5	1.5	0.0
14342	1.9	1.9	0.0
14345	1.4	1.3	0.0
14346	1.9	1.9	0.0
14359	0.6	0.5	0.0
14446	1.1	1.0	0.0
14499	1.4	1.4	0.0
14501	1.4	1.4	0.0
14502	2.4	2.4	0.0
14545	2.0	1.9	0.0
14546	1.3	1.3	0.0
14547	0.5	0.5	0.0
14548	1.4	1.4	0.0
14587	1.9	1.9	0.0
14620	3.9	3.8	0.1
14795	3.6	3.5	0.1
14843	2.3	2.3	0.0
14846	1.9	1.9	0.0
14847	2.3	2.2	0.0
14848	2.1	2.0	0.0
14850	2.0	2.0	0.0
14851	0.9	0.9	0.0
14852	0.9	0.9	0.0
14854	0.1	0.1	0.0
15056	2.1	2.1	0.0
15057	2.7	2.6	0.0
15073	2.0	2.0	0.0
15074	1.7	1.7	0.0
15076	0.4	0.3	0.0
15150	3.3	3.2	0.0
15153	1.9	1.9	0.0
15158	3.4	3.3	0.0
15273	3.3	3.2	0.0
15276	1.8	1.8	0.0
15280	3.1	3.1	0.0
15322	2.7	2.7	0.0
15357	1.2	1.1	0.0
15367	2.2	2.2	0.0
15372	1.0	0.9	0.0
15452	3.3	3.2	0.0
15461	2.5	2.4	0.0
15493	3.3	3.3	0.0
15525	1.3	1.3	0.0
15526	1.5	1.4	0.0
15527	1.3	1.2	0.0

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
15548	3.0	2.9	0.1
15604	2.4	2.4	0.0
15605	3.5	3.4	0.1
15612	3.3	3.3	0.0
15617	1.7	1.6	0.0
15743	0.3	0.2	0.0
15795	3.8	3.8	0.0
15798	3.3	3.3	0.0
15802	1.1	1.1	0.0
15813	3.0	2.9	0.0
15820	2.6	2.5	0.1
15843	1.4	1.4	0.0
15863	2.3	2.3	0.0
15913	4.3	4.2	0.1
15947	3.6	3.5	0.0
15983	3.4	3.4	0.0
15991	2.3	2.2	0.1
16098	2.1	2.0	0.0
16099	2.9	2.8	0.0
16101	2.8	2.8	0.0
16102	3.0	3.0	0.0
16128	3.8	3.8	0.0
16130	2.2	2.1	0.0
16160	3.6	3.5	0.0
16161	2.9	2.8	0.0
16174	4.8	4.7	0.1
16554	2.7	2.7	0.0
16555	3.2	3.1	0.0
16556	2.8	2.7	0.0
16557	2.8	2.8	0.0
16561	3.6	3.5	0.0
16562	1.9	1.9	0.0
16563	3.9	3.9	0.0
16566	3.5	3.4	0.0
16567	2.9	2.9	0.0
16568	1.2	1.2	0.0
16618	2.4	2.3	0.1
16793	4.8	4.7	0.1
16851	2.5	2.5	0.0
16854	1.6	1.5	0.0
16959	5.0	5.0	0.0
17056	1.1	1.1	0.0
17254	3.3	3.2	0.0
17263	5.0	5.0	0.0
17319	1.7	1.7	0.1
17325	2.6	2.6	0.0

