Agenda

City Council Work Session Meeting

Oelwein Public Library, 201 East Charles, Oelwein, Iowa

6:30 PM

May 13, 2024
Oelwein, Iowa

Mayor: Brett DeVore
Mayor Pro Tem: Matt Weber
Council Members: Karen Seeders, Anthony Ricchio, Lynda Payne, Dave Garrigus, Dave Lenz

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Pledge of Allegiance

Discussions

1. Discussion on the Flood Mitigation Scoping study.

Adjournment

In compliance with the Americans with Disabilities Act, those requiring accommodation for Council meetings should notify the City Clerk's Office at least 24 hours prior to the meeting at 319-283-5440

Flood Mitigation Scoping Study for Dry Run Creek

City of Oelwein, Fayette County, IA

DRAFT 04/29/2024

MSA Professional Services
400 Ice Harbor Drive #100
Dubuque, IA 52001
Project #0884010

Acknowledgments

The Oelwein Flood Mitigation Scoping study was only possible with the contributions from the City of Oelwein, the Iowa Department of Homeland Security, and the Army Corp of Engineers. Specifically, the following individuals are acknowledged for their efforts on this project.

City of Oelwein

- Dylan Mulfinger, City Administrator
- City Staff, Community Development

Iowa Department of Homeland Security

- Jim Marwedel, State Hazard Mitigation Planner
- Jack Stinogel, Hazard Mitigation Planner

U.S. Army Corps of Engineers

- Abigail Steele, Iowa Mitigation Bank Manager
- April Marcangeli, Regulatory Ecologist

MSA Professional Services

- Marie Amundson, PE, Project Manager, Water Resources Engineer
- Amber Converse, Senior GIS Analyst
- Eric Thompson, PE, Project Manager, Water Resources Team Leader
- Brandon Melton, Community Development Administrator
- Jim Holtz, Client Service Manager

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Executive Summary

Project Scope

The City of Oelwein has experienced regular flooding of the downtown area from Dry Run Creek a natural watercourse flowing through the northeast part of the City. Both public and private properties are impacted during flooding, many of which are impacted by events of less severity than the 100-yr event.

The purpose of this study was to **(1)** update the Federal Emergency Management Agency (FEMA) regulatory floodplain model for Dry Run Creek to add additional detail to support flood reduction alternative analyses, **(2)** to conceptualize and model mitigation alternatives, **(3)** to estimate the benefits associated with each alternative using FEMA's Benefit-Cost Analysis (BCA) Toolkit , **(4)** estimate the cost for the alternatives, **(5)** identify preferred mitigation alternative(s), and **(6)** highlight funding opportunities to complete mitigation project(s).

Project Background

The Dry Run Creek watershed is approximately 2,064 acres (3.22 sq. miles) in size and flows from northeast to southwest through the northeastern portion of the City of Oelwein until it joins Otter Creek on the City's western edge. The stream originates in agricultural fields outside of the City limits. Within the City, land use within the watershed is predominantly residential; however, a significant portion of the land use is non-residential with much of the non-residential land clustered around the creek in areas subjected to higher risk of flooding. A significant feature of the watershed is a large railroad yard that crosses the creek just downstream from Oelwein's downtown area. This report focuses on the watershed upstream of the railroad yard. **Figure EX-1** shows the project Study Area, and the Focus Area northeast of the railroad yard.

The current effective Flood Insurance Study (FIS) for Dry Run Creek, document 19065CV000C, dated March 13, 2024 (revised during the course of this study) indicated that the restrictive bridges/culverts, many of which obstruct flow at 10-yr flood levels, are the biggest source of flooding concern. The downtown area between 8th Ave NE and the railroad culvert are the most heavily impacted. The original FIS report from 1988 and subsequent revisions dated 2011 and 2021 reported similar flooding conditions, although with less detail (except that the language in the 2021 report was identical to that of the 2024 report).

Flooding conditions along Dry Run Creek have been studied many times. Most recently, the City coordinated with the Iowa DNR, as a FEMA Cooperating Technical Partner (CTP), to complete a high-level analysis through the Real Time Technical Assistance (RTTA). The engineering firm Atkins completed the analysis and published a report in December 2021 which identified several conceptual solutions to mitigate flooding along Dry Run Creek upstream of the railroad yard. This current study advances the work completed in the 2021 study, providing a more thorough modeling analysis of the more feasible conceptual mitigation alternatives, development of cost-benefit ratios for those alternatives and presenting recommendations to the City for pursuit of grant funds to implement flood reduction projects.

Modeling and Cost Benefit Analysis

Floodplain modeling for Dry Run Creek was completed using HEC-RAS software. **Figure EX-2** shows the updated modeled 100-yr floodplain, buildings within the 100-yr floodplain, and culverts and bridges included in the model within this project's study area. There are 42 residential properties, 26 non-residential properties, and 1 critical Facility (the Oelwein Fire Department) within the updated* 100-yr floodplain. Three bridges/culverts are predicted to overtop under the 10-yr flood conditions (Outer Rd Culvert, Wings Park Ped Bridge East and Wings Park Ped Bridge West) and all of the remaining structures are predicted to overtop during flood events of 50-yr severity or greater.

**It is important to note that the floodplain shown in Figure EX-2 is from this study and is not the official FEMA 100-yr floodplain (Special Flood Hazard Area).*

Construction and maintenance costs for each mitigation alternative were calculated following standard engineering methods and were based upon concept design drawings developed as part of this study. These designs and estimates are preliminary, include a significant contingency and will need to be updated if a project is selected for design. Project benefits were calculated using the FEMA Benefit Cost Analysis (BCA) toolkit. The BCA toolkit estimates the monetary benefits of flood risk reduction for each structure within the floodplain. Projects with benefit-to-cost ratios greater than 1.0 (i.e. the monetary flood-reduction benefit is greater than the cost to build and maintain the flood mitigation practice) the project is more likely to be eligible for grant funding opportunities with FEMA. Monetized benefits include Standard Mitigation Benefits and Social Benefits. Standard benefits account for reduced risk to buildings, contents within the building, displacement costs and ecosystem services**. Social benefits account for the improvement metal health and productivity for residents who are less impacted by flooding.

***Ecosystem service benefits are obtained when the land is converted to provide a higher level of natural benefits (e.g. agricultural lands converted to rural open space, a parking lot converted to urban open space). Ecosystem services were found to increase the benefits dramatically, and therefore are broken out specifically within the benefit calculations.*

Flood Mitigation Alternatives

Twelve (12) mitigation alternatives were considered (see **Section 5.2**). Eight (8) alternatives were removed from consideration due to feasibility of construction, high costs or limited flood mitigation benefits. The following four (4) were selected for more in-depth review.

- **Flood Storage Pond (Configuration 3b Revised)**: This alternative involves construction of a new flood storage pond located in what is currently an agricultural field immediately upstream of 8th Ave NE. Because of its anticipated height and storage volume, the embankment required to create this storage area would be classified as a dam by the Iowa Department of Natural Resources and would be required to meet additional design safety standards. The pond could be designed to freely pass low (normal) flows in the creek but would greatly restrict discharges under flood conditions. Construction of the flood storage facility would convert the land from its current agricultural use to rural open space and should qualify for Ecosystem service benefits; these benefits were estimated assuming 17 - 46 acres of land converted, and the final amount will depend on the formal design.

Of the alternatives evaluated, this one has the highest upfront cost and includes long-term maintenance costs, but it has the potential for the greatest benefit, removing 57 structures from the modeled 100-yr floodplain. Funding options would have to be reviewed to determine if they would cover all the initial costs, specifically property acquisition, permitting, and stream mitigation (a fee to the Army Corp of Engineers for filling and relocating the existing stream channel). **Figure EX-3** shows the Regional Detention Pond 3b Revised concept.

