

# 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 40<sup>th</sup> Street and SW 27<sup>th</sup> 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

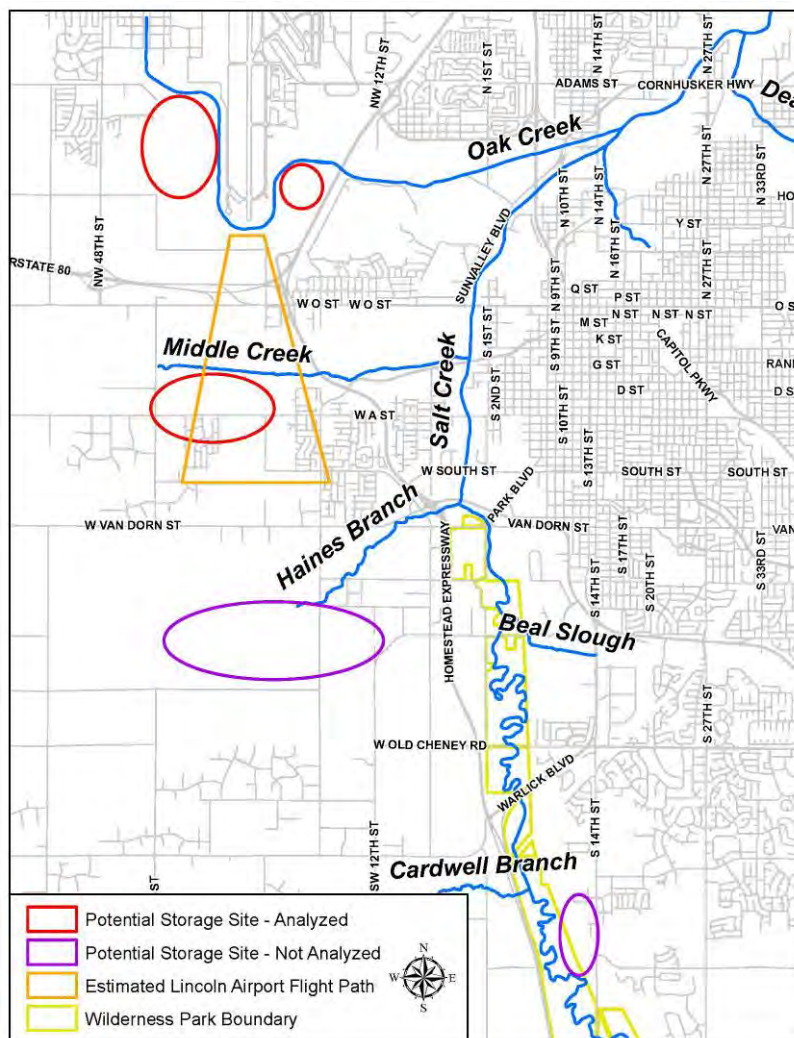


Figure 4-1 Possible Offline Storage Sites

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.