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
17328	2.5	2.5	0.0
17331	2.3	2.2	0.0
17336	2.2	2.1	0.0
17339	2.5	2.4	0.0
17341	2.8	2.7	0.0
17351	2.4	2.4	0.0
17355	2.5	2.4	0.0
17529	1.1	1.0	0.0
17530	2.9	2.8	0.1
17567	3.0	2.9	0.0
17572	1.9	1.9	0.0
17574	2.5	2.4	0.0
17593	1.7	1.7	0.0
17609	2.4	2.4	0.0
17617	1.8	1.7	0.0
17618	2.5	2.4	0.0
17625	3.0	2.9	0.0
17634	1.3	1.2	0.0
17661	1.8	1.7	0.0
17667	0.2	0.1	0.0
17672	3.4	3.3	0.1
17694	1.4	1.4	0.0
17704	3.0	3.0	0.1
17774	2.0	2.0	0.0
17812	3.2	3.1	0.1
17889	1.7	1.7	0.0
17891	0.3	0.2	0.0
17897	1.9	1.8	0.0
17898	2.1	2.1	0.0
17901	1.0	0.9	0.0
17906	3.0	2.9	0.1
17921	2.2	2.2	0.0
17927	1.5	1.5	0.0
17936	2.6	2.5	0.0
17939	3.3	3.2	0.1
17951	0.7	0.6	0.0
17959	1.4	1.4	0.0
17968	0.3	0.3	0.0
17972	3.1	3.1	0.1
18002	1.6	1.6	0.0
18011	0.4	0.4	0.0
18015	3.4	3.4	0.1
18030	1.0	1.0	0.0
18033	4.0	0.7	3.3
18047	1.2	1.2	0.0
18054	3.7	3.7	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
18067	1.3	1.3	0.0
18070	0.8	0.7	0.1
18075	1.2	1.2	0.0
18079	1.8	1.8	0.0
18083	0.7	0.7	0.0
18089	2.8	2.7	0.0
18090	2.1	2.1	0.0
18093	3.2	3.2	0.1
18116	3.1	3.1	0.1
18119	1.9	1.9	0.0
18129	2.1	2.0	0.0
18142	3.3	3.2	0.1
18200	3.2	3.2	0.1
18213	1.9	1.9	0.0
18272	0.5	0.5	0.0
18277	1.2	1.2	0.0
18284	1.2	1.2	0.0
18285	1.3	1.3	0.0
18286	0.7	0.7	0.0
18288	3.3	3.2	0.1
18297	1.9	1.8	0.0
18309	0.9	0.8	0.1
18313	0.8	0.7	0.1
18319	1.1	1.1	0.0
18320	3.4	3.3	0.1
18404	0.6	0.6	0.1
18443	4.0	4.0	0.1
18455	4.6	4.6	0.1
18464	4.4	4.4	0.1
18466	3.7	3.6	0.1
18469	3.6	3.5	0.1
18471	2.3	2.2	0.1
18479	3.3	3.2	0.1
18482	0.9	0.9	0.1
18485	1.8	1.7	0.1
18489	2.5	2.4	0.1
18491	0.1	0.0	0.0
18598	0.6	0.5	0.1
18610	3.2	3.2	0.1
18613	3.8	3.7	0.1
18614	1.7	1.6	0.1
18618	1.8	1.7	0.1
18662	3.0	3.0	0.1
18700	3.7	3.6	0.1
18743	0.3	0.3	0.1
18755	0.4	0.3	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
18771	2.3	2.2	0.1
18778	3.2	3.1	0.1
18816	1.3	1.3	0.1
18856	2.3	2.3	0.1
18881	1.9	1.8	0.1
18883	3.4	3.3	0.1
18894	0.2	0.1	0.1
18897	1.0	0.9	0.1
18914	0.2	0.1	0.1
18916	2.0	1.9	0.1
18923	1.9	1.8	0.1
18948	3.3	3.2	0.1
19019	0.2	0.1	0.1
19025	1.6	1.5	0.1
19026	1.7	1.6	0.1
19031	2.3	2.2	0.1
19042	1.8	1.7	0.1
19052	2.1	2.1	0.1
19077	2.3	2.2	0.1
19109	0.7	0.6	0.1
19113	0.3	0.2	0.1
19169	1.3	1.2	0.1
19184	2.1	2.0	0.1
19193	1.7	1.6	0.1
19207	0.9	0.8	0.1
19212	2.3	2.2	0.1
19245	1.9	1.9	0.1
19246	0.9	0.8	0.1
19259	1.2	1.2	0.1
19266	1.1	1.0	0.1
19276	2.0	1.9	0.1
19288	4.9	4.8	0.1
19310	0.8	0.7	0.1
19354	0.8	0.7	0.1
19359	0.7	0.6	0.1
19410	1.4	1.3	0.1
19444	1.3	1.2	0.1
19447	5.0	4.9	0.1
19463	1.8	1.7	0.1
19488	2.0	1.9	0.1
19513	1.7	1.6	0.1
19520	1.8	1.8	0.1
19563	0.8	0.7	0.1
19566	0.7	0.6	0.1
19592	1.1	1.1	0.1
19607	0.5	0.4	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
19613	0.9	0.8	0.1
19614	0.6	0.5	0.1
19616	0.3	0.2	0.1
19630	0.3	0.2	0.1
19650	0.8	0.7	0.1
19680	0.5	0.5	0.1
19724	0.4	0.3	0.1
19735	1.3	1.2	0.1
19797	0.2	0.2	0.1
19876	0.1	0.0	0.1
19878	0.4	0.3	0.1
19880	0.9	0.8	0.1
20153	2.3	2.2	0.1
20267	1.0	0.9	0.1
20269	4.7	4.6	0.1
20442	2.1	2.0	0.1
20459	2.3	2.2	0.1
20463	2.6	2.5	0.1
20657	1.0	0.9	0.1
20673	0.4	0.3	0.1
20680	3.0	3.0	0.1
21177	1.3	1.2	0.1
21381	4.3	4.2	0.1
21530	1.1	1.0	0.1
21537	0.6	0.5	0.1
21872	0.5	0.4	0.1
22001	2.4	2.3	0.1
22018	0.4	0.3	0.1
22056	3.0	2.9	0.1
22058	3.1	3.0	0.1
22061	3.2	3.1	0.1
22062	3.8	3.7	0.1
22069	2.6	2.5	0.1
22075	1.8	1.7	0.1
22089	3.0	2.9	0.1
22225	2.2	2.1	0.1
22244	2.2	2.1	0.1
22382	3.4	3.3	0.1
22876	2.8	2.7	0.1
22878	0.2	0.1	0.1
22893	0.2	0.1	0.1
22918	3.4	3.3	0.1
22928	3.4	3.3	0.1
22949	2.2	2.1	0.1
22962	2.0	2.0	0.1
22966	3.1	3.0	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
22976	5.0	5.0	0.0
22982	3.6	3.5	0.1
22989	4.2	4.1	0.1
22991	2.5	2.4	0.1
22994	4.7	4.6	0.1
23000	5.0	5.0	0.0
23031	2.5	2.4	0.1
23054	0.4	0.3	0.1
23092	3.1	3.0	0.1
23098	3.0	2.9	0.1
23179	1.9	1.8	0.1
23198	3.1	3.0	0.1
23290	2.4	2.3	0.1
23330	2.1	2.0	0.1
23344	4.0	3.9	0.1
23397	2.7	2.6	0.1
23400	0.1	0.0	0.1
23404	1.3	1.1	0.1
23407	1.1	1.0	0.1
23417	0.6	0.5	0.1
23487	2.8	2.7	0.1
23518	3.5	3.4	0.1
23538	2.7	2.6	0.1
23541	2.8	2.7	0.1
23546	3.7	3.6	0.1
23550	3.7	3.6	0.1
23685	5.0	5.0	0.0
23689	4.4	4.3	0.1
23690	1.6	1.5	0.1
23710	4.6	4.5	0.1
23777	2.6	2.5	0.1
23788	0.6	0.5	0.1
23790	1.0	0.8	0.1
23792	0.3	0.2	0.1
23869	4.1	4.0	0.1
23928	5.0	5.0	0.0
23929	4.3	4.2	0.1
23943	5.0	5.0	0.0
23993	0.2	0.1	0.1
24182	3.0	2.9	0.1
24254	1.4	1.3	0.1
24256	0.7	0.6	0.1
24259	0.6	0.5	0.1
24319	5.0	5.0	0.0
24350	3.9	3.8	0.1
24366	5.0	4.9	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
24385	5.0	5.0	0.0
24388	4.9	4.7	0.1
24395	3.6	3.5	0.1
24396	4.4	4.3	0.1
24403	2.7	2.6	0.1
24406	3.4	3.3	0.1
24412	2.5	2.4	0.1
24414	1.3	1.2	0.1
24422	2.7	2.6	0.1
24435	3.8	3.7	0.1
24450	3.7	3.6	0.1
24481	4.3	4.2	0.1
24541	4.6	4.5	0.1
24591	2.8	2.7	0.1
24605	5.0	5.0	0.0
24621	4.6	4.5	0.1
24628	3.9	3.8	0.1
24652	1.9	1.8	0.1
24653	0.9	0.8	0.1
24690	2.0	1.9	0.1
24717	3.7	3.6	0.1
24726	4.1	4.0	0.1
24798	2.6	2.5	0.1
24884	1.4	1.3	0.1
24916	1.5	1.4	0.1
25033	4.0	3.9	0.1
25035	4.3	4.2	0.1
25051	3.4	3.3	0.1
25108	2.3	2.2	0.1
25146	3.5	3.4	0.1
25176	0.3	0.2	0.1
25180	5.0	5.0	0.0
25242	3.9	3.8	0.1
25255	4.5	4.4	0.1
25277	3.9	3.8	0.1
25278	4.7	4.6	0.1
25283	1.4	1.4	0.1
25284	2.2	2.1	0.1
25285	1.3	1.2	0.1
25286	1.4	1.3	0.1
25287	1.0	0.9	0.1
25289	0.7	0.6	0.1
25290	1.3	1.2	0.1
25291	1.1	1.0	0.1
25296	0.6	0.5	0.1
25297	0.5	0.4	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
25348	1.7	1.6	0.1
25409	4.0	3.9	0.1
25414	2.4	2.3	0.1
25444	4.1	4.0	0.1
25450	0.3	0.2	0.1
25451	1.3	1.2	0.1
25458	5.0	5.0	0.0
25474	4.7	4.5	0.1
25476	4.1	4.0	0.1
25496	4.0	3.9	0.1
25504	4.0	3.9	0.1
25612	5.0	4.9	0.1
25632	5.0	5.0	0.0
25638	5.0	5.0	0.0
25648	5.0	5.0	0.0
25653	4.1	4.0	0.1
25665	3.8	3.7	0.1
25672	1.3	1.2	0.1
25679	1.1	1.0	0.1
25680	1.4	1.3	0.1
25681	1.2	1.1	0.1
25683	1.7	1.6	0.1
25684	0.9	0.8	0.1
25686	2.0	1.9	0.1
25687	1.1	1.0	0.1
25688	1.0	0.9	0.1
25689	0.1	0.1	0.1
25691	0.9	0.8	0.1
25692	0.2	0.1	0.1
25693	0.6	0.5	0.1
25697	0.2	0.1	0.1
25763	5.0	5.0	0.0
25882	3.3	3.2	0.1
25897	0.3	0.2	0.1
26023	1.5	1.5	0.1
26025	0.4	0.3	0.1
26049	4.6	4.5	0.1
26050	4.6	4.5	0.1
26051	5.0	5.0	0.0
26059	5.0	5.0	0.0
26072	0.2	0.1	0.1
26102	4.6	4.5	0.1
26105	4.6	4.5	0.1
26111	4.7	4.6	0.1
26114	4.0	3.9	0.1
26116	4.2	4.1	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
26128	0.1	0.1	0.1
26129	4.5	4.4	0.1
26140	2.2	2.0	0.1
26294	0.2	0.1	0.1
26303	4.5	4.4	0.1
26304	4.5	4.4	0.1
26305	4.5	4.4	0.1
26306	4.3	4.2	0.1
26308	4.9	4.8	0.1
26310	4.6	4.5	0.1
26314	5.0	4.9	0.1
26323	4.5	4.4	0.1
26325	4.5	4.4	0.1
26327	4.6	4.5	0.1
26341	4.6	4.5	0.1
26343	5.0	4.9	0.1
26344	4.6	4.5	0.1
26345	4.2	4.1	0.1
26355	4.7	4.6	0.1
26357	5.0	5.0	0.0
26359	5.0	5.0	0.0
26370	0.2	0.2	0.1
26379	4.7	4.6	0.1
26412	4.8	4.7	0.1
26428	5.0	4.9	0.1
26452	4.8	4.7	0.1
26476	4.5	4.4	0.1
26479	3.3	3.2	0.1
26485	5.0	5.0	0.0
26487	2.4	2.3	0.1
26490	5.0	5.0	0.0
26496	1.3	1.2	0.1
26497	5.0	5.0	0.0
26501	4.6	4.5	0.1
26503	5.0	5.0	0.0
26514	5.0	4.9	0.1
26517	4.7	4.6	0.1
26518	5.0	5.0	0.0
26519	5.0	5.0	0.0
26520	4.9	4.8	0.1
26521	4.9	4.8	0.1
26522	4.8	4.7	0.1
26530	2.7	2.6	0.1
26537	1.9	1.8	0.1
26539	2.9	2.8	0.1
26540	1.4	1.3	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
26541	2.2	2.1	0.1
26544	2.3	2.1	0.1
26566	4.8	4.6	0.1
26600	4.6	4.5	0.1
26732	5.0	4.9	0.1
26738	5.0	5.0	0.0
26740	5.0	5.0	0.0
26744	4.8	4.7	0.1
26746	5.0	5.0	0.0
26747	5.0	5.0	0.0
26752	5.0	5.0	0.0
26759	5.0	4.9	0.1
26761	4.9	4.8	0.1