- **Remove 1st Ave SW Bridge**: Modeling has shown that the existing 1st Ave SW bridge is one of the more hydraulically restrictive structures along the creek. Discussion with City representatives have indicated that this crossing could be eliminated without substantial impact to traffic patterns in the area. Removing this bridge would be a comparatively low-cost option and would remove 6 structures from the modeled 100-yr floodplain. There are no anticipated long-term maintenance costs associated with this option. There are no ecosystem service benefits associated with this option. **Figure EX-4** shows the location of the 1st Ave SW Bridge.

- **Remove Charles St Parking Lot over Dry Run Creek**: Approximately 200 feet of Dry Run Creek is enclosed below a large parking lot immediately north of Charles St. The enclosure below the parking lot effectively acts like a long bridge over the creek and causes a hydraulic restriction under flood conditions. **Figure EX-4** shows the location of the Charles St Parking Lot over the creek.

  Removing this parking lot would not remove any structures from the modeled 100-yr floodplain. However, this improvement is still recommended because the City does not feel this parking lot is necessary to serve the downtown and the City anticipates a future need to conduct major repairs to the structure. Because removing this structure does not lower the flood elevations or discharge rates within Dry Run Creek it is not awarded any benefits per the BCA toolkit. However, if the City decided to implement this improvement *in tandem* with work that restores the creek and surrounding lands to a more natural state (e.g. creating urban open space) the project could have ecosystem service benefits. For a reference point, converting 1 ac of land to Urban Open Space would provide $222K in benefits and converting 2 acres of land would provide $444K in benefits. The BCA toolkit would need to be re-run if this alternative was selected with an expanded scope to capture Ecosystem Services.

- **Property Acquisition/Relocation**: Acquiring properties that are located within the floodplain is often the most cost-effective permanent flood mitigation alternative. Properties that are located within the floodplain could be acquired, existing buildings relocated or razed, and the land converted to Urban Open Space. The resulting open space could be used as an urban park with walking paths, benches or picnic spaces and provide additional Ecosystem Services benefits within the BCA toolkit.

  In general, property acquisition is easier if the structure is within the FEMA 100-yr Special Flood Hazard Area, *which is different from the modeled 100-yr floodplain mapped within this study*. Oelwein has 79 structures within the FEMA Special Flood Hazard Area (including the Oelwein Fire Department, 52 residential properties, and 26 non-residential properties), and of these 8 are classified as Repetitive Loss properties. Funding can cover property acquisition, demolition, and some relocation costs;

however, the program is voluntary and property owners must agree to participate in the program. **Figure EX-5** shows those properties that are classified by the National Flood Insurance Program as Repetitive Loss Structures, and **Figure EX-6** shows all the properties within the FEMA 100-yr Special Flood Hazard Area (dated May 2021).

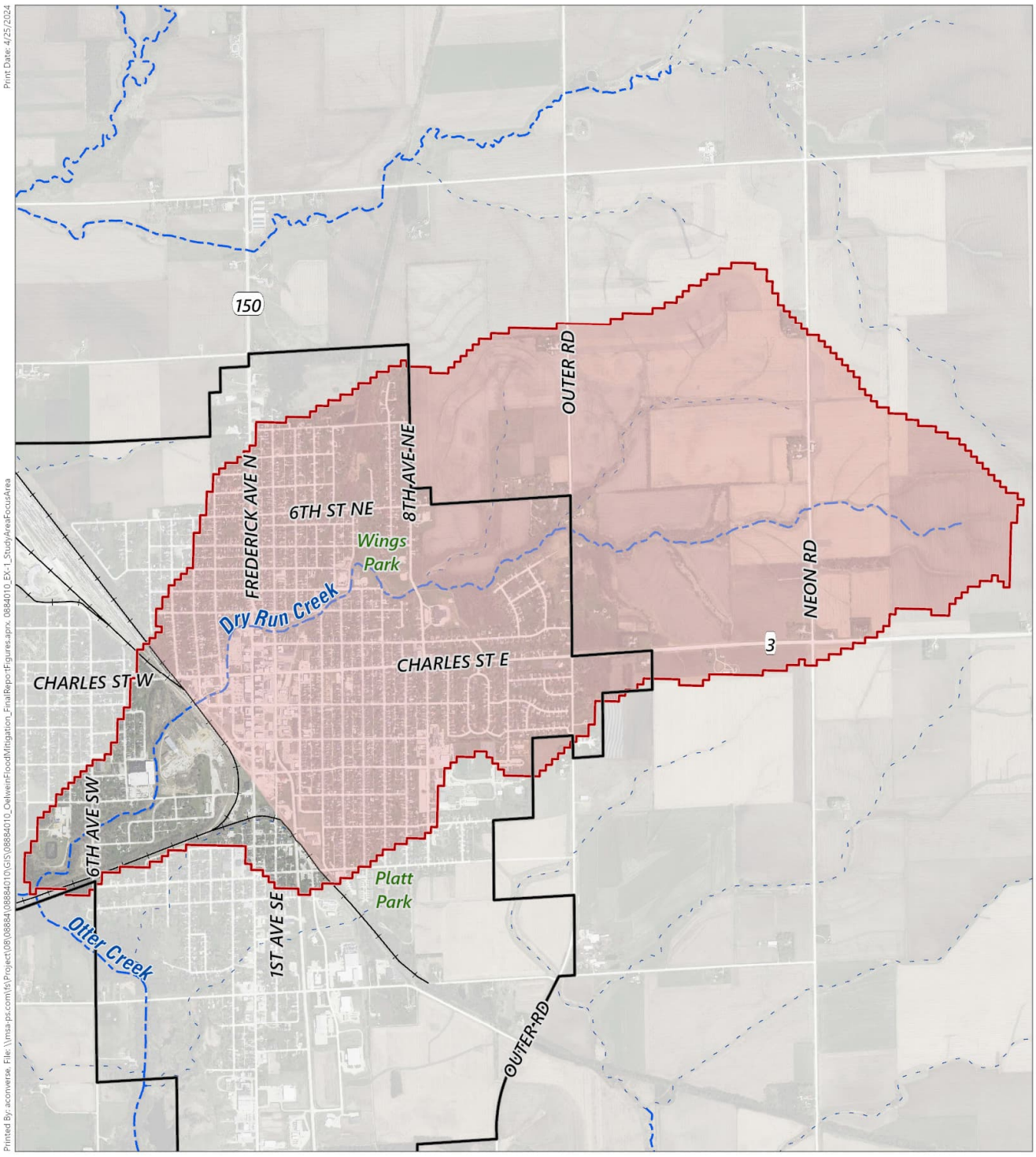
Table EX-1 lists the estimated benefits and costs associated with each mitigation alternative. Costs should be considered preliminary and will need to be revised to reflect additional design details once selected by the City as a project to implement. Some elements of the cost are unknown (e.g. property acquisition costs) and therefore not included within the estimate. The benefits associated with each mitigation action might be duplicative, therefore total benefits listed below cannot simply be added together. A complete benefit analysis needs to be performed with the set of combined mitigation actions. The costs, however, can be considered stand-alone costs and added together if multiple mitigation alternatives are prioritized.

Table EX-1: Estimated benefits and costs associated with four (4) flood mitigation alternatives. Reference Chapter 4 for how benefits were calculated in the BCA toolkit and Chapter 6 for details on cost estimates and assumptions. Cost estimates should be considered preliminary and would be revised after a formal project design. The City has indicated that non-residential property owners would be unlikely to participate in property acquisition; therefore, just the 52 residential properties within the FEMA Special Flood Hazard Area are included in the benefit/cost estimate. *The FEMA BCA Toolkit requires a project lifespan. For projects that are permanent, 100-yr is used.