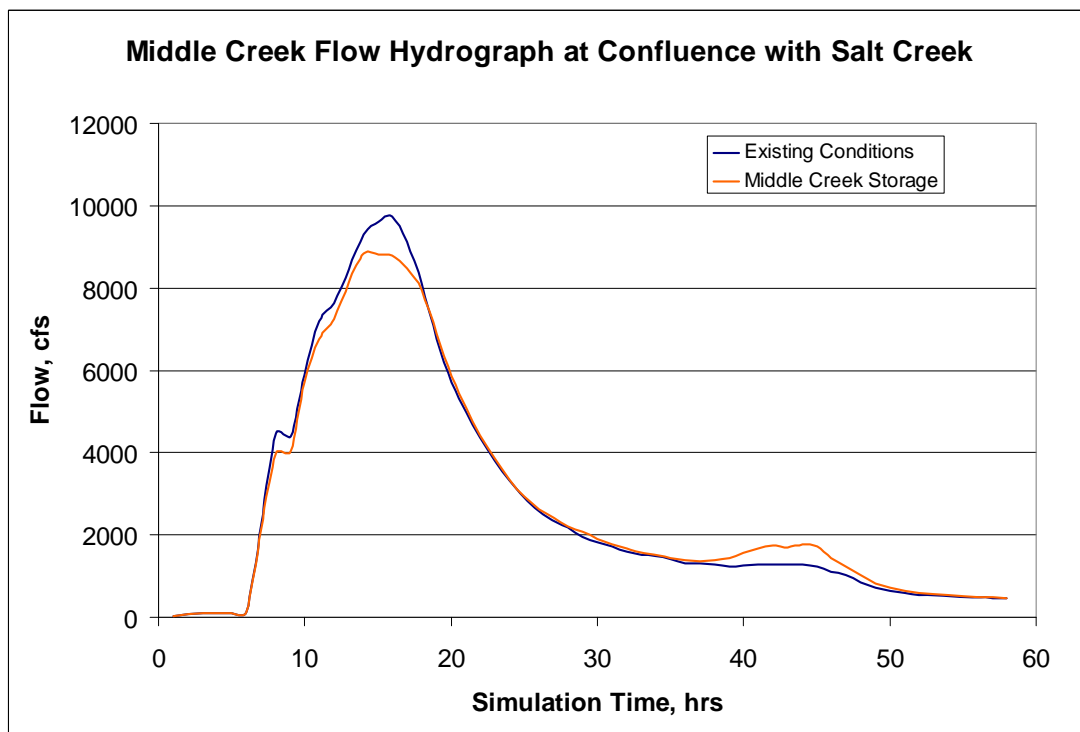


Figure 4-3 Middle Creek Hydrograph

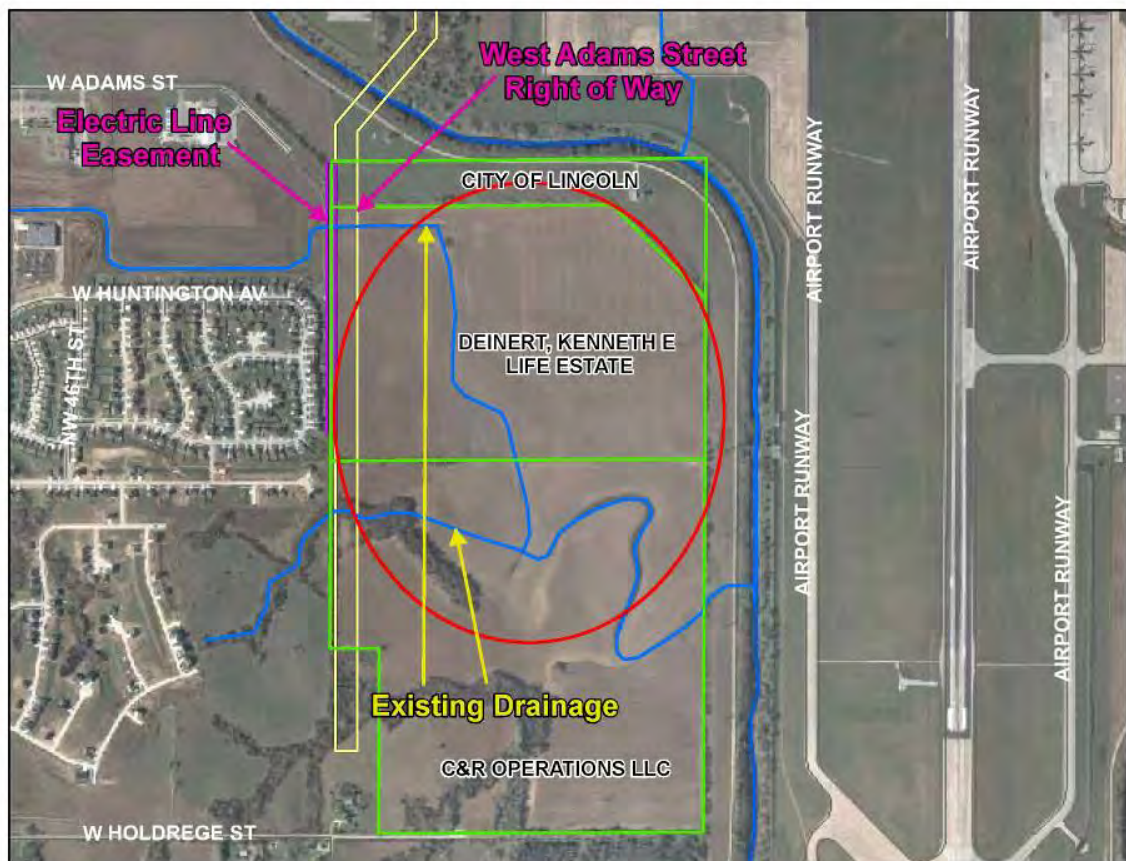
## 4.3 Oak Creek

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 41<sup>st</sup> 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.