26766	4.9	4.8	0.1
26793	4.7	4.6	0.1
26807	4.8	4.7	0.1
26820	4.5	4.4	0.1
26829	4.6	4.5	0.1
26841	4.8	4.7	0.1
26870	4.7	4.6	0.1
26899	1.7	1.6	0.1
26920	4.9	4.8	0.1
26942	0.9	0.8	0.1
26962	4.7	4.6	0.1
26969	0.4	0.3	0.1
26980	5.0	5.0	0.0
26986	5.0	5.0	0.0
26989	5.0	4.9	0.1
26993	5.0	5.0	0.0
26995	5.0	4.9	0.1
27000	4.6	4.5	0.1
27002	4.8	4.7	0.1
27005	4.8	4.7	0.1
27007	4.8	4.7	0.1
27009	5.0	5.0	0.0
27017	5.0	5.0	0.0
27033	4.8	4.7	0.1
27155	2.9	2.8	0.1
27156	3.0	2.9	0.1
27158	5.0	5.0	0.0
27163	5.0	5.0	0.0
27166	5.0	5.0	0.0
27200	0.3	0.1	0.1
27201	0.5	0.4	0.1
27231	0.5	0.4	0.1
27271	2.1	2.0	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
27290	1.2	1.0	0.1
27314	0.7	0.6	0.1
27333	1.1	0.9	0.1
27401	2.6	2.5	0.1
27403	2.4	2.3	0.1
27408	2.9	2.8	0.1
27415	2.7	2.6	0.1
27425	2.8	2.7	0.1
27437	1.8	1.7	0.1
27466	1.2	1.1	0.1
27468	0.4	0.3	0.1
27477	4.5	4.4	0.1
27489	2.2	2.1	0.1
27498	0.3	0.3	0.1
27500	1.3	1.3	0.1
27516	0.8	0.7	0.1
27621	1.3	1.2	0.1
27622	2.3	2.2	0.1
27628	3.2	3.1	0.1
27629	5.0	5.0	0.0
27631	5.0	5.0	0.0
27655	2.4	2.3	0.1
27656	2.3	2.2	0.1
27714	1.3	1.2	0.1
27720	5.0	5.0	0.0
27721	1.9	1.8	0.1
27735	2.6	2.5	0.1
27741	3.7	3.6	0.1
27742	2.8	2.7	0.1
27745	3.7	3.6	0.1
27746	3.0	2.9	0.1
27752	0.3	0.2	0.1
27761	1.0	0.9	0.1
27794	0.7	0.6	0.1
27819	0.9	0.8	0.1
27839	1.3	1.2	0.1
27847	2.7	2.6	0.1
27936	5.0	5.0	0.0
27954	0.5	0.4	0.1
27978	1.2	1.1	0.1
27994	1.3	1.2	0.1
28054	1.8	1.7	0.1
28072	3.7	3.6	0.1
28092	3.7	3.6	0.1
28096	2.0	1.9	0.1
28101	1.7	1.6	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
28102	5.0	4.9	0.1
28110	3.1	3.0	0.1
28111	2.5	2.4	0.1
28112	2.2	2.1	0.1
28115	3.0	2.8	0.1
28116	3.1	2.9	0.1
28117	2.6	2.5	0.1
28119	2.8	2.7	0.1
28120	2.5	2.4	0.1
28121	2.9	2.8	0.1
28122	3.5	3.3	0.1
28123	2.3	2.2	0.1
28170	1.9	1.8	0.1
28288	2.0	1.8	0.1
28300	3.4	3.3	0.1
28328	1.9	1.9	0.1
28350	3.7	3.6	0.1
28355	3.5	3.4	0.1
28359	2.8	2.7	0.1
28362	2.4	2.3	0.1
28363	2.0	1.9	0.1
28365	2.7	2.6	0.1
28448	0.5	0.4	0.1
28696	3.6	3.4	0.1
28697	5.0	5.0	0.0
28706	2.5	2.4	0.1
28770	4.4	4.3	0.1
28857	3.7	3.6	0.1
28897	2.8	2.7	0.1
28901	2.6	2.5	0.1
29038	5.0	4.9	0.1
29080	3.6	3.5	0.1
29096	1.3	1.2	0.1
29189	3.1	3.0	0.1
29320	0.8	0.7	0.1
29408	0.1	0.0	0.1
29424	2.5	2.4	0.1
29426	2.9	2.8	0.1
29428	3.5	3.4	0.1
29430	2.9	2.8	0.1
29433	1.3	1.2	0.1
29434	3.8	3.7	0.1
29477	0.9	0.8	0.1
29527	3.3	3.2	0.1
29551	1.3	1.2	0.1
29721	3.8	3.7	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
29778	0.9	0.7	0.1
29863	0.3	0.2	0.1
29866	0.5	0.4	0.1
29951	3.1	3.0	0.1
29981	1.8	1.7	0.1
30014	1.7	1.6	0.1
30109	3.8	3.7	0.1
30136	1.4	1.3	0.1
30166	0.5	0.4	0.1
30169	1.2	1.1	0.1
30280	0.7	0.6	0.1
30281	0.9	0.8	0.1
30417	0.5	0.4	0.1
30515	0.5	0.4	0.1
30545	0.4	0.3	0.1
30628	0.2	0.1	0.1
30786	0.2	0.1	0.1
30877	0.4	0.3	0.1
31000	5.0	5.0	0.0
31021	5.0	5.0	0.0
31142	0.7	0.6	0.1
31371	0.6	0.5	0.1
31410	0.6	0.5	0.1
31412	1.2	1.1	0.1
31416	5.0	5.0	0.0
31431	1.2	1.1	0.1
31451	1.5	1.4	0.1
31465	3.3	3.2	0.1
31468	0.7	0.6	0.1
31491	0.8	0.7	0.1
31557	0.5	0.4	0.1
31564	2.4	2.3	0.1
31599	0.5	0.4	0.1
31626	0.8	0.7	0.1
31630	0.2	0.1	0.1
31631	0.3	0.2	0.1
31634	2.5	2.4	0.1
31654	5.0	5.0	0.0
31665	0.2	0.1	0.1
31749	0.3	0.2	0.1
31892	5.0	5.0	0.0
31907	1.2	1.1	0.1
31938	0.2	0.1	0.1
31994	1.4	1.3	0.1
31998	0.2	0.1	0.1
32035	0.3	0.2	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
32040	0.4	0.3	0.1
32123	0.2	0.1	0.1
32130	0.2	0.1	0.1
32220	2.3	2.1	0.1
32222	4.8	4.7	0.1
32224	5.0	5.0	0.0
32228	3.4	3.3	0.1
32363	5.0	5.0	0.0
32570	3.7	3.6	0.1
32644	1.8	1.7	0.1
32738	2.8	2.7	0.1
32852	2.9	2.8	0.1
32862	2.6	2.5	0.1
32863	2.0	1.9	0.1
32864	2.1	2.0	0.1
32867	1.7	1.6	0.1
32868	1.6	1.5	0.1
32870	2.7	2.6	0.1
32872	3.6	3.5	0.1
32925	2.7	2.6	0.1
32970	2.4	2.3	0.1
32971	3.8	3.7	0.1
32972	5.0	5.0	0.0
33161	3.2	3.1	0.1
33177	2.5	2.4	0.1
33180	3.0	2.9	0.1
33199	3.9	3.8	0.1
33202	3.6	3.5	0.1
33203	3.1	3.0	0.1
33204	3.2	3.1	0.1
33206	3.8	3.7	0.1
33207	3.5	3.4	0.1
33208	3.1	3.0	0.1
33209	2.4	2.3	0.1
33210	3.1	3.0	0.1
33211	2.8	2.6	0.1
33234	1.8	1.7	0.1
33277	2.4	2.3	0.1
33279	3.2	3.1	0.1
33280	3.0	2.9	0.1
33281	2.5	2.4	0.1
33295	0.3	0.2	0.1
33352	2.6	2.5	0.1
33353	5.0	5.0	0.0
33410	5.0	5.0	0.0
33450	2.5	2.4	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
33464	2.5	2.4	0.1
33469	2.9	2.8	0.1
33475	5.0	5.0	0.0
33476	3.2	3.1	0.1
33500	5.0	5.0	0.0
33504	5.0	5.0	0.0
33507	5.0	5.0	0.0
33513	5.0	5.0	0.0
33524	5.0	5.0	0.0
33533	1.7	5.0	-3.3
33536	5.0	5.0	0.0
33538	5.0	5.0	0.0
33552	2.5	2.4	0.1
33555	3.7	3.6	0.1
33556	4.2	4.1	0.1
33557	2.9	2.8	0.1
33558	2.9	2.8	0.1
33559	3.2	3.1	0.1
33560	2.7	2.6	0.1
33561	3.1	3.0	0.1
33562	2.9	2.8	0.1
33563	3.7	3.6	0.1
33564	3.6	3.5	0.1
33565	3.7	3.6	0.1
33566	3.8	3.7	0.1
33567	4.1	3.9	0.1
33568	4.0	3.9	0.1
33569	4.0	3.9	0.1
33570	3.9	3.8	0.1
33571	3.8	3.7	0.1
33572	4.0	3.9	0.1
33573	2.2	2.1	0.1
33574	3.9	3.8	0.1
33575	4.3	4.2	0.1
33576	3.9	3.8	0.1
33577	3.9	3.8	0.1
33578	2.3	2.2	0.1
33580	2.8	2.7	0.1
33581	3.0	2.9	0.1
33582	3.1	3.0	0.1
33583	2.9	2.8	0.1
33584	2.7	2.6	0.1
33585	2.3	2.2	0.1
33586	2.8	2.7	0.1
33587	3.2	3.1	0.1
33588	2.6	2.5	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
33589	2.2	2.1	0.1
33591	3.1	3.0	0.1
33593	2.8	2.7	0.1
33620	4.0	3.9	0.1
33622	1.9	1.8	0.1
33623	2.7	2.6	0.1
33626	1.4	1.3	0.1
33777	4.3	4.2	0.1
33869	4.2	4.1	0.1
33888	5.0	5.0	0.0
33889	1.8	1.7	0.1
33894	2.6	2.5	0.1
33916	4.7	4.6	0.1
33917	2.9	2.8	0.1
34026	3.4	3.2	0.1
34031	4.8	4.7	0.1
34033	3.8	3.7	0.1
34035	3.6	3.5	0.1
34039	3.5	3.4	0.1
34043	3.7	3.6	0.1
34045	3.7	3.6	0.1
34048	5.0	5.0	0.0
34051	4.1	4.0	0.1
34053	3.1	3.0	0.1
34055	2.5	2.4	0.1
34057	2.5	2.4	0.1
34059	3.2	3.1	0.1
34062	2.8	2.7	0.1
34065	3.0	2.9	0.1
34066	4.3	4.2	0.1
34069	2.3	2.2	0.1
34070	2.3	2.2	0.1
34075	2.2	2.1	0.1
34079	2.3	2.1	0.1
34082	2.7	2.6	0.1
34084	2.8	2.7	0.1
34086	2.9	2.8	0.1
34090	2.7	2.6	0.1
34093	2.1	2.0	0.1
34096	2.5	2.4	0.1
34100	2.4	2.3	0.1
34102	2.5	2.4	0.1
34105	2.5	2.4	0.1
34107	2.7	2.5	0.1
34110	3.1	3.0	0.1
34112	2.3	2.2	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
34115	2.0	1.9	0.1
34202	3.8	3.7	0.1
34274	2.3	2.2	0.1
34276	1.7	1.6	0.1
34330	1.8	1.6	0.1
34375	4.3	4.2	0.1
34376	3.7	3.6	0.1
34378	4.2	4.1	0.1
34379	4.5	4.4	0.1
34380	3.9	3.8	0.1
34381	3.8	3.7	0.1
34382	3.9	3.8	0.1
34383	3.6	3.5	0.1
34384	4.2	4.1	0.1
34385	4.5	4.4	0.1
34386	5.0	5.0	0.0
34387	4.5	4.4	0.1
34388	4.0	3.9	0.1
34389	3.4	3.3	0.1
34391	3.5	3.4	0.1
34392	2.5	2.4	0.1
34393	2.6	2.5	0.1
34394	4.3	4.2	0.1
34395	4.9	4.8	0.1
34396	4.3	4.1	0.1
34397	0.9	0.8	0.1
34398	3.4	3.3	0.1
34399	3.1	3.0	0.1
34401	3.6	3.4	0.1
34405	3.9	3.7	0.1
34406	4.4	4.3	0.1
34407	2.2	2.1	0.1
34408	3.0	2.9	0.1
34409	2.5	2.4	0.1
34410	2.4	2.3	0.1
34411	3.5	3.4	0.1
34415	3.0	2.9	0.1
34416	1.9	1.8	0.1
34417	3.1	3.0	0.1
34418	2.8	2.7	0.1
34419	2.7	2.6	0.1
34420	2.5	2.4	0.1
34421	2.8	2.7	0.1
34423	3.1	3.0	0.1
34426	3.0	2.9	0.1
34428	2.3	2.2	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
34429	2.2	2.1	0.1
34430	2.3	2.2	0.1
34433	2.1	2.0	0.1
34434	2.2	2.1	0.1
34435	2.9	2.8	0.1
34436	1.5	1.4	0.1
34438	3.0	2.9	0.1
34440	1.4	1.3	0.1
34441	1.1	1.0	0.1
34465	3.5	3.4	0.1
34584	2.1	2.0	0.1
34627	3.1	3.0	0.1
34635	2.1	2.0	0.1
34663	0.9	0.8	0.1
34925	4.5	4.4	0.1
34926	4.6	4.5	0.1
34927	5.0	5.0	0.0
34930	2.8	2.7	0.1
34931	3.1	3.0	0.1
34933	3.4	3.2	0.1
34935	3.7	3.6	0.1
34936	4.6	4.5	0.1
34937	3.3	3.2	0.1
34938	3.2	3.1	0.1
34939	3.7	3.6	0.1
34940	3.2	3.1	0.1
34941	2.9	2.7	0.1
34942	2.7	2.6	0.1
34943	1.5	1.4	0.1
34944	2.0	1.9	0.1