Benefit/Costs	**Regional Pond 3b Revised**	**Remove 1st Ave SW Bridge**	**Remove Charles St Parking over Creek**	**52 Residential Property Acquisition within FEMA Special Flood Hazard Area**
Assumed Project Lifespan	*30-yr*	*100-yr**	*100-yr**	*100-yr**
Structure/Social Benefits	$2.710 M	$1.125 M	$0	$18.720 M
Ecosystem Services Benefits	$2.243M to $6.069M *(dependent on size of new rural open space)*	*None, unless project converts land to urban open space*	*None, unless project converts land to urban open space*	*None, unless project converts land to urban open space*
Total Benefits	**$4.953M to $8.779M**	**$1.125 M**	**$0 M**	**$18.720 M**
One Time Costs	$3.845 M	$0.192 M	$0.546 M	$3.958 M
Unknown One Time Costs/Assumptions	*Property Acquisition, Hauling, Permitting, and Stream Mitigation (~760K)*			*One-time costs based on assessor's values and 15K per structure for demolition*
Maintenance Costs	$0.255 M	None	None	None
Total Costs	**$4.100M + Unknown Costs**	**$0.192 M**	**$0.546 M**	**$3.958 M**

This study recommends the City consider **(1)** construction of the Flood Storage Pond or **(2)** a combination of the other three alternatives: Removing the 1st Ave SW Bridge, Removing the Charles St Parking Lot, and/or Property Acquisition and possible relocation of the Fire Department. The cost-benefit ratios for the Regional Pond 3b Revised, Removing the 1st Ave SW bridge and Property Acquisition are favorable (greater than 1.0) and would be eligible for outside funding for the initial one-time costs (see **Section 7.1)**. Removing the Charles St Parking Lot would require a larger project scope, likely converting land to Urban Open Space to received Ecosystem Services Benefits to have a favorable cost-benefit ratio. Note that some costs might not be eligible for funding (e.g. stream mitigation fees and long-term maintenance costs.)

It is recommended that the City review the alternatives, gather public feedback, and then consider funding opportunities that would support engineering design and implementation.



Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Floodplain Extents: FEMA (2021/05/17)
Aerial: Fayette County