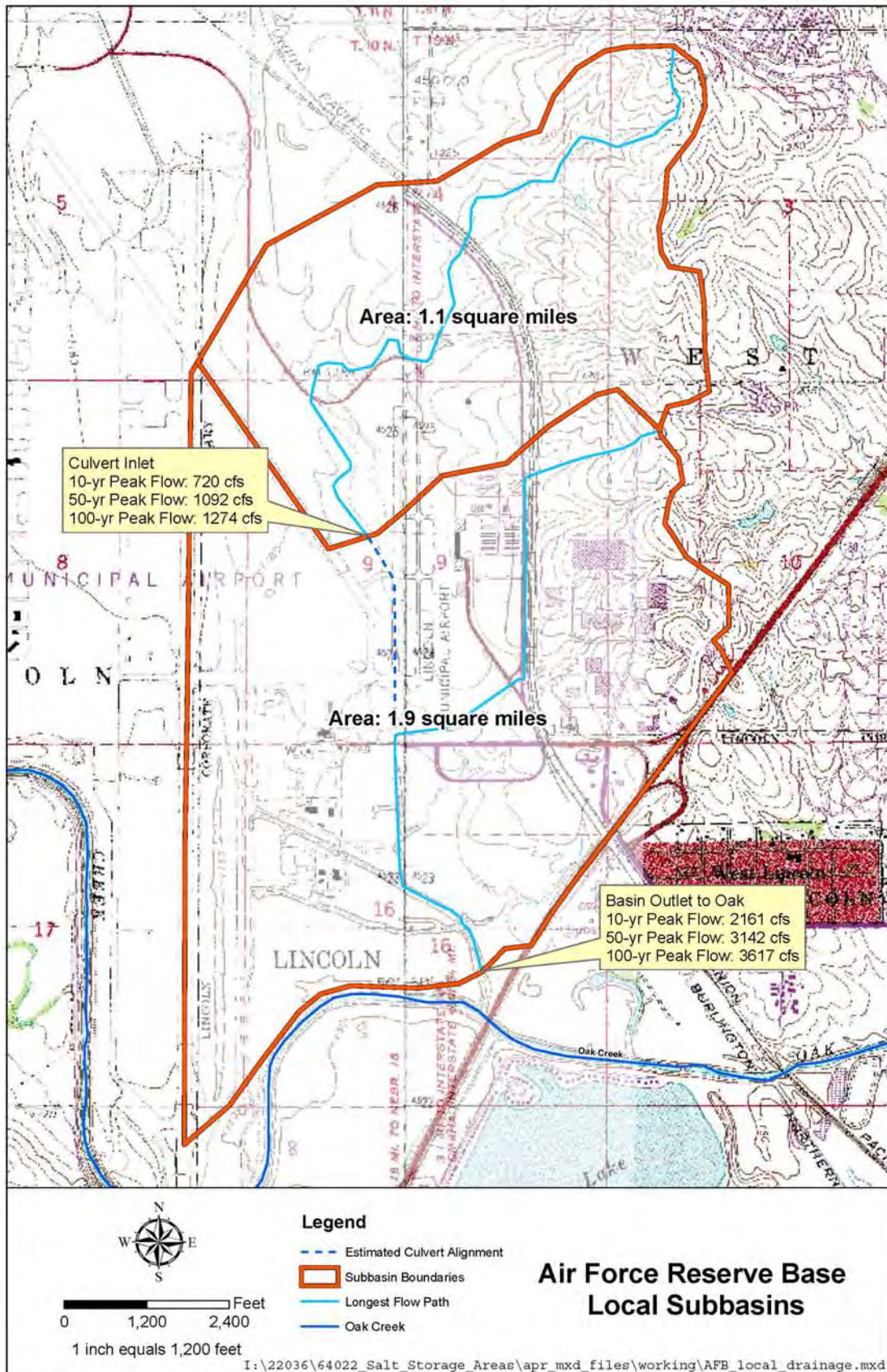


Figure 4-6 Air Force Reserve Base Local Subbasins

### 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.