34947	3.3	3.1	0.1
34952	2.5	2.4	0.1
34953	2.2	2.1	0.1
34954	1.5	1.4	0.1
34955	1.6	1.5	0.1
34957	2.8	2.7	0.1
34960	2.9	2.8	0.1
34961	2.0	1.9	0.1
34962	2.1	2.0	0.1
34963	2.2	2.1	0.1
34964	2.5	2.4	0.1
34966	3.3	3.2	0.1
34967	2.8	2.6	0.1
34972	2.0	1.9	0.1
34973	2.6	2.5	0.1
34974	2.2	2.1	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
34976	2.8	2.7	0.1
34977	3.0	2.9	0.1
34978	2.5	2.4	0.1
34979	3.0	2.9	0.1
34981	2.0	1.9	0.1
34982	2.9	2.8	0.1
34984	3.7	3.6	0.1
34986	1.3	1.2	0.1
34987	2.2	2.1	0.1
34988	2.9	2.7	0.1
34989	2.5	2.4	0.1
34990	1.0	0.9	0.1
34991	1.9	1.8	0.1
34992	2.2	2.1	0.1
34993	1.2	1.1	0.1
34994	3.2	3.1	0.1
34996	2.3	2.2	0.1
35240	5.0	4.9	0.1
35249	4.0	3.9	0.1
35250	1.8	1.7	0.1
35252	3.3	3.2	0.1
35253	3.4	3.3	0.1
35254	1.5	1.4	0.1
35256	1.2	1.1	0.1
35258	2.1	1.9	0.1
35260	2.7	2.6	0.1
35264	2.3	2.2	0.1
35266	1.8	1.6	0.1
35268	1.8	1.7	0.1
35270	2.9	2.8	0.1
35271	3.4	3.3	0.1
35272	2.8	2.7	0.1
35275	3.4	3.3	0.1
35287	2.5	2.4	0.1
35290	2.8	2.7	0.1
35291	1.8	1.7	0.1
35293	2.1	2.0	0.1
35304	3.2	3.1	0.1
35309	2.0	1.9	0.1
35311	2.3	2.2	0.1
35312	2.4	2.3	0.1
35313	2.2	2.1	0.1
35317	2.1	2.0	0.1
35320	2.7	2.6	0.1
35324	2.7	2.6	0.1
35326	2.3	2.1	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
35330	3.4	3.3	0.1
35334	3.8	3.7	0.1
35336	3.7	3.6	0.1
35337	3.3	3.2	0.1
35338	2.6	2.5	0.1
35340	2.6	2.5	0.1
35341	2.4	2.2	0.1
35344	3.1	3.0	0.1
35345	2.2	2.1	0.1
35390	3.9	3.8	0.1
35400	3.6	3.5	0.1
35407	0.8	0.7	0.1
35409	1.6	1.5	0.1
35711	5.0	5.0	0.0
35723	3.9	3.8	0.1
35730	3.2	3.1	0.1
35732	2.3	2.1	0.1
35734	2.4	2.3	0.1
35736	1.4	1.3	0.1
35738	0.9	0.8	0.1
35740	1.8	1.7	0.1
35741	1.7	1.6	0.1
35742	2.1	2.0	0.1
35743	2.0	1.9	0.1
35744	1.8	1.7	0.1
35745	2.9	2.7	0.1
35746	2.8	2.7	0.1
35747	1.9	1.8	0.1
35748	1.9	1.8	0.1
35749	2.2	2.1	0.1
35750	2.1	2.0	0.1
35751	0.8	0.7	0.1
35752	1.5	1.3	0.1
35753	2.4	2.3	0.1
35754	2.3	2.1	0.1
35755	1.9	1.8	0.1
35756	2.4	2.3	0.1
35757	1.8	1.7	0.1
35758	1.8	1.7	0.1
35759	1.9	1.8	0.1
35761	2.4	2.3	0.1
35762	2.5	2.4	0.1
35763	2.6	2.5	0.1
35764	2.6	2.5	0.1
35766	2.8	2.6	0.1
35767	2.3	2.2	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
35768	2.3	2.2	0.1
35769	3.1	3.0	0.1
35770	3.5	3.4	0.1
35771	2.9	2.8	0.1
35772	3.0	2.9	0.1
35773	2.7	2.6	0.1
35775	3.5	3.4	0.1
35776	1.8	1.7	0.1
35777	3.7	3.6	0.1
35811	2.3	2.2	0.1
35813	3.8	3.6	0.1
35867	2.3	2.2	0.1
35869	2.8	2.7	0.1
36022	5.0	5.0	0.0
36042	3.1	3.0	0.1
36048	3.2	3.1	0.1
36050	3.3	3.2	0.1
36051	3.0	2.9	0.1
36053	1.9	1.8	0.1
36055	1.8	1.7	0.1
36057	2.4	2.3	0.1
36058	2.9	2.7	0.1
36060	2.3	2.2	0.1
36061	1.6	1.5	0.1
36063	1.8	1.7	0.1
36064	2.1	1.9	0.1
36065	2.0	1.9	0.1
36066	2.0	1.9	0.1
36067	1.9	1.8	0.1
36068	2.2	2.1	0.1
36069	3.2	3.1	0.1
36070	1.8	1.7	0.1
36071	2.2	2.1	0.1
36074	1.4	1.2	0.1
36077	2.5	2.4	0.1
36078	2.9	2.7	0.1
36079	3.3	3.2	0.1
36080	2.8	2.7	0.1
36081	2.5	2.4	0.1
36082	2.1	2.0	0.1
36083	2.1	2.0	0.1
36084	2.0	1.9	0.1
36085	2.5	2.4	0.1
36086	3.0	2.9	0.1
36093	2.4	2.3	0.1
36141	2.8	2.6	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
36150	1.4	1.3	0.1
36151	2.2	2.1	0.1
36165	3.3	3.2	0.1
36250	2.7	2.6	0.1
36291	3.5	3.4	0.1
36368	0.5	0.4	0.1
36459	1.7	1.6	0.1
36497	2.4	2.3	0.1
36507	3.6	3.5	0.1
36508	1.5	1.3	0.1
36510	2.2	2.1	0.1
36513	2.3	2.2	0.1
36514	2.0	1.8	0.1
36517	1.9	1.8	0.1
36518	1.9	1.8	0.1
36547	0.9	0.8	0.1
36550	2.1	2.0	0.1
36586	2.8	2.7	0.1
36588	2.8	2.7	0.1
36592	2.4	2.3	0.1
36597	2.0	1.9	0.1
36598	1.9	1.8	0.1
36663	2.5	2.4	0.1
36664	1.6	1.5	0.1
36667	2.0	1.9	0.1
36754	2.7	2.6	0.1
36755	2.3	2.2	0.1
36757	2.4	2.3	0.1
36765	2.5	2.3	0.1
36766	3.3	3.2	0.1
36818	2.2	2.1	0.1
36821	2.0	1.9	0.1
36823	2.6	2.4	0.1
36824	1.4	1.3	0.1
36854	2.8	2.7	0.1
36887	1.8	1.7	0.1
36910	2.9	2.7	0.1
37072	0.2	0.1	0.1
37134	2.4	2.3	0.1
37137	2.7	2.6	0.1
37139	2.3	2.2	0.1
37140	2.7	2.6	0.1
37188	3.5	3.4	0.1
37197	2.8	2.6	0.1
37198	1.7	1.6	0.1
37199	1.4	1.3	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
37206	1.9	1.8	0.1
37306	2.9	2.8	0.1
37334	2.4	2.3	0.1
37415	2.2	2.1	0.1
37428	2.7	2.6	0.1
37466	0.3	0.2	0.1
37539	2.6	2.5	0.1
37573	5.0	5.0	0.0
37585	1.2	1.0	0.1
37651	5.0	5.0	0.0
37653	2.0	1.9	0.1
37787	0.6	0.5	0.1
37809	5.0	5.0	0.0
37828	0.8	0.7	0.1
37902	0.3	0.2	0.1
37905	1.3	1.1	0.1
37954	1.3	1.2	0.1
38034	3.2	3.1	0.1
38063	3.3	3.2	0.1
38084	0.1	0.0	0.1
38093	0.5	0.4	0.1
38097	1.2	1.1	0.1
38103	0.4	0.3	0.1
38124	1.4	1.3	0.1
38140	0.8	0.6	0.1
38175	2.4	2.3	0.1
38257	0.5	0.4	0.1
38266	3.4	3.3	0.1
38310	2.6	2.5	0.1
38311	3.0	2.8	0.1
38323	2.8	2.7	0.1
38378	5.0	5.0	0.0
38415	0.5	0.4	0.1
38418	0.4	0.3	0.1
38431	0.7	0.6	0.1
38461	0.3	0.2	0.1
38477	1.0	0.9	0.1
38489	0.8	0.7	0.1
38504	1.3	1.2	0.1
38527	0.8	0.7	0.1
38533	0.9	0.8	0.1
38537	0.2	0.1	0.1
38548	0.5	0.4	0.1
38585	1.3	1.2	0.1
38671	2.1	2.0	0.1
38742	0.8	0.7	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
38787	3.8	3.7	0.1
38799	0.2	0.1	0.1
38806	0.5	0.4	0.1
38877	0.7	0.6	0.1
38905	3.9	3.7	0.1
38917	1.2	1.1	0.1
38919	0.5	0.4	0.1
38940	0.3	0.2	0.1
38968	0.2	0.1	0.1
38970	0.7	0.6	0.1
38996	4.7	4.5	0.1
39103	0.3	0.1	0.1
39157	0.5	0.4	0.1
39164	2.4	2.3	0.1
39227	2.1	2.0	0.1
39233	0.2	0.1	0.1
39239	4.2	4.1	0.1
39284	1.4	1.3	0.1
39351	0.3	0.2	0.1
39394	1.4	1.2	0.1
39406	4.9	4.8	0.1
39437	0.7	0.5	0.1
39505	3.9	3.8	0.1
39547	1.9	1.7	0.1
39586	0.3	0.2	0.1
39747	0.1	0.0	0.1
39748	0.7	0.6	0.1
39762	5.0	4.8	0.1
39833	5.0	5.0	0.0
40122	5.0	5.0	0.0
40179	0.2	0.0	0.1
40182	5.0	5.0	0.0
40271	1.2	1.1	0.1
40347	0.3	0.2	0.1
40519	5.0	5.0	0.0
40850	1.2	1.1	0.1
41066	2.6	2.5	0.1
41111	5.0	5.0	0.0
41425	4.0	3.8	0.1
41635	5.0	5.0	0.0
41636	5.0	5.0	0.0
41904	1.0	0.9	0.1
41907	0.7	0.6	0.1
41914	3.8	3.6	0.1
42311	5.0	5.0	0.0
42317	3.7	3.5	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
42321	3.4	3.2	0.1
42389	0.1	0.0	0.1
42400	3.7	3.6	0.1
42554	0.7	0.5	0.1
42622	5.0	5.0	0.0
42666	2.2	2.1	0.1
42700	4.4	4.3	0.1
42926	2.0	1.9	0.1
42948	2.6	2.5	0.1
42970	5.0	5.0	0.0
42972	5.0	5.0	0.0
43038	1.3	1.2	0.1
43375	5.0	5.0	0.0
43376	5.0	5.0	0.0
43395	5.0	5.0	0.0
43397	5.0	5.0	0.0
43401	4.0	3.8	0.1
43402	5.0	5.0	0.0
43404	4.5	4.4	0.1
43406	4.7	4.5	0.1
43411	2.8	2.7	0.1
43414	1.9	1.8	0.1
43429	1.9	1.8	0.1
43431	0.4	0.3	0.1
43434	3.6	3.5	0.1
43436	0.3	0.1	0.1
43449	2.8	2.7	0.1
43455	0.6	0.4	0.1
43498	0.3	0.2	0.1
43530	5.0	5.0	0.0
43691	1.7	1.6	0.1
43703	2.5	2.4	0.1
43951	5.0	5.0	0.0
43977	0.3	0.2	0.1
43984	2.1	2.0	0.1
43985	2.9	2.8	0.1
43987	3.0	2.8	0.1
43989	3.8	3.7	0.1
44002	5.0	5.0	0.0
44004	5.0	5.0	0.0
44008	5.0	5.0	0.0
44015	0.5	0.4	0.1
44017	1.1	1.0	0.1
44033	4.4	4.3	0.1
44041	3.8	3.7	0.1
44072	0.7	0.6	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
44184	1.1	1.0	0.1
44188	1.1	1.0	0.1
44196	1.3	1.2	0.1
44204	1.6	1.5	0.1
44213	1.8	1.7	0.1
44226	1.1	1.0	0.1
44254	2.0	1.9	0.1
44256	1.6	1.5	0.1
44272	1.8	1.7	0.1
44273	0.5	0.4	0.1
44283	3.1	3.0	0.1
44287	2.6	2.5	0.1
44297	1.5	1.3	0.1
44305	5.0	5.0	0.0
44308	5.0	5.0	0.0
44311	2.0	1.9	0.1
44316	2.3	2.2	0.1
44434	2.4	2.3	0.1
44460	1.0	0.9	0.1
44479	2.0	1.8	0.1
44510	2.2	2.0	0.1
44512	2.7	2.6	0.1
44513	1.9	1.8	0.1
44514	1.1	1.0	0.1
44515	2.1	2.0	0.1
44519	2.2	2.1	0.1
44632	5.0	5.0	0.0
44753	3.9	3.7	0.1
44759	3.6	3.4	0.1
44762	3.7	3.6	0.1
45074	1.6	1.4	0.1
45080	2.8	2.7	0.1
45115	2.0	1.8	0.2
45195	2.0	1.9	0.1
45386	5.0	5.0	0.0
45391	4.4	4.3	0.1
45396	5.0	5.0	0.0
45463	4.5	4.4	0.1
45476	5.0	5.0	0.0
45480	5.0	5.0	0.0
45481	5.0	5.0	0.0
45486	2.6	2.5	0.1
45764	4.7	4.6	0.1
45795	4.9	4.8	0.1
45796	4.7	4.5	0.1
45887	3.7	3.5	0.2