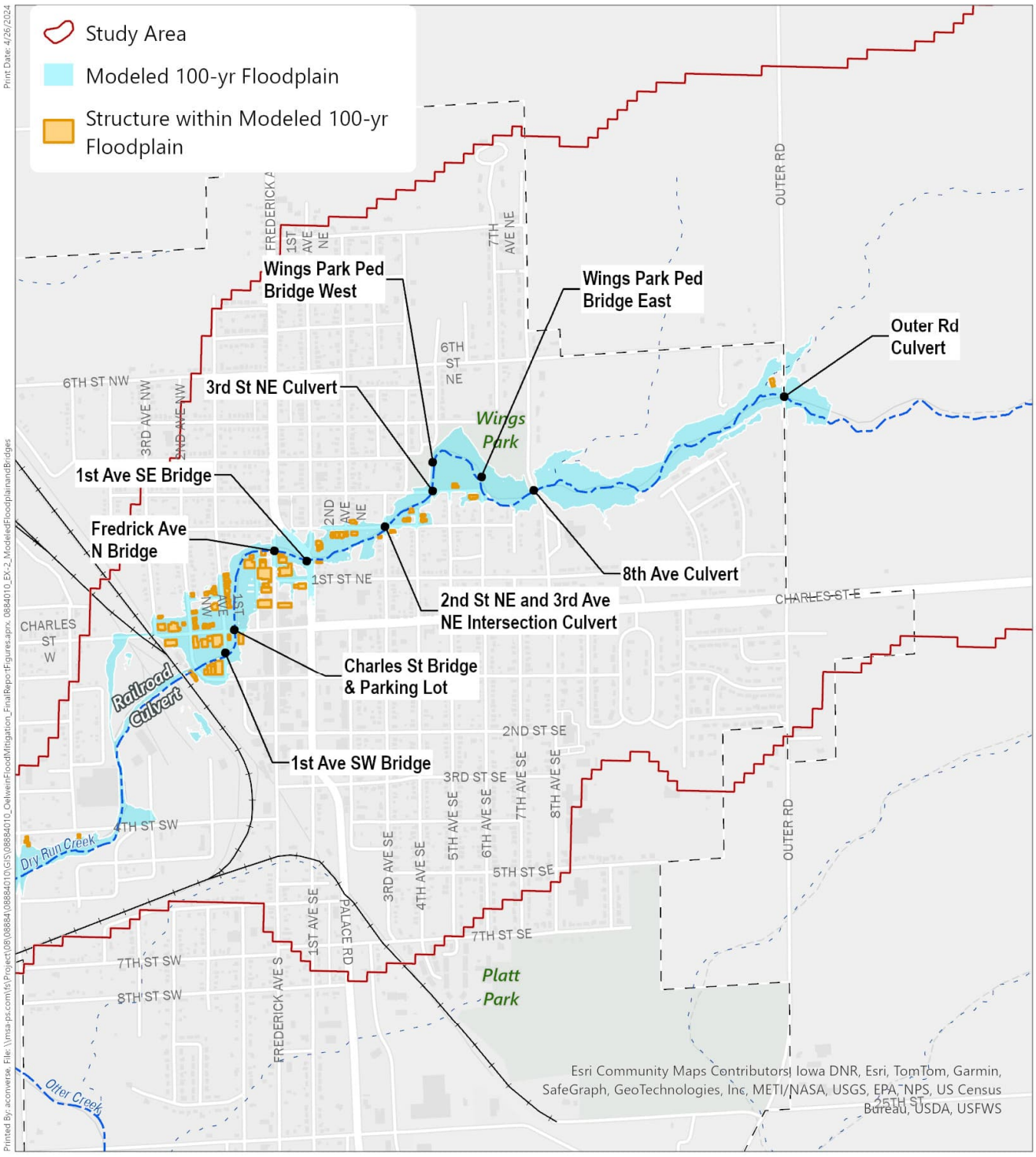
Oelwein
Study Area
Focus Area

0 0.2 0.4 Miles

N

Study Area

Figure EX-1
Flood Mitigation Scoping



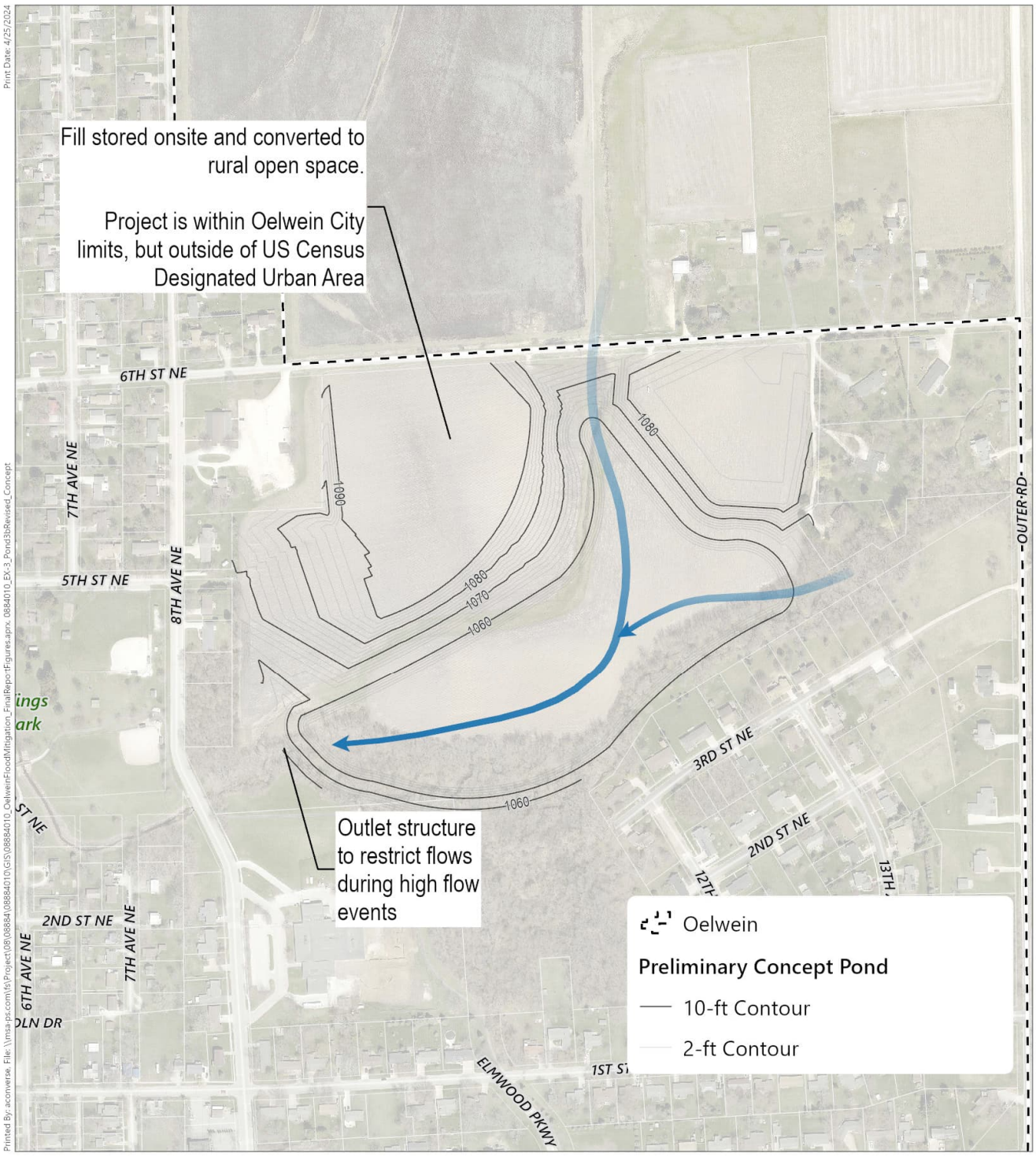
Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Floodplain Extents: FEMA (2021/05/17)