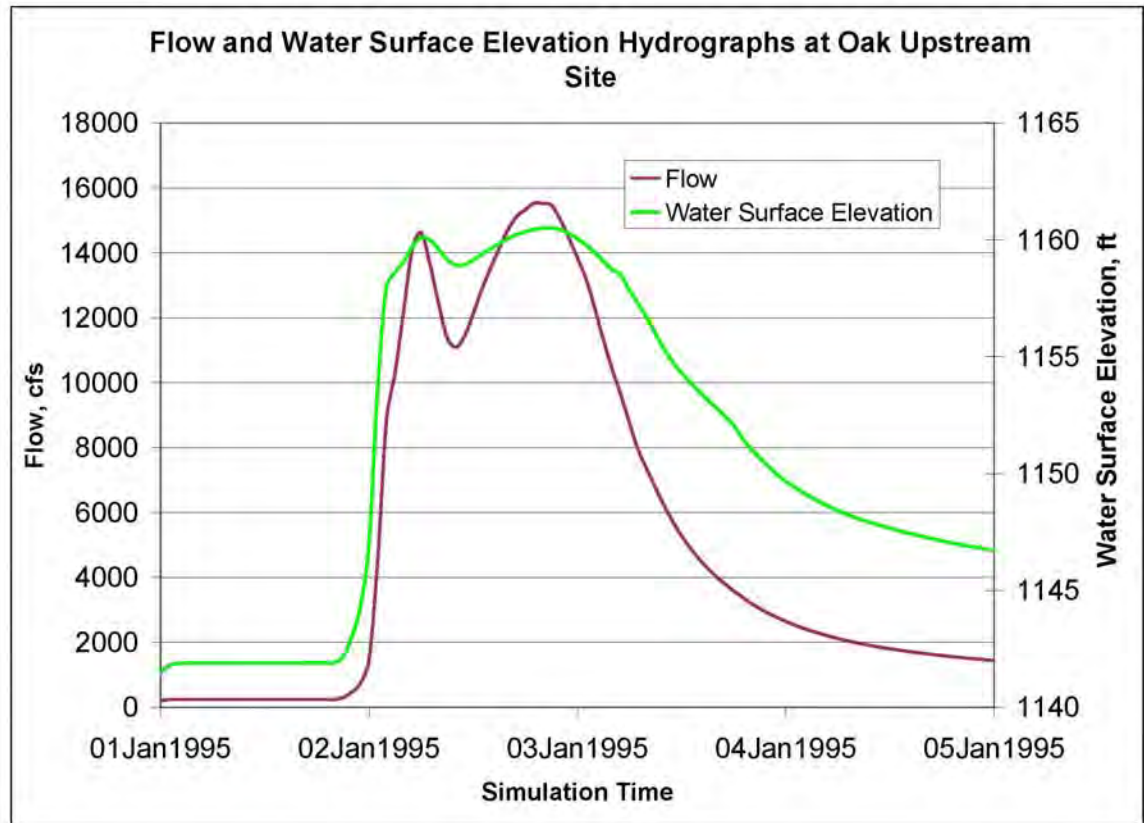


Figure 4-7 Flow and Water Surface Hydrograph at Upstream Oak Site

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.