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
45892	2.4	2.3	0.1
46078	5.0	5.0	0.0
46141	3.9	3.8	0.1
46205	0.5	0.3	0.3
46261	4.3	4.2	0.1
46262	4.5	4.4	0.1
46264	5.0	5.0	0.0
46265	4.4	4.3	0.1
46266	5.0	5.0	0.0
46268	5.0	5.0	0.0
46275	3.3	3.2	0.1
46340	3.7	3.5	0.1
46394	5.0	5.0	0.0
46436	5.0	5.0	0.0
46446	3.6	3.5	0.1
46465	5.0	5.0	0.0
46485	4.5	4.4	0.1
46486	4.8	4.6	0.1
46487	4.7	4.6	0.1
46488	4.7	4.6	0.1
46489	4.5	4.4	0.1
46564	5.0	5.0	0.0
46637	4.9	4.8	0.1
46680	5.0	5.0	0.0
46707	5.0	4.9	0.1
46732	4.6	4.5	0.1
46794	3.3	3.2	0.1
46849	4.5	4.4	0.1
46927	5.0	5.0	0.0
46928	3.7	3.6	0.1
46934	3.4	3.3	0.1
46935	2.7	2.6	0.1
46936	4.0	3.8	0.1
46938	4.0	3.9	0.1
47010	4.1	3.9	0.1
47035	5.0	4.9	0.1
47085	3.0	2.8	0.1
47159	5.0	5.0	0.0
47160	3.0	2.9	0.1
47178	3.7	3.6	0.1
47286	4.3	4.1	0.1
47287	3.3	3.2	0.1
47289	2.5	2.4	0.1
47290	2.7	2.6	0.1
47291	3.3	3.2	0.1
47292	3.5	3.3	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
47293	3.7	3.6	0.1
47677	1.4	1.3	0.1
47685	2.4	2.2	0.1
47687	3.0	2.9	0.1
47733	3.4	3.3	0.1
47893	5.0	5.0	0.0
48498	2.6	2.5	0.1
48507	0.4	0.2	0.1
48591	4.1	4.0	0.1
48592	3.3	3.2	0.1
48593	3.7	3.6	0.1
48594	3.2	3.1	0.1
48595	3.7	3.6	0.1
48878	4.8	4.7	0.1
48966	3.0	2.6	0.4
48999	4.7	4.6	0.1
49013	4.0	3.9	0.1
49017	4.3	4.2	0.1
49019	4.5	4.4	0.1
49020	3.4	3.2	0.1
49021	3.7	3.6	0.1
49022	2.6	2.5	0.1
49023	2.7	2.6	0.1
49024	3.3	3.2	0.1
49025	3.1	3.0	0.1
49042	5.0	5.0	0.0
49088	5.0	5.0	0.0
49096	4.1	4.0	0.1
49098	4.9	4.8	0.1
49100	5.0	5.0	0.0
49108	4.6	4.5	0.1
49115	5.0	5.0	0.0
49125	5.0	5.0	0.0
49394	0.7	0.5	0.2
49455	5.0	5.0	0.0
49468	3.8	3.7	0.1
49469	4.1	4.0	0.1
49471	3.4	3.3	0.1
49472	3.6	3.4	0.1
49474	4.2	4.1	0.1
49475	3.3	3.2	0.1
49476	3.8	3.7	0.1
49477	3.7	3.5	0.1
49478	3.2	3.0	0.1
49479	3.4	3.3	0.1
49480	3.3	3.2	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
49484	3.3	3.2	0.1
49486	1.7	1.6	0.1
49488	4.2	4.1	0.1
49490	3.9	3.7	0.1
49491	3.6	3.5	0.1
49494	3.9	3.8	0.1
49495	4.1	4.0	0.1
49496	3.0	2.8	0.1
49498	3.2	3.1	0.1
49499	3.1	3.0	0.1
49500	2.8	2.6	0.1
49501	3.1	3.0	0.1
49502	2.7	2.6	0.1
49503	2.5	2.4	0.1
49506	2.8	2.7	0.1
49507	4.3	4.2	0.1
49508	3.8	3.6	0.1
49509	3.2	3.1	0.1
49511	3.2	3.1	0.1
49512	3.6	3.5	0.1
49706	3.6	3.5	0.1
49872	3.8	3.7	0.1
49881	5.0	5.0	0.0
49884	4.3	4.2	0.1
49886	4.3	4.2	0.1
49887	2.4	2.3	0.1
49888	2.5	2.4	0.1
49889	3.3	3.2	0.1
49893	3.6	3.4	0.1
49894	2.3	2.2	0.1
49901	3.7	3.6	0.1
49902	3.7	3.6	0.1
49903	4.2	4.1	0.1
49904	4.4	4.3	0.1
49906	4.2	4.1	0.1
49908	4.0	3.9	0.1
49910	3.1	2.9	0.1
49911	2.7	2.6	0.1
49912	2.2	2.1	0.1
49913	2.0	1.9	0.1
49915	3.8	3.7	0.1
49917	3.1	3.0	0.1
49918	3.2	3.1	0.1
49920	2.9	2.7	0.1
49921	3.8	3.7	0.1
49922	3.5	3.4	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
49923	4.4	4.3	0.1
49924	3.0	2.8	0.1
49925	2.4	2.2	0.1
49926	2.8	2.7	0.1
49930	2.7	2.6	0.1
49932	2.2	2.1	0.1
50448	5.0	5.0	0.0
50449	4.2	4.1	0.1
50450	4.5	4.4	0.1
50451	5.0	5.0	0.0
50454	5.0	5.0	0.0
50455	5.0	5.0	0.0
50456	5.0	5.0	0.0
50457	5.0	4.9	0.1
50462	4.2	4.1	0.1
50466	3.0	2.9	0.1
50469	2.3	2.2	0.1
50471	3.0	2.9	0.1
50472	3.1	3.0	0.1
50473	3.1	3.0	0.1
50474	3.4	3.3	0.1
50475	4.4	4.2	0.1
50479	3.6	3.5	0.1
50480	4.0	3.9	0.1
50483	2.4	2.3	0.1
50485	1.7	1.6	0.1
50487	1.7	1.6	0.1
50489	1.4	1.3	0.1
50491	1.4	1.3	0.1
50494	3.2	3.1	0.1
50499	3.6	3.5	0.1
50501	1.7	1.6	0.1
50555	5.0	5.0	0.0
50727	2.1	2.0	0.1
50833	3.9	3.8	0.1
50835	4.0	3.9	0.1
50838	5.0	5.0	0.0
50840	5.0	5.0	0.0
50842	4.5	4.3	0.1
50846	2.3	2.2	0.1
50847	3.7	3.5	0.1
50848	3.4	3.3	0.1
50851	3.4	3.3	0.1
50853	3.0	2.9	0.1
50854	2.8	2.7	0.1
50855	2.6	2.5	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
50856	3.9	3.8	0.1
50858	2.7	2.6	0.1
50860	2.2	2.1	0.1
50862	3.1	3.0	0.1
50863	3.2	3.1	0.1
50866	2.0	1.9	0.1
50867	2.3	2.2	0.1
50869	3.4	3.3	0.1
50870	3.3	3.2	0.1
50871	1.8	1.7	0.1
50872	2.8	2.7	0.1
50873	1.8	1.7	0.1
50874	2.9	2.8	0.1
50876	2.2	2.0	0.1
50877	2.5	2.4	0.1
50878	2.6	2.5	0.1
50879	2.8	2.7	0.1
50881	2.9	2.8	0.1
50882	3.4	3.3	0.1
50959	2.9	2.8	0.1
50989	3.4	3.3	0.1
51023	2.9	2.8	0.1
51064	2.7	2.6	0.1
51083	2.2	2.1	0.1
51119	1.7	1.6	0.1
51132	3.1	3.0	0.1
51302	4.6	4.5	0.1
51337	3.6	3.5	0.1
51338	4.5	4.4	0.1
51339	4.8	4.7	0.1
51340	4.3	4.2	0.1
51343	4.1	4.0	0.1
51344	3.4	3.3	0.1
51346	3.6	3.5	0.1
51347	3.9	3.8	0.1
51348	4.9	4.8	0.1
51349	3.4	3.3	0.1
51350	2.8	2.7	0.1
51351	2.4	2.3	0.1
51352	3.3	3.1	0.1
51353	3.5	3.4	0.1
51354	3.3	3.2	0.1
51356	3.4	3.3	0.1
51358	2.4	2.3	0.1
51360	3.7	3.6	0.1
51361	4.0	3.9	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
51362	3.5	3.4	0.1
51363	3.6	3.5	0.1
51364	2.8	2.6	0.1
51365	3.4	3.3	0.1
51366	2.7	2.5	0.1
51368	2.3	2.2	0.1
51369	2.8	2.7	0.1
51370	2.6	2.5	0.1
51371	3.6	3.5	0.1
51373	1.9	1.7	0.1
51375	2.8	2.7	0.1
51378	2.7	2.5	0.1
51502	0.4	0.3	0.1
51568	2.2	2.1	0.1
51574	3.8	3.7	0.1
51629	1.2	1.1	0.1
51657	4.7	4.6	0.1
51664	1.0	0.7	0.4
51668	1.0	0.7	0.4
51713	5.0	5.0	0.0
51722	2.6	2.5	0.1
51723	3.4	3.3	0.1
51724	3.2	3.1	0.1
51725	3.3	3.1	0.1
51726	3.5	3.4	0.1
51727	3.9	3.8	0.1
51731	3.2	3.1	0.1
51734	4.0	3.9	0.1
51735	3.8	3.7	0.1
51737	0.6	0.5	0.1
51738	4.7	4.6	0.1
51739	4.4	4.3	0.1
51742	4.4	4.3	0.1
51743	3.1	2.9	0.1
51745	2.9	2.8	0.1
51746	4.1	4.0	0.1
51747	3.0	2.9	0.1
51748	3.6	3.5	0.1
51751	3.2	3.1	0.1
51752	3.4	3.3	0.1
51756	2.6	2.4	0.1
51757	3.2	3.1	0.1
51758	3.5	3.3	0.1
51759	2.6	2.5	0.1
51762	2.9	2.8	0.1
51764	2.3	2.1	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
51765	2.6	2.5	0.1
51766	2.1	1.9	0.1
51767	2.5	2.4	0.1
51768	1.9	1.8	0.1
51771	1.6	1.5	0.1
51785	3.4	3.3	0.1
51840	3.5	3.4	0.1
51961	3.4	3.3	0.1
52036	2.5	2.4	0.1
52039	3.1	3.0	0.1
52052	3.4	3.3	0.1
52058	5.0	5.0	0.0
52063	1.6	1.4	0.1
52066	1.0	0.8	0.1
52086	1.8	1.7	0.1
52095	5.0	5.0	0.0
52105	2.8	2.7	0.1
52145	0.7	0.4	0.3
52151	2.1	1.8	0.4
52156	2.5	2.1	0.4
52157	0.5	0.1	0.4
52160	1.0	0.7	0.4