0 0.13 0.25 Miles

N

Modeled 100-yr Floodplain and Existing Bridges & Culverts

Figure EX-2
Flood Mitigation Scoping

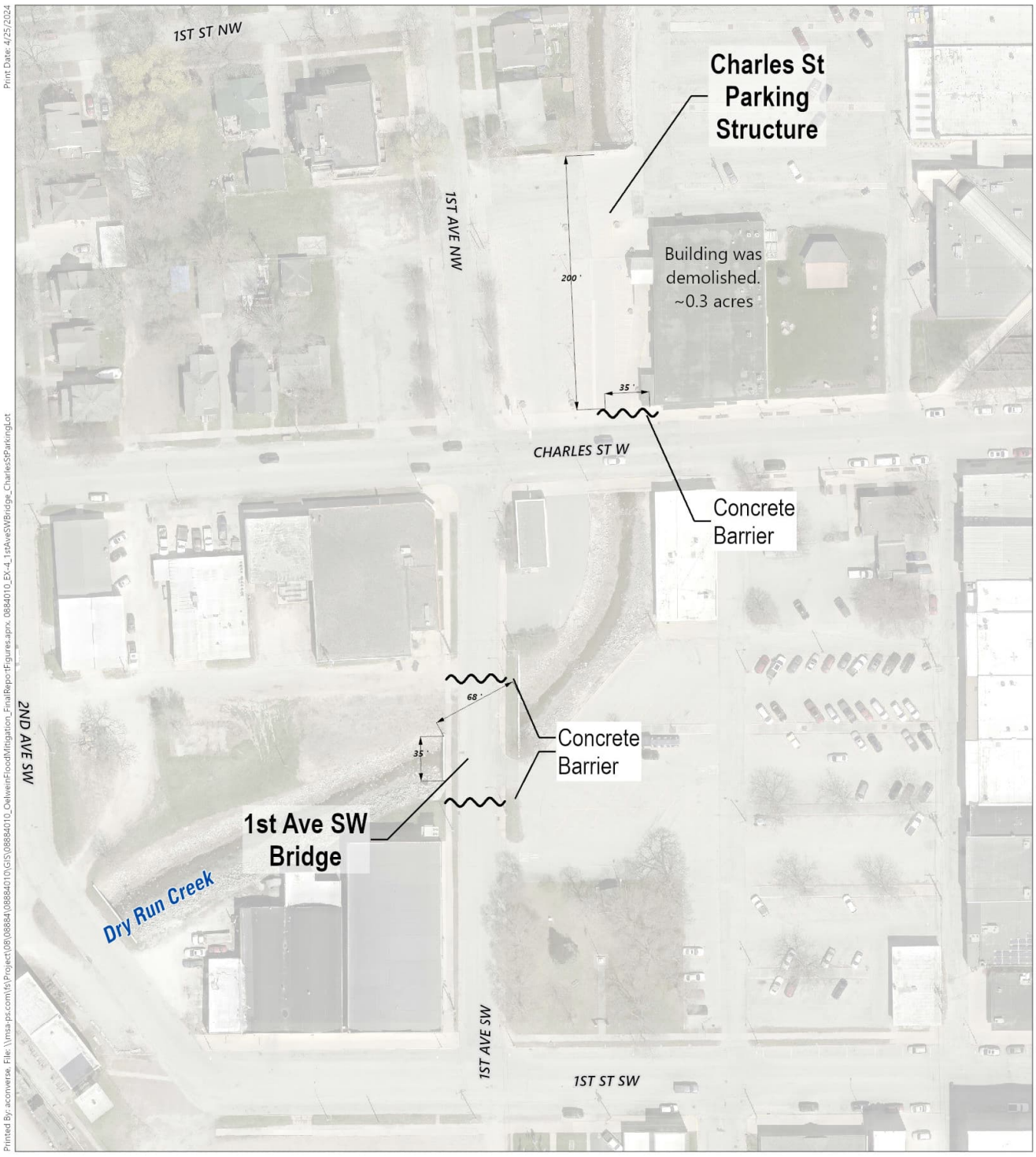


Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Aerial: Fayette County

0 200 400 US Feet

Proposed Pond 3b Revised Concept

Figure EX-3
Flood Mitigation Scoping



Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Aerial: Fayette County

0 50 100 US Feet

N

Remove 1st Ave SW Bridge and Charles St Parking Lot

Figure EX-4
Flood Mitigation Scoping

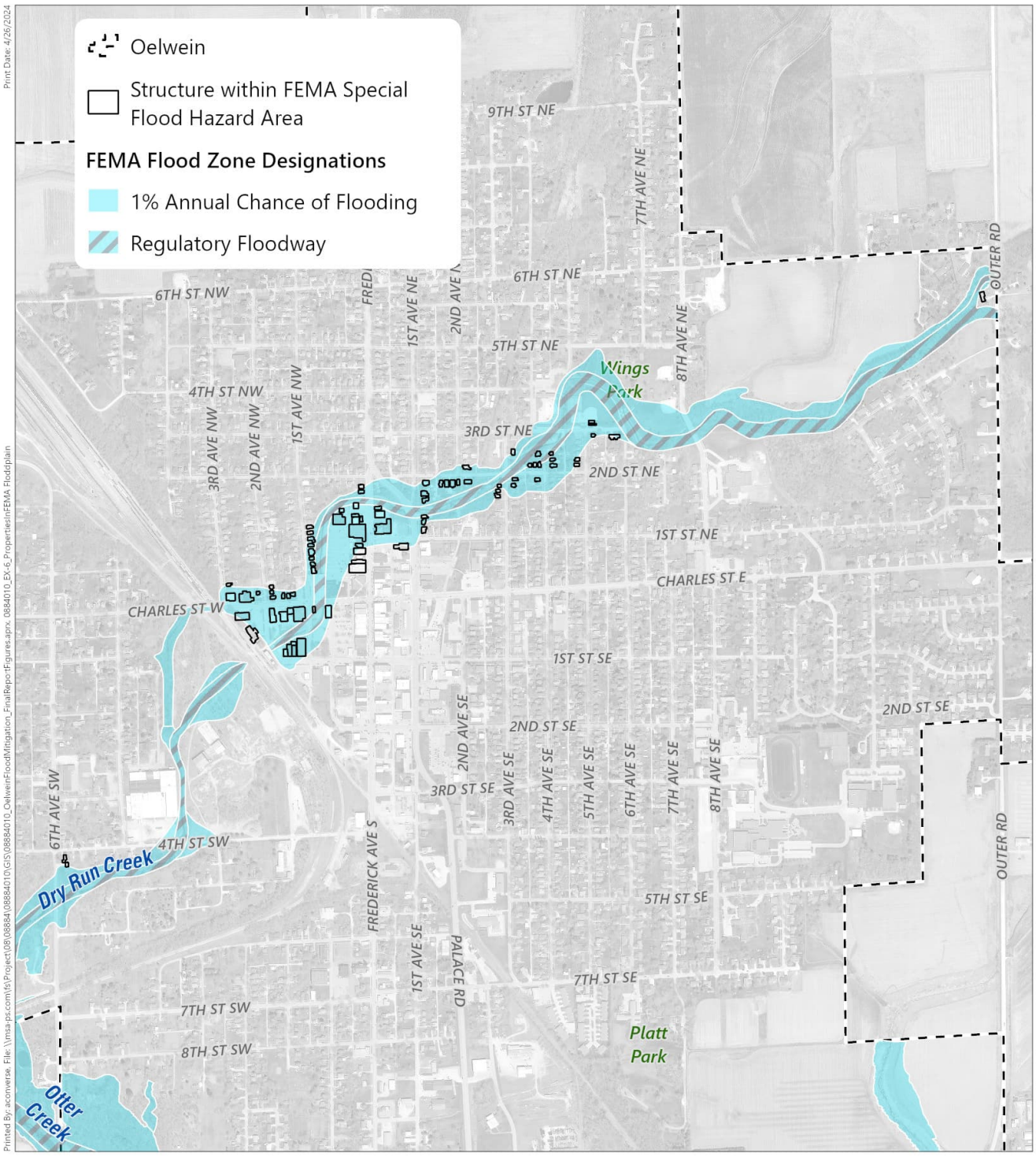
Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Floodplain Extents: FEMA (2021/05/17)
Aerial: Fayette County

0 125 250 US Feet

N

Repetitive Loss Structures

Figure EX-5
Flood Mitigation Scoping



Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Floodplain Extents: FEMA (2021/05/17)
Aerial: Fayette County

0 0.1 0.2 Miles

N

Structures within FEMA Special Flood Hazard Area

Figure EX-6
Flood Mitigation Scoping

1 Introduction

1.1 Project Background and Purpose

The City of Oelwein has experienced regular flooding of the downtown area from Dry Run Creek. The creek is highly urbanized and flows through the northeastern portions of the City (**Figure 1)**. Baseflow within the stream is low at approximately 200 cfs, however it experiences flash flooding, with 100-yr flow rates in the stream over 3,500 cfs at the stream's confluence with Otter Creek. The creek passes through a culvert underneath the Union Pacific Railroad, and portions of the downtown area upstream of this culvert have historically experienced flooding. The City's fire station, City Hall, private commercial buildings, and private residences have been impacted; a 2021 study commissioned by the Iowa DNR (see **Appendix A**) included photos documenting extensive flooding along the creek for every year since 2016.

The City would like to protect both public and private properties from flooding and improve the resiliency of their community. The 2021 study completed high level hydrologic and hydraulic model simulations to evaluate the effectiveness of different flood mitigation alternatives along the creek. This current study builds upon the 2021 study, specifically to determine the technical feasibility of mitigation alternatives and estimate cost-effectiveness.

This report will summarize all the alternatives considered as part of the analysis, provide conceptual designs and estimated construction costs for feasible alternatives, use the Federal Emergency Management Agency (FEMA) Benefit-Cost Analysis (BCA) toolkit, and finally identify funding sources for capital planning efforts.

1.2 Historic Flooding and Large Precipitation Events

Oelwein has experienced regular flooding, often associated with intense spring and summer storms. Dry Run Creek is a flashy catchment, resulting in water levels in the creek rising relatively quickly during rainfall events. The downtown area between 8th Ave NE and the railroad culvert are the most heavily impacted. The FEMA Flood Insurance Study (FIS) report dated May 18, 2021 (No. 19065CV000B) states that the restrictive bridges/culverts and the highwater velocities are the biggest source of flooding concern; the report estimates average annual damages from flooding in the City to be $71,900. *Note that this monetary value has not likely been updated in recent years, as the last study of Dry Run Creek completed by FEMA is from 1986.* There are 52 residential properties, 26 non-residential properties, and the Oelwein Fire Department within the FEMA Special Flood Hazard Area (a total of 79 buildings impacted). *Note that one of these residential structures is SW of the railroad culvert.*

City staff have reported that flooding has impacted the Oelwein Fire Department building and flooding along Charles St (specifically within the viaduct underneath the railroad tracks) has limited the ability for local responders to reach those in need during flood events. Photos of flooding were included in the 2021 report (see **Appendix A**).

Information on the largest storms in the past 25-years is described below, with website links for more details. **Table 1** lists the top 10 daily precipitation totals recorded at rain gauges in Oelwein from the Midwestern

Regional Climate Center (MRCC). *Note that some of the largest storm events span more than one day, and therefore total rainfall associated with longer storms might not be reflected in the daily totals*. For context, the NOAA Atlas-14 precipitation frequency depth estimates for the 24-hr storm is 7.61" for the 100-yr event and 10.3" for the 500-yr event.

- **May 16-17, 1999**
  Approximately 8.3" of rainfall was recorded north of Oelwein. The National Weather Service reported major damage to homes, businesses, and roadways within Oelwein (https://www.weather.gov/arx/may1799). A USGS report later published a report documenting the extents of the flooding due to this storm (Flood of May 17-20, 1999, in the Volga and Wapsipinicon River basins, Northeast Iowa).

- **July 22-24, 2010**
  The National Weather Service reported a series of back-to-back storms, with between 8-10" of rainfall measured in Fayette County and reported flash flooding in Oelwein and road closures (https://www.weather.gov/arx/jul2410).

- **June 10, 2020**
  The National Weather Service reported 5.25" of rain in Oelwein from Tropical Depression Cristobal. This was only the 2nd record of a tropical weather system center passing through Iowa (https://www.weather.gov/arx/jun0920).