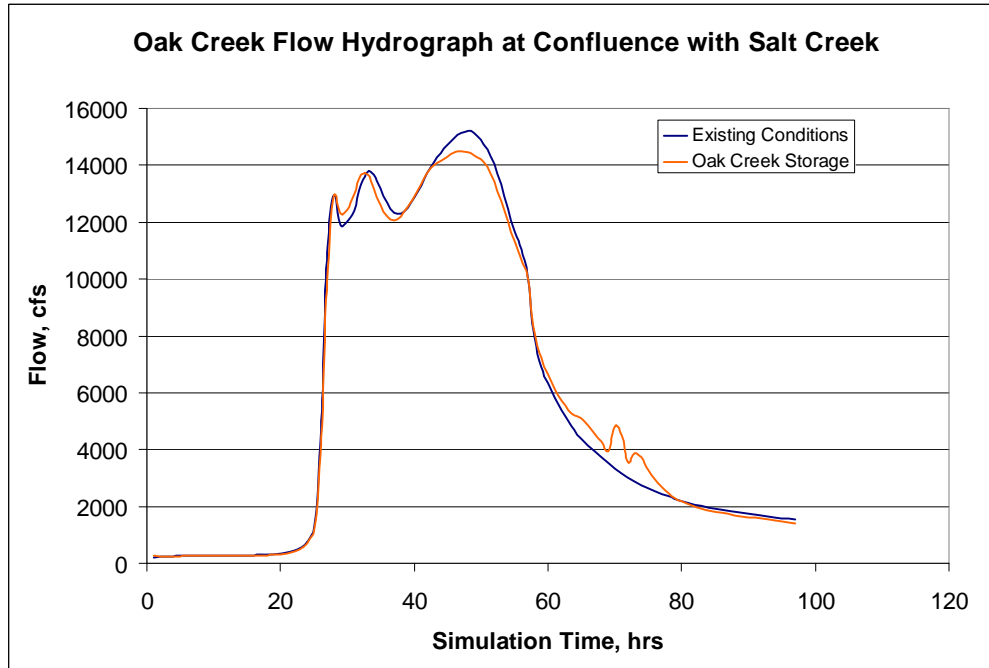


Figure 4-8 Oak Creek Hydrograph With and Without Offline Storage

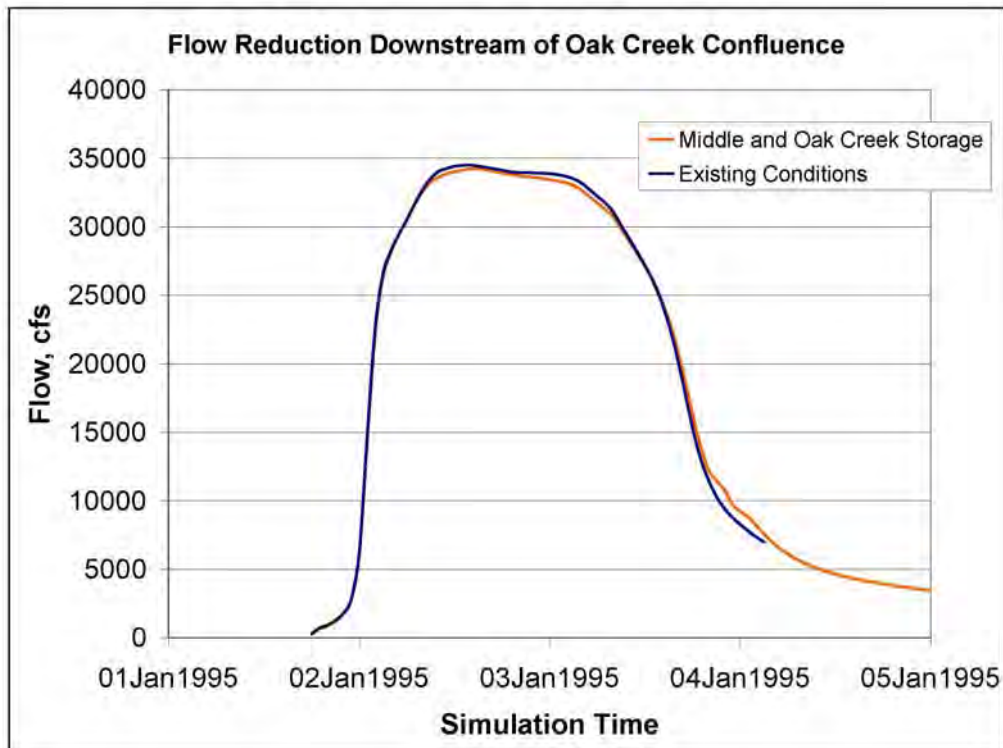


Figure 4-9 Salt Creek Flow Hydrograph Downstream of Oak Creek Confluence

## 4.4 Wilderness Park

### 4.4.1 Site Description

Wilderness Park is characterized by