52185	0.7	0.3	0.4
52321	3.0	2.9	0.1
52322	3.1	3.0	0.1
52324	3.3	3.2	0.1
52325	3.3	3.2	0.1
52326	3.0	2.9	0.1
52327	3.2	3.1	0.1
52328	3.5	3.4	0.1
52332	3.7	3.6	0.1
52334	3.2	3.0	0.1
52335	4.0	3.9	0.1
52336	3.6	3.5	0.1
52337	3.9	3.8	0.1
52339	3.3	3.2	0.1
52340	3.0	2.8	0.1
52342	3.0	2.9	0.1
52346	3.0	2.9	0.1
52347	3.8	3.7	0.1
52348	3.1	3.0	0.1
52349	4.9	4.8	0.1
52351	4.4	4.3	0.1
52352	3.4	3.3	0.1
52353	3.0	2.9	0.1
52354	2.2	2.1	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
52355	2.4	2.3	0.1
52356	3.5	3.4	0.1
52357	2.3	2.2	0.1
52358	2.7	2.6	0.1
52362	1.8	1.7	0.1
52363	1.1	1.0	0.1
52364	0.7	0.6	0.1
52365	1.9	1.8	0.1
52366	1.0	0.9	0.1
52367	0.8	0.7	0.1
52405	5.0	5.0	0.0
52462	5.0	5.0	0.0
52558	3.4	3.3	0.1
52560	3.2	3.1	0.1
52561	5.0	4.9	0.1
52562	2.7	2.6	0.1
52564	2.8	2.7	0.1
52577	3.0	2.8	0.1
52578	0.5	0.4	0.1
52583	1.8	1.7	0.1
52596	3.2	3.1	0.1
52612	4.6	4.5	0.1
52713	1.4	1.0	0.3
52721	5.0	5.0	0.0
52746	1.4	1.3	0.1
52749	3.3	3.1	0.1
52750	2.5	2.4	0.1
52752	2.9	2.8	0.1
52753	2.6	2.5	0.1
52757	3.6	3.5	0.1
52762	4.2	4.1	0.1
52764	3.5	3.4	0.1
52766	3.4	3.3	0.1
52767	3.8	3.7	0.1
52768	3.8	3.7	0.1
52769	4.8	4.6	0.1
52770	3.2	3.1	0.1
52771	1.6	1.5	0.1
52774	4.2	4.1	0.1
52775	3.4	3.3	0.1
52776	3.3	3.2	0.1
52777	4.2	4.1	0.1
52778	3.8	3.7	0.1
52779	3.4	3.3	0.1
52786	2.4	2.2	0.1
52787	2.5	2.4	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
52789	2.3	2.2	0.1
52791	0.9	0.8	0.1
52792	2.8	2.7	0.1
52793	1.6	1.5	0.1
52794	1.6	1.5	0.1
52795	2.7	2.6	0.1
52796	1.2	1.1	0.1
52797	1.0	0.9	0.1
52798	2.1	2.0	0.1
52799	1.3	1.2	0.1
52969	4.6	4.5	0.1
53009	0.5	0.4	0.1
53021	0.9	0.8	0.1
53023	2.8	2.7	0.1
53024	3.6	3.5	0.1
53025	2.8	2.7	0.1
53046	5.0	5.0	0.0
53063	2.3	2.2	0.1
53169	0.3	0.2	0.1
53210	2.6	2.5	0.1
53260	1.3	1.2	0.1
53281	2.3	2.2	0.1
53284	0.7	0.6	0.1
53287	4.4	4.3	0.1
53292	3.6	3.5	0.1
53296	3.4	3.2	0.1
53299	3.4	3.3	0.1
53302	3.8	3.7	0.1
53304	3.8	3.7	0.1
53305	3.8	3.7	0.1
53307	3.8	3.7	0.1
53310	4.8	4.7	0.1
53312	3.9	3.8	0.1
53313	1.9	1.8	0.1
53317	3.4	3.3	0.1
53318	3.0	2.9	0.1
53319	3.5	3.4	0.1
53322	3.3	3.1	0.1
53323	3.0	2.9	0.1
53324	2.2	2.1	0.1
53326	1.8	1.7	0.1
53328	2.9	2.8	0.1
53329	2.9	2.8	0.1
53333	2.8	2.7	0.1
53334	3.0	2.8	0.1
53335	2.9	2.8	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
53338	0.8	0.7	0.1
53339	1.7	1.6	0.1
53340	1.9	1.8	0.1
53341	1.3	1.2	0.1
53342	1.0	0.9	0.1
53343	1.6	1.4	0.1
53347	0.5	0.4	0.1
53582	4.9	4.8	0.1
53599	0.9	0.8	0.1
53721	3.2	3.1	0.1
53722	3.5	3.4	0.1
53723	3.4	3.3	0.1
53725	4.3	4.2	0.1
53726	2.8	2.7	0.1
53727	4.0	3.9	0.1
53728	2.5	2.4	0.1
53730	3.0	2.9	0.1
53733	3.6	3.5	0.1
53737	3.9	3.8	0.1
53738	3.4	3.3	0.1
53739	3.5	3.4	0.1
53741	3.0	2.9	0.1
53742	2.8	2.7	0.1
53744	3.3	3.2	0.1
53745	2.6	2.5	0.1
53746	3.3	3.1	0.1
53747	2.3	2.2	0.1
53748	2.3	2.2	0.1
53749	3.3	3.2	0.1
53750	2.5	2.4	0.1
53751	2.9	2.7	0.1
53752	2.7	2.6	0.1
53754	1.6	1.5	0.1
53756	2.0	1.9	0.1
53757	2.3	2.2	0.1
53758	1.4	1.3	0.1
53760	1.6	1.4	0.1
53761	0.5	0.4	0.1
53763	0.4	0.3	0.1
53796	5.0	4.9	0.1
53867	0.6	0.3	0.4
53907	3.6	3.5	0.1
53947	5.0	5.0	0.0
54098	0.3	0.2	0.1
54164	0.3	0.2	0.1
54166	0.3	0.1	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
54167	0.1	0.0	0.1
54345	3.4	3.3	0.1
54346	2.9	2.8	0.1
54347	2.9	2.8	0.1
54349	3.6	3.5	0.1
54350	4.4	4.3	0.1
54357	4.2	4.1	0.1
54368	4.0	3.8	0.1
54370	3.5	3.3	0.1
54374	2.5	2.4	0.1
54375	3.1	3.0	0.1
54376	3.5	3.4	0.1
54379	3.7	3.6	0.1
54380	3.0	2.9	0.1
54381	2.7	2.6	0.1
54386	2.7	2.6	0.1
54387	3.5	3.4	0.1
54389	2.6	2.5	0.1
54390	2.9	2.8	0.1
54391	3.7	3.6	0.1
54392	3.3	3.2	0.1
54393	3.5	3.4	0.1
54394	2.7	2.6	0.1
54396	2.7	2.6	0.1
54397	1.5	1.4	0.1
54398	1.9	1.8	0.1
54399	0.8	0.7	0.1
54400	3.1	3.0	0.1
54401	2.0	1.9	0.1
54402	1.4	1.3	0.1
54403	1.4	1.3	0.1
54404	1.3	1.2	0.1
54568	0.3	0.1	0.2
54605	2.8	2.7	0.2
54608	3.3	3.1	0.2
54610	0.3	0.1	0.2
54611	4.5	4.3	0.1
54613	0.7	0.5	0.2
54616	2.0	1.9	0.1
54619	0.7	0.6	0.1
54771	2.8	2.7	0.1
54774	2.8	2.7	0.1
54775	3.5	3.4	0.1
54776	2.7	2.6	0.1
54777	3.6	3.5	0.1
54778	1.5	1.4	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
54780	4.1	4.0	0.1
54781	2.2	2.1	0.1
54782	1.3	1.2	0.1
54783	1.6	1.5	0.1
54788	1.6	1.5	0.1
54790	2.2	2.1	0.1
54791	3.4	3.3	0.1
54792	3.1	3.0	0.1
54793	3.3	3.1	0.1
54797	1.6	1.5	0.1
54798	2.9	2.8	0.1
54803	0.8	0.7	0.1
54805	2.1	2.0	0.1
54807	4.4	4.3	0.1
54809	1.7	1.6	0.1
54811	1.7	1.6	0.1
54819	1.6	1.5	0.1
54821	2.5	2.4	0.1
54822	2.4	2.3	0.1
54906	3.6	3.5	0.1
54946	3.4	3.3	0.1
54947	3.0	2.9	0.1
54953	4.1	4.0	0.1
55068	3.0	2.8	0.1
55069	1.8	1.7	0.1
55138	3.6	3.5	0.1
55356	4.2	4.1	0.1
55361	1.3	1.2	0.1
55483	1.5	1.4	0.1
55488	1.9	1.8	0.1
55510	2.4	2.3	0.1
55512	3.0	2.9	0.1
55760	3.4	3.2	0.1
55828	3.9	3.8	0.1
55831	4.2	4.1	0.1
55836	3.7	3.6	0.1
55875	5.0	5.0	0.0
55913	4.6	4.5	0.1
55932	3.8	3.7	0.1
56071	2.7	2.6	0.1
56277	5.0	5.0	0.0
56345	3.3	3.2	0.1
56347	4.3	4.2	0.1
56384	0.7	0.6	0.1
56476	2.5	2.3	0.1
56536	4.8	4.7	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
56581	2.9	2.7	0.1
56626	2.9	2.8	0.1
56629	4.8	4.7	0.1
56949	3.3	3.2	0.1
57065	3.1	3.0	0.1
57069	4.4	4.3	0.1
57141	2.7	2.6	0.1
57369	2.9	2.8	0.1
57538	5.0	4.9	0.1
57539	1.9	1.8	0.1
57541	3.5	3.4	0.1
57552	4.7	4.6	0.1
57634	3.4	3.3	0.1
57674	3.5	3.4	0.1
57928	2.4	2.3	0.1
57936	3.4	3.3	0.1
57941	3.7	3.6	0.1
58034	4.9	4.8	0.1
58085	4.2	4.1	0.1
58254	2.8	2.7	0.1
58476	3.8	3.7	0.1
58515	3.8	3.7	0.1
58538	3.7	3.6	0.1
58595	4.8	4.7	0.1
58893	0.4	0.3	0.1
58942	4.8	4.7	0.1
59489	5.0	5.0	0.0
59509	5.0	5.0	0.0
59511	2.8	2.7	0.1
59918	4.8	4.7	0.1
60541	5.0	5.0	0.0
60575	0.6	0.5	0.1
60827	0.6	0.5	0.1
61059	1.5	1.4	0.1
61585	3.6	3.5	0.1
62118	2.9	2.9	0.1
62398	0.6	0.6	0.1
62611	2.2	2.2	0.1
62623	2.7	2.6	0.1
62806	0.6	0.5	0.1
63698	5.0	5.0	0.0
63721	3.2	3.1	0.1
63791	3.4	3.3	0.1
65029	0.9	0.8	0.1
65042	2.4	2.3	0.1
65140	2.8	2.7	0.1