***Table 1**: Top 10 daily precipitation totals collected from two rainfall gages in Oelwein (USC00136200 and USC00136199) from the Midwestern Regional Climate Center. Date of record is from 1923 – present (2024).*

Date	Daily Total Precipitation (in)	Rainfall Gage	National Weather Service, Additional Information
July 23, 2010	9.93	OELWEIN 1E (IA)	*A series of back-to-back storms, with between 8-10" of rainfall measured in Fayette County.*
September 7, 1989	7.19	OELWEIN 2 S (IA)	
June 15, 1925	6.5	OELWEIN 2 S (IA)	
August 31, 1981	6.38	OELWEIN 2 S (IA)	
June 10, 2020	5.48	OELWEIN 1E (IA)	*5.25" of rain in Oelwein from Tropical Depression Cristobal.*
July 19, 1963	4.63	OELWEIN 2 S (IA)	
July 26, 1940	4.55	OELWEIN 2 S (IA)	
August 21, 1966	4.44	OELWEIN 2 S (IA)	
May 16, 1999	4.38	OELWEIN 2 S (IA)	*8.3" of rainfall was recorded north of Oelwein.*
September 8, 1941	4.25	OELWEIN 2 S (IA)	

1.3 Flood Mitigation Goals

The City would prefer that no homes, businesses, or municipally owned infrastructure be flooded in the 1% Annual Exceedance Probability (AEP) design storm (often referred to as a the 100-yr storm event). Any solutions proposed to reduce flooding risk along one part of Dry Run Creek must not cause increased flooding risk to other parts of the creek.

1.4 Summary of Past Studies

The Army Corp of Engineers completed a Flood Control Project Report for Dry Run Creek in 1987 (see **Appendix B** for just the main body text of the report**),** and it referenced a series of other reports completed in the early 1980s with focus on flood reduction. Earlier project reports were not found as part of this study, but the 1987 report summarized their findings.

- *Storm Sewer Study, 1981*. The study recommended detention upstream of 8th Ave NE, surface water interception, and soil stabilization.
- *Flood Study Report, 1982*. The study recommended channel improvements, tile outlet terraces, and floodwater detention upstream of 8th Ave NE.
- *Initial Appraisal, 1983*. Recommended a more detailed study of flood reduction methods.

The 1987 report (**Appendix B**) included a cost benefit analysis for a series of flood mitigation alternatives, and ultimately recommended channel modification to widen the channel to 20-ft downstream of 3rd St NW and upstream of the railroad culvert. It was noted that even with the channel modification, flooding would still occur frequently, with some overbank flooding for the 2-yr event (50% AEP) in some areas. It is unknown while writing this report if this project was implemented. Many other mitigation alternatives were considered but eliminated from consideration due to cost.

The US Army Corp of Engineers Rock Island District published a Water Resources Development Book in 2009 which included a feasibility study of Dry Run Creek completed in August 1990. Included in the study were plans and specifications for approximately 3,500 linear feet of channel improvements. Work for the channel improvements was completed in 1995.

More recently, the City coordinated with the Iowa DNR, as a FEMA Cooperating Technical Partner (CTP), to complete a high-level analysis through the Real Time Technical Assistance (RTTA). Atkins published a report in December 2021, identifying high-level mitigation solutions to reduce or eliminate the flooding along Dry Run Creek upstream of the railroad crossing to the 3rd Avenue NE. A complete copy of this report is included in **Appendix A**. Mitigation solutions included increasing the culvert capacity underneath the railway tracks, removal of bridges, removal of a parking deck over the Creek, upstream storage reservoirs, improvements to the stream channel and creating small floodwalls. The City reviewed the solutions provided in the report and in communication with MSA as part of this study, decided to focus efforts on upstream storage solutions, removal of bridges, and removal of parking structures. The 2021 report did not include details on the feasibility of each solution or the potential costs. Instead, the aim was simply to determine if any mitigation actions (feasible or otherwise) would remove structures from the floodplain.

The current effective (official/regulatory) mapped floodplain associated with Dry Run Creek is based upon maps 19065C0416F and 19065C0417F, both of which are dated March 13, 2024. These maps were developed during the duration of this study. It is unknown, but expected, that the modeling used to complete the effective maps is different than that used as the basis for this study. **Figure 2** shows the effective floodplain within the Study Area as it was mapped when this study began (FEMA map date 05/17/2021). The mapped floodplain boundary on the most current map is substantially larger than that shown on Figure 2. Application of this floodplain boundary to the findings of this study would likely make the cost-benefit ratios for the various alternatives more favorable (higher benefit for the same project cost); however, it is not expected that this would change the recommendations made by this study. When the City selects a flood mitigation project for implementation, the design of that project will need to be based on the current effective floodplain model in existence at the time.

1.5 Scope of Study

Existing Conditions Detailed Mapping

The study uses the hydrologic and hydraulic models provided by the City from the 2021 study to evaluate the estimated flood elevations and extents along Dry Run Creek for the 10-, 50-, 100- and 500-yr events. These events were used since they are used as the defaults in the FEMA BCA toolkit. The HEC-RAS model developed during the 2021 study georeferenced and updated the FEMA HEC2 model from 1986. MSA augmented the model geometry further using more recent elevation data (LiDAR from 2019), historical plans from the Charles Street viaduct provided by the City (which was not included within the prior 2021 HEC-RAS model) and updated flow rates based on the United States Geological Survey (USGS) StreamStats website, which utilized Regression Equations for Region 2 from 2015.

Existing Conditions Flood Risk Summary

A GIS dataset was created of building footprints impacted by flooding up to the 500-yr storm event. Each building was assigned an estimated low grade based on LiDAR elevation, and an estimated lowest opening based on the number of steps up to the main entrance of the property. The Water Surface Elevation (WSE) and Discharge flow rate for each event was assigned to each property based on the existing conditions detailed mapping for each of the design storm events (10-, 50-, 100-, and 500-yr). Detailed assessment information from the County's assessor's office was also added to each building for use within the FEMA BCA toolkit. All this information is combined in the BCA Toolkit to determine the associated cost of damage to the properties within the modeled flood extents.

Alternatives Optimization

Each of the three (3) recommended combined alternative scenarios presented within the 2021 study were reviewed and modeled. **Table 2** is a summary of the alternative packages from the 2021 study. Refer to **Appendix A** for a complete copy of the 2021 study.

*Table 2: Summary of Alternative Packages from 2021 Atkins study. Refer to **Appendix A** for complete details.*

Potential Alternative Improvement		Combined Alternatives Scenario										
		1	2	3	4	5	6	7	8	9	10	11
A	Increased railroad culvert size	X										
B	Removal of 1st Avenue SW Bridge		X	X	X	X	X	X	X	X	X	X
C	Removal of parking deck north of W. Charles Street		X	X	X	X	X	X	X	X	X	X
D	Reconfiguration & replacement of W. Charles Street Bridge		X	X	X	X	X	X	X	X	X	X
E	Storage in Wings Park			X								
F	Storage reservoirs upstream of Outer Road				X		X	X	X	X	X	
G	Lined rectangular channel, upstream of railroad					X	X					
H	Deepened & lined rectangular channel, upstream of railroad							X	X	X	X	X
I	Deepened & lined trapezoid channel, downstream of railroad									X	X	X
J	Small flood wall on left side of channel upstream of railroad								X			
K	Small flood wall on right side of channel upstream of railroad								X		X	
	Recommended	N	N	N	~	N	~	~	**Y**	**Y**	**Y**	N

The prior study only presented modeling results for combinations of improvements, rather than modeling each potential alternative individually. This can make it challenging to decipher which individual mitigation action delivers the most flood reduction improvements. Therefore, each potential Alternative Improvement was modeled individually as part of this study.