dense wooded area with few large open 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 14<sup>th</sup> 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.

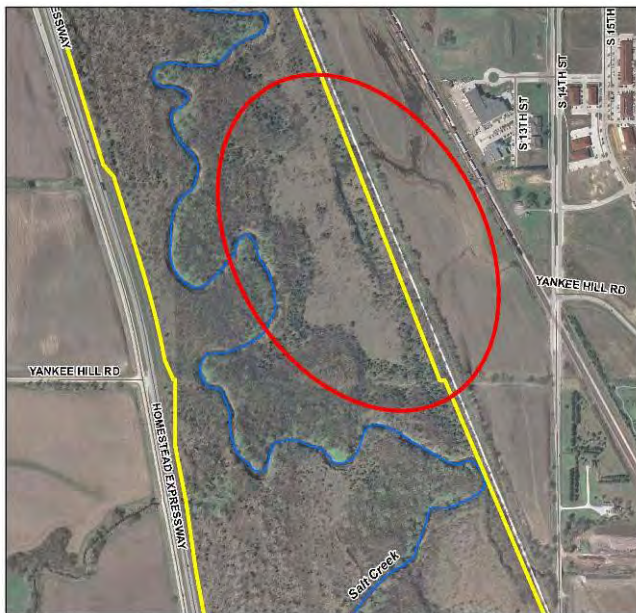


Figure 4-10 Wilderness Park Offline Storage Site

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.