Parcel ID	Existing 100-yr Depth of Flooding, ft	100-yr Depth of Flooding with Recommended Offline Storage Basins, ft	Difference
65402	1.9	1.9	0.1
65782	0.5	0.5	0.1
66191	0.4	0.4	0.1
66474	1.5	1.5	0.0
66564	1.2	1.2	0.0
67031	2.2	2.2	0.0
67593	1.5	1.4	0.0
67783	0.7	0.7	0.0
68329	1.0	0.9	0.0
68787	1.6	1.5	0.0

Appendix J

FEMA Benefit-Cost Analysis

FEMA

Benefit-Cost Analysis of Hazard Mitigation Projects

LIMITED DATA MODULE

Version 5.2.3
May 2, 2006

Report of Benefit-Cost Analysis

Project	**Evaluation to Reduce Salt (**
Address	
City, State, Zip	**Lincoln, NE**
County	
Applicant	
Contact Person	
Analysis Date	**09/09/2008**
Analyst	**CDM**
Scenario Run ID	**Preferred Alternative**
File Save As Name	**Cost-Benefit Ratio**
Disaster Number	
DSR Number	

LIMITED DATA MODULE
Benefit-Cost Analysis of Flood Mitigation Projects

PROJECT INFORMATION

Disaster Number		Project	Evaluation to Reduce Salt Creek BFEs
DSR Number		Address	
DSR Category		City, State, Zip	Lincoln, NE
DSR Subject		County	Lancaster County
Inspection Date		Applicant	
Application Date		Contact Person	
Analysis Date	09/09/2008	Scenario Run ID	Preferred Alternative
Analyst	CDM	File Save As Name	Cost-Benefit Ratio

PROJECT DATA

Off-line stormwater detention along Middle and Oak Creek to reduce BFEs along Salt Creek. Proposed Alternative is to build multiple cell stormwater detention at three sites. Total number of basins for this alternative is 7 basins.

Project Useful Life (Years)	50
Base Year of Costs	2008
Historic Preservation Issues (Yes or No)?	No
Environmental Issues (Yes or No)?	No

Economic Factors: Discount Rate (%) 4.88 Present Value Coefficient 18.61

Net Mitigation Project Cost: $38,600,000

Notes:

Additional Annual Maintenance Cost ($/year) for Mitigation Project	$30,000
Present Value of Additional Annual Maintenance Cost ($)	$558,428
TOTAL MITIGATION PROJECT COST	$39,158,428

TYPE OF FACILITY (for Loss of Function): ROADS/BRIDGES

FACILITY DESCRIPTION

Loss of Function for Roads/Bridges

Estimated Number of One-Way Traffic Trips Per day	0
Estimated Delay (Detour) Time Per One Way Trip (hours)	0.00
Total Economic Loss Per Hour of Delay: Ordinary, commercial, and emergency traffic	$0.00
Economic Loss Per Day of Loss of Function of Bridge or Road	$0

FLOOD HISTORY

Estimated Frequency of Declared Flood Event (Years)

Data Sources and Documentation

LIMITED DATA MODULE
Benefit-Cost Analysis of Flood Mitigation Projects

DAMAGES BEFORE MITIGATION

Flood Frequency Events (Years)	Scenario Flood Damages			Loss of Function Time and Dollars		TOTAL Damages and Losses
	A	B	C	Days	Losses	
1					$0	$0
2					$0	$0
5					$0	$0
10	$26,400,000				$0	$26,400,000
25					$0	$26,400,000
50	$140,000,000				$0	$140,000,000
100	$240,591,696				$0	$240,591,696
250					$0	$240,591,696
500					$0	$240,591,696
					Total Annualized Damages	$7,184,134

Data Sources and Documentation

DAMAGES AFTER MITIGATION

Flood Frequency Events (Years)	Scenario Flood Damages			Loss of Function Time and Dollars		TOTAL Damages and Losses
	A	B	C	Days	Losses	
1					$0	$0
2					$0	$0
5					$0	$0
10	$21,300,000				$0	$21,300,000
25					$0	$21,300,000
50	$124,000,000				$0	$124,000,000
100	$216,000,000				$0	$216,000,000
250					$0	$216,000,000
500					$0	$216,000,000
					Total Annualized Damages	$6,252,818

Data Sources and Documentation

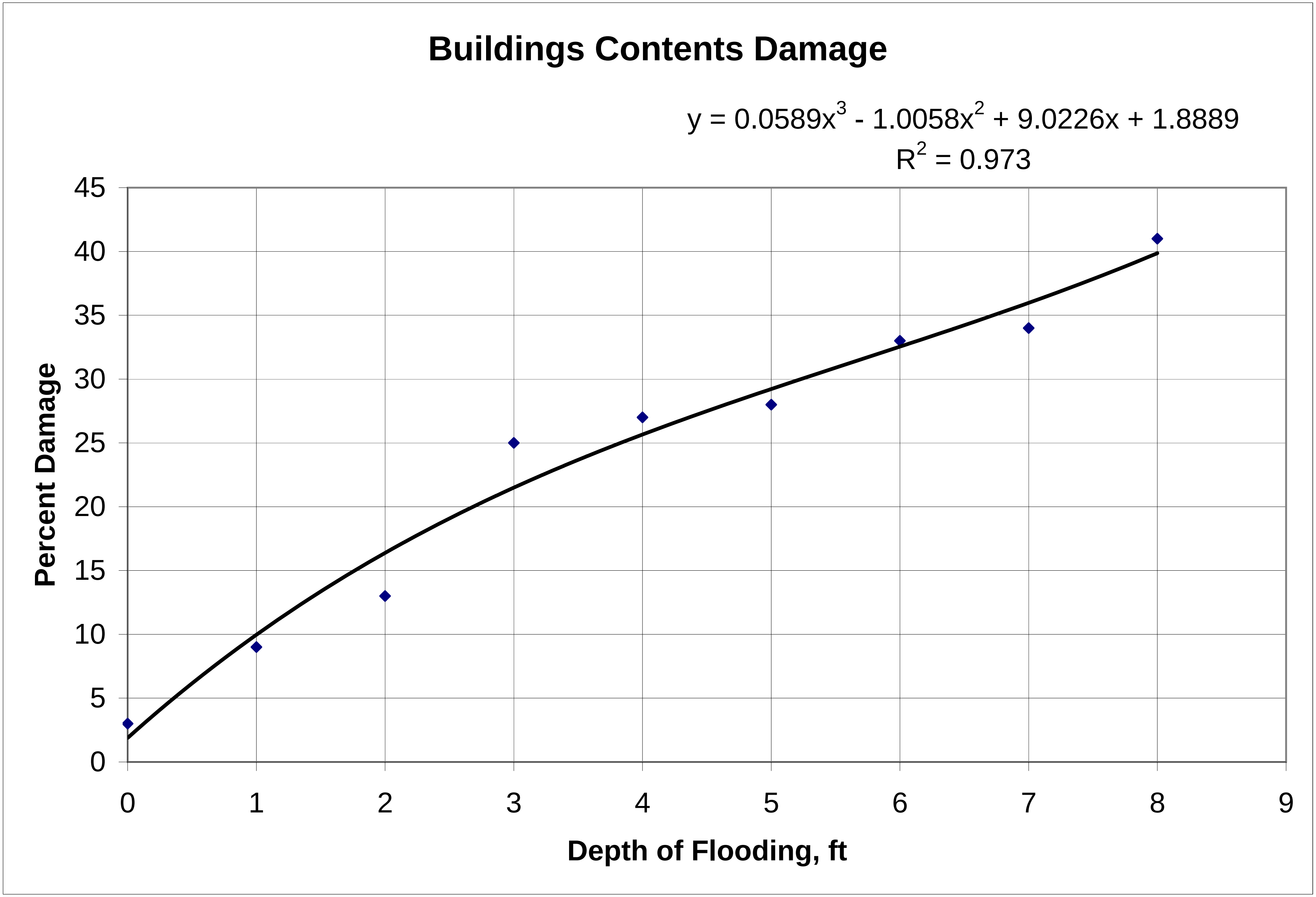
SUMMARY OF BENEFITS AND COSTS

	Expected Annual	Present Value
Expected Annual Damages Before Mitigation	$7,184,134	$133,727,263
Expected Annual Damages After Mitigation	$6,252,818	$116,391,515
Expected Avoided Damages After Mitigation (BENEFITS)	$931,316	$17,335,747