Upstream storage reservoirs were reviewed in more detail, to determine the approximate size requirements to keep flows within the streambanks for the 100-yr storm event and remove buildings from the flood boundary. In some cases, the pond sizes were maximized based on the available land rather than a storm event as the pond required to contain the 100-yr storm event was larger than the parcel or available space.

2 Water Resources Inventory

2.1 Study Setting

The City of Oelwein is in northeastern Iowa in Fayette County, as shown in **Figure 1**. It is located within a rural area, surrounded by agricultural fields, and has a population of 5,920 as of the 2020 Census. The study area watershed includes the northeastern portions of the City as well as agricultural land outside of the City limits. Runoff from agricultural fields northeast of the City flows to Dry Run Creek until it passes under the railroad tracks which bisect the City from NW-SE; the Dry Run Creek Watershed includes approximately 60% of the City northeast of the railroad tracks. Dry Run Creek has been channelized within the City limits. Much of the creek is lined with heavy riprap, and some of the buildings in the downtown area are constructed within feet of the riverbanks.

The watershed (as defined by this study) is approximately 2,064 acres (3.22 sq. miles). The watershed upstream of the railroad culvert is 1,857 acres (2.90 sq. miles).

Approximately 45% of the watershed is fully developed, with 34% classified as residential, 5% commercial, 3% institutional (including schools, government offices, community services), 1% industrial, 1% as parks and open space and 1% as utilities. The remaining land area is agricultural. **Figure 3** shows the land use and select features within the Study Area. Prominent features in the watershed include:

- Oelwein City Hall
- Oelwein Fire Department
- Orville Christophel Park
- Wings Park
- Oelwein Family Aquatics Center
- Hub City Heritage Corporation Railway Museum (currently closed)

The study area is comprised of many different soil types, with hydrology soil groups A to D, based on the NRCS-USDA soil classification (see **Figure 4**).

2.2 Topography

The Topography of the City is relatively flat, but the surrounding agricultural areas have clearly defined ridgelines. This study used Long Term Hydrologic Impact Analysis (L-THIA) watershed boundaries from Purdue University for Great Lakes Watersheds. The HEC-RAS modeling referenced more recent LiDAR elevation data (2019) to provide more detailed mapped flood extents. The top of the watershed is at 1184’ and the culvert at the railroad is at ~1038’. **Figure 5** shows the topography within the study area and the LiDAR contours.

2.3 Drainage System

The City has urban drainage, with many neighborhoods and streets being served by stormwater infrastructure. Since this modeling focused on riverine flooding (not urban stormwater runoff), the stormwater system was not used in the modeling. The mapped stormwater system data was not requested or used within this study.

3 Existing Conditions Model Development

3.1 Data Sources

This study updated the HEC-RAS model provided by Atkins in the 2021 study. Model geometry was augmented using the more recent LiDAR data available from the statewide repository (2019). The original model did not include the Charles St viaduct under the railroad tracks, which often floods and acts as an unintentional secondary outlet for runoff during large storm events. Plans for the viaduct (from 1847, 1915, and 2022) were provided by the City staff to incorporate the viaduct into the HEC-RAS model. Flow rates for the 10-, 50-, 100-, and 500-yr storm events were developed using HydroCAD v10.20-4a.

3.2 Modeling Software

The original model from the 2021 Study was HEC-RAS v5.0.6. This was converted to a GeoHEC-RAS model v4.1.0.2545 for this study.

3.3 Modeling Approach

3.3.1 Model Geometry

No survey was completed as part of this study. Instead, the cross sections were used from the 2021 HEC-RAS model and not changed. After review, it appears as though the 2021 model used the FEMA 1986 HEC2 model as a base and made minor updates.

3.3.2 Model Flows

Flows for Dry Run Creek were developed in HydroCAD v10.20-4a using L-THIA watershed data and NOAA Atlas 14 Precipitation Frequency Depths for the 10-, 50-, 100-, and 500-yr storm events. L-THIA watersheds provide land use and hydrologic soil groups per sub-watershed. This data was entered into the HydroCAD model to develop rating curves and flow rates. The flow rates were calibrated by modifying times of concentration to converge on flows obtained from StreamStats, which uses 2015 USGS regression equations. The various upstream storage reservoirs were modeled in HydroCAD and the peak flow rates used for outlet flows in the GeoHEC-RAS model. Model flows were analyzed at five locations along Dry Run Creek: at the confluence with Otter Creek, the upstream side of the railroad culvert, the upstream side of the 1st Ave bridge, the upstream side of the 8th Ave culvert, the upstream side of the Outer Rd culvert, and in the agricultural field northeast of the City (see **Figure 6**).

3.3.3 Model Plans

Existing and proposed plans are run using a subcritical flow regime.

3.4 Hydrologic and Hydraulic Analysis

3.4.1 Existing Conditions

Dry Run Creek flows from northeast to southwest through the City of Oelwein to its confluence with Otter Creek. Thirteen culverts and bridges carry Dry Run Creek between its inlet in an agricultural field northeast of the City to its mouth at Otter Creek, southwest of the City.

The banks of Dry Run Creek are overtopped in some places during the lowest storm event analyzed, the 10-yr or 10% annual exceedance probability storm event. The GeoHEC-RAS model shows flows backing up into the Charles St Viaduct and utilizing the floodplain in the stretch of Dry Run Creek that was not channelized through the City center. During the three larger storm events, the entirety of Dry Run Creek overtops its banks.

Ten bridges and culverts carry Dry Run Creek upstream of the railroad culvert. Of the ten, 1/3 overtop during the 10-yr storm event (see **Figure 7**). All ten overtop at the 50-yr storm event. As the FIS report notes, these structures present a significant obstruction to flow.

The flow rates used in the FIS HEC2 model are slightly lower than the flows calculated as part of this study. Additionally, this study uses newer LiDAR data to develop flood boundaries for each storm event and, as noted previously, includes the Charles St Viaduct. Because of these modifications, the 100-yr flood boundary calculated using the GeoHEC-RAS model differs from the FEMA regulatory Special Flood Hazard Area (see **Figure 2** for FEMA mapping**, Figure 8** for MSA's revised mapping**,** and **Figure 9** for a comparison of the two). This results in an change to the number impacted buildings, 69 total (MSA) as compared to 79 (FEMA). **Table 3** displayed the number of structures within the FEMA Special Flood Hazard Area and the modeling completed for this study.

***Table 3**: Number of structures within the FEMA Special Flood Hazard Area and within the updated Hec-RAS modeling for the 10-, 50-, 100- and 500-yr events.*

Event Size	Number of Structures within Floodplain	
	FEMA Special Flood Hazard Area (as of 05/17/2021)	MSA Updated Hec-RAS Modeling
10-yr	*not mapped*	2
50-yr	*not mapped*	56
100-yr	79	69
500-yr	*not mapped in this area*	112

3.4.2 Proposed Alternatives

Proposed alternatives were modeled in GeoHEC-RAS to compare with existing conditions. Alternatives include upstream storage ponds, removing obstructions to the stream, and modifications to the stream or existing infrastructure. Descriptions of each alternative can be found in **Chapter 5**.

Ponds were modeled in HydroCAD to develop peak discharges for the 10-, 50-, 100-, and 500-yr storm events. These peak discharges were then used in GeoHEC-RAS as the proposed hydrology to determine the WSEs and flood boundaries. The model geometry remained the same for each of the pond alternatives.

Alternatives which removed or modified obstructions to the stream, such as bridges or culverts, updated model geometry by either removing a bridge or shortening the structure in the GeoHEC-RAS data editor. Modifications to the stream were modeled by changing the cross-sectional geometry as well as the terrain surface, which allows for the floodplain boundary to be accurately portrayed with the cross-section edits. Model hydrology remained the same for each of the removal or modification alternatives.