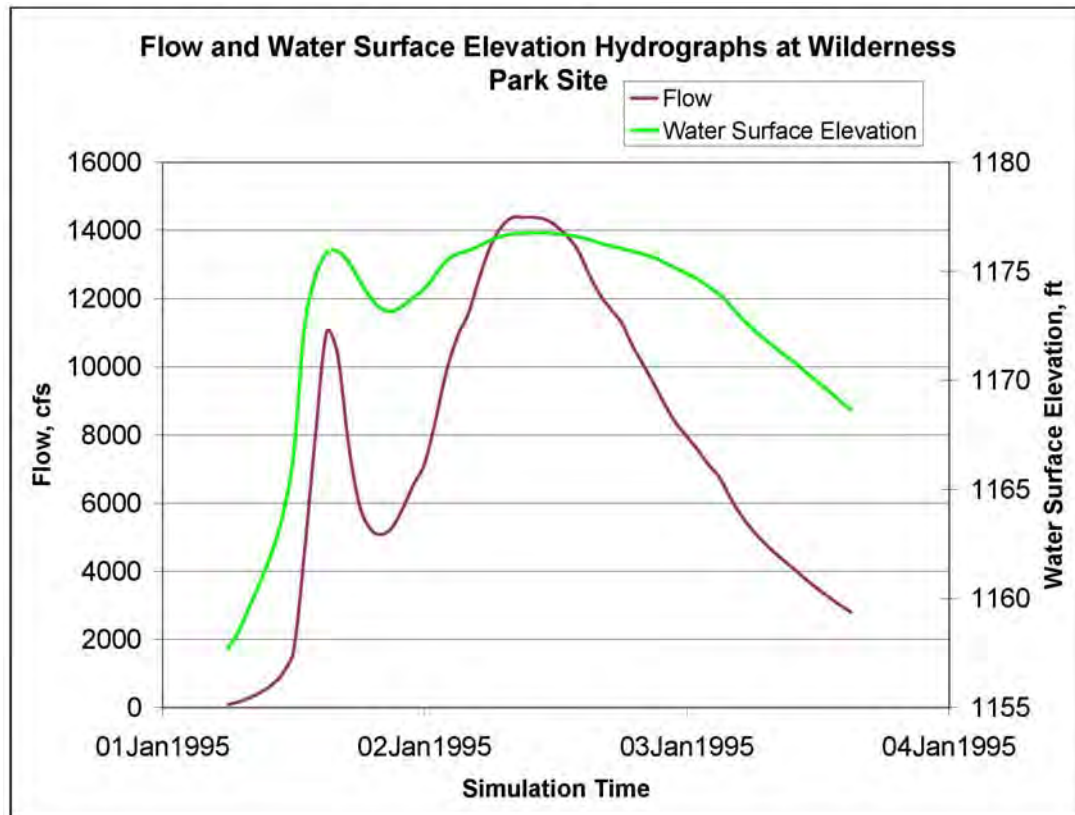


Figure 4-11 Flow and Water Surface Hydrograph for Wilderness Park Site

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.