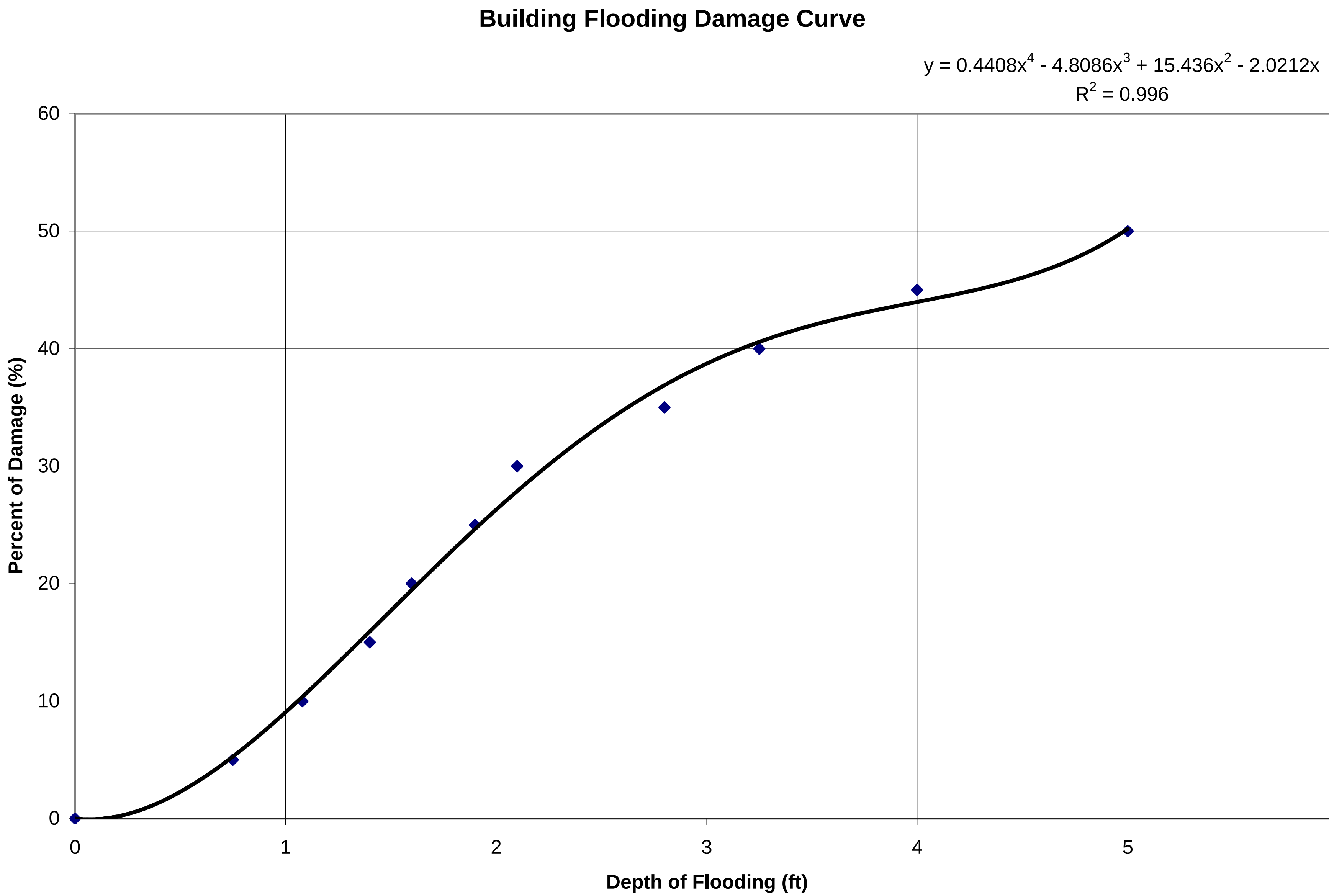
PROJECT COSTS	$39,158,428
PROJECT BENEFITS	$17,335,747
BENEFITS MINUS COSTS	($21,822,680)
BENEFIT-COST RATIO	0.44

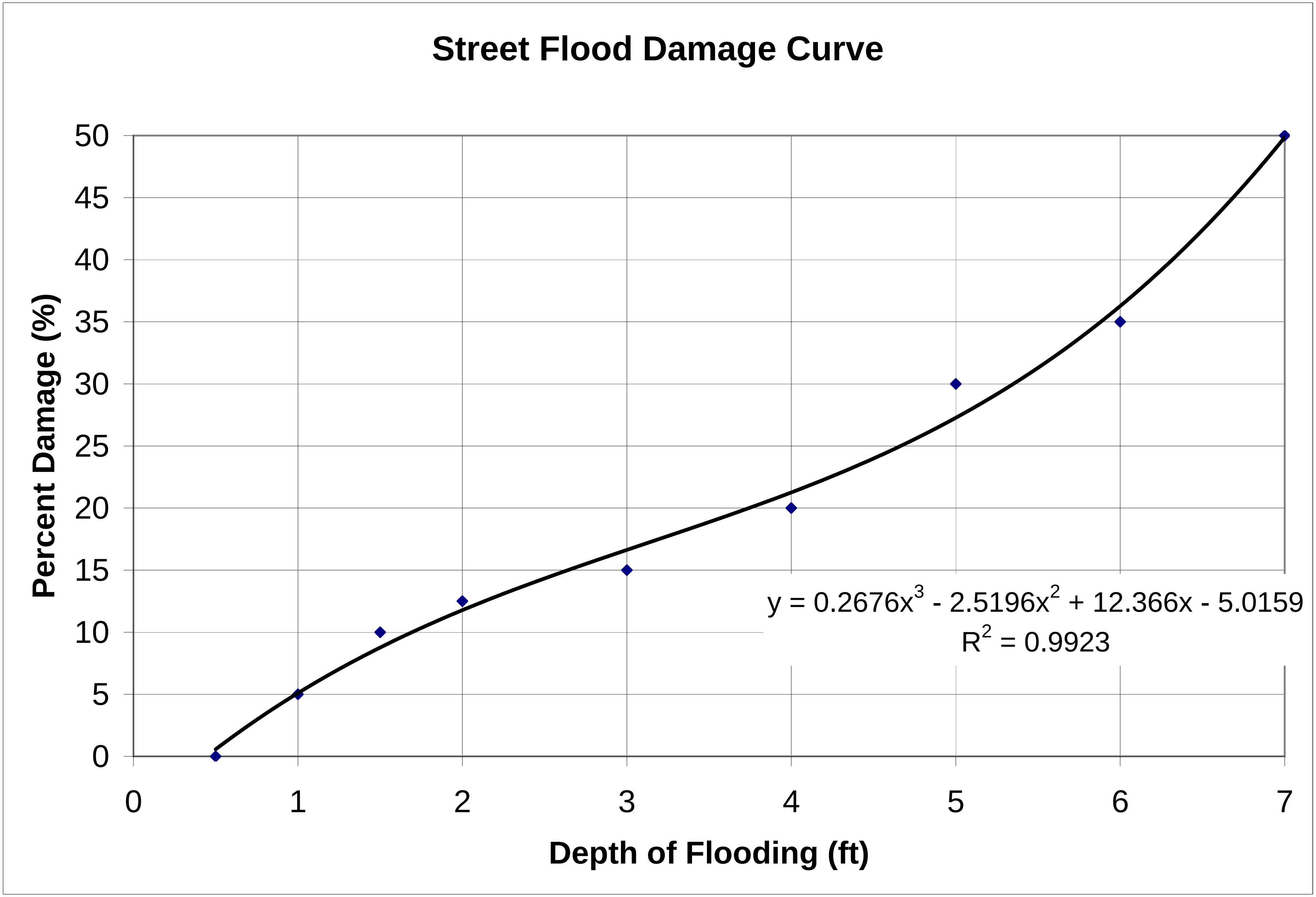
Data Sources and Documentation

FEMA Disclaimer: The results produced by this analysis are neither conclusive evidence that a proposed project is cost-effective, nor a guarantee that a project is eligible for any government grant for whatever purpose.



Buildings Contents Damage
y = 0.0589x3 - 1.0058x2 + 9.0226x + 1.8889
R2 = 0.973
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
9
Percent Damage
Depth of Flooding, ft


Building Flooding Damage Curve
y = 0.4408x4 - 4.8086x3 + 15.436x2 - 2.0212x
R2 = 0.996
Percent of Damage (%)
60
50
40
30
20
10
0
0
1
2
3
4
5
6
Depth of Flooding (ft)


Street Flood Damage Curve
Percent Damage (%)
Depth of Flooding (ft)
y = 0.2676x3 - 2.5196x2 + 12.366x - 5.0159
R2 = 0.9923
0
5
10
15
20
25
30
35
40
45
50
0
1
2
3
4
5
6
7

Damages Cost Estimates

Salt Creek Existing Conditions

10-Year Event	
No. of Properties with Damaged Buildings:	*140*
Length of Street (mi):	*5.1*
Building Damage:	$19,000,000
Contents Damage:	$7,000,000
Street Damage:	$400,000
Total Damages:	$26,400,000
50-yr Event	
No. of Properties with Damaged Buildings:	*1386*
Length of Street (mi):	*36.1*
Building Damage:	$94,000,000
Contents Damage:	$39,000,000
Street Damage:	$4,000,000
Total Damages:	$137,000,000
100-yr Event	
No. of Properties with Damaged Buildings:	*1770*
Length of Street (mi):	*50.8*
Building Damage:	$166,000,000
Contents Damage:	$64,000,000
Street Damage:	$7,000,000
Total Damages:	$237,000,000
Lincoln Airport Damages (HWS Report)	
With No Levees	$3,591,696

Salt Creek Preferred Alternative

10-Year Event	
No. of Properties with Damaged Buildings:	*76*
Length of Street (mi):	*4.2*
Building Damage:	$16,000,000
Contents Damage:	$5,000,000
Street Damage:	$300,000
Total Damages:	$21,300,000
50-yr Event	
No. of Properties with Damaged Buildings:	*1335*
Length of Street (mi):	*35.0*
No. of Buildings:	1267
Building Damage:	$88,000,000
Contents Damage:	$33,000,000
Street Damage:	$3,000,000
Total Damages:	$124,000,000
100-yr Event	
No. of Properties with Damaged Buildings:	*1740*
Length of Street (mi):	*49.5*
Building Damage:	$149,000,000
Contents Damage:	$60,000,000
Street Damage:	$7,000,000
Total Damages:	$216,000,000
Lincoln Airport Damages (HWS Report)	
Levees meet FEMA	$0