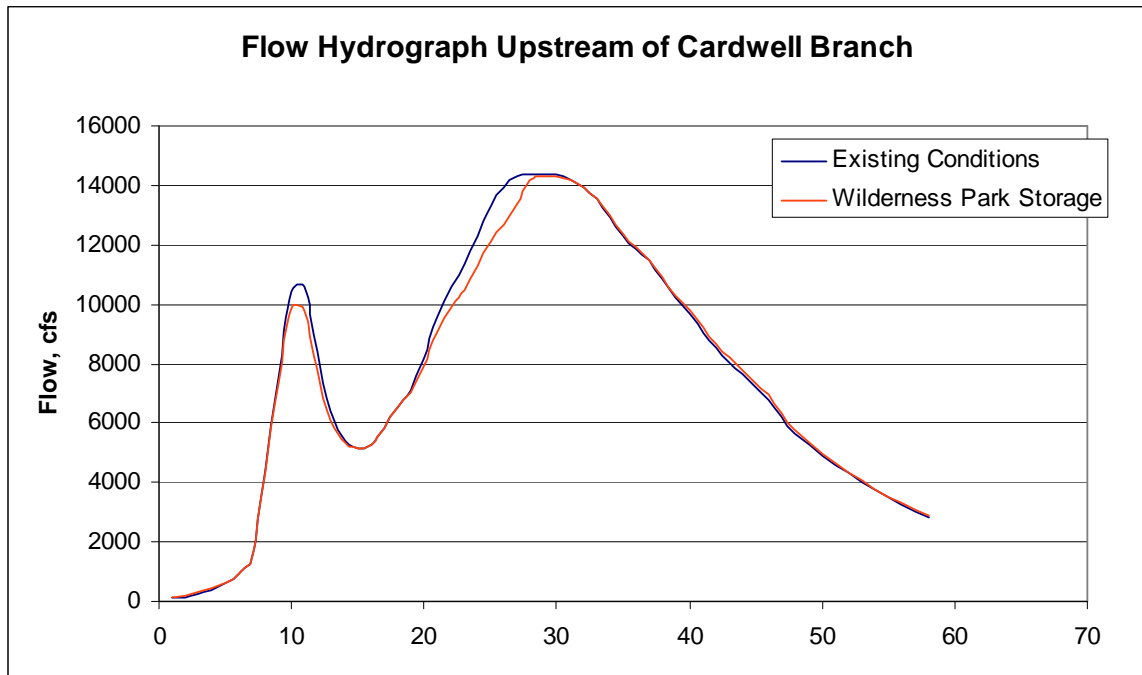


Figure 4-12 Salt Creek Hydrograph Upstream Cardwell Branch Confluence

## 4.5 Haines Branch

### 4.5.1 Site Description

Offline storage was considered on Haines Branch between SW 56<sup>th</sup> 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.

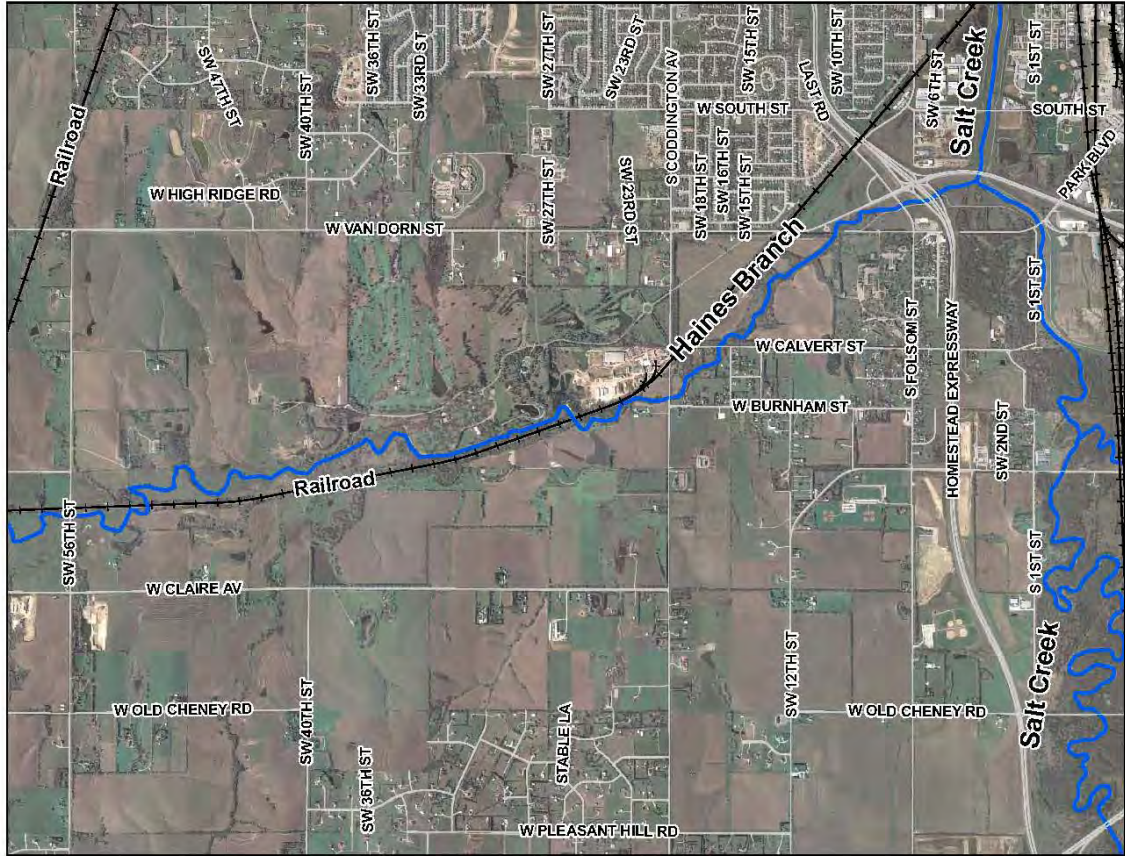


Figure 4-13 Aerial View of Haines Branch Area