3.5 Model Results

WSE raster files with the flood elevations for the four storm events and flood boundaries were exported from GeoHEC-RAS to GIS for use with the BCA Toolkit. The WSE raster file use is detailed in **Section 4.3**. Flood boundaries are used to determine the number of structures within the floodplain.

4 FEMA BCA Toolkit

The FEMA Benefit Cost Analysis (BCA) toolkit is a publicly available tool (a Microsoft Excel add-on) that is intended to help communities estimate the long-term costs and benefits associated with flood mitigation projects. If the total benefits of a project are higher than the anticipated costs for a project, it might be a viable project to receive federal FEMA funding (benefit-cost ratio of 1.0 or greater). The Building Resilient Infrastructure and Communities (BRIC) program is a FEMA funding source to help communities become more resilient in the face of natural disasters, including flooding. More information on funding opportunities is included in **Chapter 7**. The BCA toolkit was used for each of the proposed alternatives to estimate the flood reduction benefits, and to support future funding opportunities.

The BCA toolkit requires detailed information about each of the properties impacted by a future risk; in the case of Oelwein, the future risk is riverine flooding. Since there are many properties that flood within Oelwein, one goal of this study was to create a process of quickly estimating the cost-benefit for a range of alternatives. Data entry for individual properties in the BCA toolkit can be time consuming and prone to data entry errors. Therefore, the data was formatted to support processing of multiple properties at once, using a "Batch Template for Riverine Flooding" that is provided within the BCA toolkit. Data was prepared for all structures impacted by the 500-yr flood, as determined by the flood inundation extends from the revised HEC-RAS model (see **Chapter 3**).

Benefits within the toolkit include benefits to structures as well as social impacts to residents. Social benefits for even a modest flood reduction risk can significantly increase overall benefits for a project.

4.1 Input Parameters: Residential and Non-Residential

This study included the creation of a GIS building footprint dataset (see **Section 1.5**), with attributes coded to match the BCA toolkit input parameters. The raw GIS data was provided to the City as a deliverable for this project. The attributes included the following parameters:

- **Building Identifier (parcel PIN).** If there are more than one building on a property, the shapes were merged into a multi-part feature.
- **Street Address.** Determined from assessor data.
- **City, State, Zip Code, County.** Oelwein, IA, 50662, Fayette County.
- **Latitude.** Determined based on centroid of building.
- **Longitude.** Determined based on centroid of building.
- **Structure Type.** Residential, Non-Residential or Critical Facility. Determined from assessor data and knowledge of the City.
- **Lowest Floor Elevation of the Property (ft).** Estimated using LiDAR DEM on the ground surface immediately in front of the main entrance and counting the number of steps visible from the street. Each step was assumed to be 0.6' in height and this was added to the DEM ground surface elevation.

- **Streambed Elevation at Property Location (ft).** Estimated using the streambed elevations within the HEC-RAS model and assigned using the HEC-RAS cross sections. Properties between each cross section were assigned the average streambed elevation between the cross sections.
- **Building Type (Residential).** One story, Split Level, Two or More Stories. Determined from assessor data.
- **Building Use (Non-Residential).** COM1, COM3, COM5, COM7, COM8, EDU1, GOV1, GOV2, IND2 and REL1. Determined from assessor data, aerial photography, Google Streetview and City staff. Definitions of building use codes can be found in BCA toolkit documentation.
- **Building Type (Non-Residential).** Clothing, Furniture, Industrial Light, Medical Office, Office One-Story, Recreation, Religious Facilities, Schools, Service Station, and Warehouse-Non-Refrig. Determined from assessor data, aerial photography, Google Streetview and City staff. Definitions of building type codes can be found in BCA toolkit documentation.
- **Building is located outside of hundred-year flood area (Non-Residential/Critical Facility).** Determined using updated HEC-RAS model results and inundation extents.
- **Building has a Basement (Residential).** Determined from assessor data.
- **First Floor Area (Non-Residential/Critical Facility – sq ft).** Determined from assessor data.
- **Size of Building (sq ft).** Determined from assessor data.

The BCA toolkit requires additional data, some of which are defaults within the toolkit, and others needed to be estimated due to lack of information about each property. The default values and estimated information are listed below:

- **Mitigation Action Type.** Acquisition, Drainage Improvement, or Floodwater Diversion and Storage. This varied based on the proposed alternative.
- **Project Useful Life.** This will vary based on the proposed alternative and is denoted in years.
- **Mitigation Project Costs ($).** A default value of $1 for the Drainage Improvements or Floodwater Diversion and Storage projects (a value of $0 produced errors). Since the data was entered for each property individually, the Proposed Alternative was added as a single line item within the BCA toolkit with the estimated project cost. MSA confirmed via email with the FEMA BCA Toolkit helpline on 2/26/24 that is "...acceptable to place all the project costs on a single mitigation action".
- **Use Default Number of Years of Maintenance?** "Yes", used the default for all properties.
- **Annual Maintenance Cost ($).** A default value of $0 was used for properties, and annual maintenance costs were added as a single line item with the proposed mitigation action alternative.
- **Building is Engineered (non-Residential/Critical Facility)**. This was assumed to be "No" for all buildings.
- **Building has Active NFIP Policy.** This was assumed to be "No," as this information was not available.
- **Damage Curve.** USACE Generic was used for residential buildings. The Building Type damage curve was used for non-residential buildings.
- **Use Default Building Replacement Value?** "Yes," used the default for all properties.
- **Use Default Demolition Threshold?** "Yes," used the default for all properties.
- **Use Default Building Contents Value?** "Yes," used the default for all properties.
- **Utilities are Elevated (Residential).** "No," as this information was not available.

- **Use Default Lodging Per Diem?** "Yes," used the default for all properties.
- **Use Default Meals Per Diem?** "Yes," used the default for all properties.
- **Number of Building Residents.** Assumed 2-residents per building. The US Census Bureau statistics state that the average people per household in Oelwein is 2.20. However, the toolkit would sometimes not work with fractional residents. The value was rounded down to 2 residents to make the toolkit functionality work consistently, resulting in a more conservative estimate of benefits. This value was doubled (4) for duplexes.
- **Use Default Per-Person Cost of Lodging?** "Yes," used the default for all properties.
- **Number of Workers**. This was assumed to be one (1) per building. Information was unavailable on a per-property basis. *Note that the number of workers determines the Social Benefits from flood reduction. Social Benefits can only be applied if the Standard Benefits are greater than zero. The BCA Toolkit will not automatically remove social benefits; therefore the number of workers was reduced to zero for those properties that did not received Standard Benefits.*

4.2 Input Parameters: Critical Facility

Critical facilities are Fire Stations, Hospitals, and Police properties. In addition to the input parameters listed in **Section 4.1**, several more parameters are needed for these locations. Only one Critical Facility was within the mapped inundation extents for Oelwein, the Fire Station. The attributes included the following parameters:

- **Critical Facility Type.** Fire Station
- **Number of people served (Fire Station).** 6,395 people. This was based on the mapped service area overlaid on the 2020 Census tracks.
- **Type of area served (Fire Station).** Rural.
- **Distance between alternate station (Fire Station).** 4.4 miles. This is the mapped driving distance to the Hazelton Fire Station.
- **Does fire station provide EMS? (Fire Station).** No.

If the City has access to more information about the Fire Station Building Cost Value (see **Section 4.1**) it is recommended this value be accounted for in the BCA toolkit. Often Fire Stations house expensive equipment (e.g. fire trucks) and that value might not be captured if using the Default Building Contents Value.

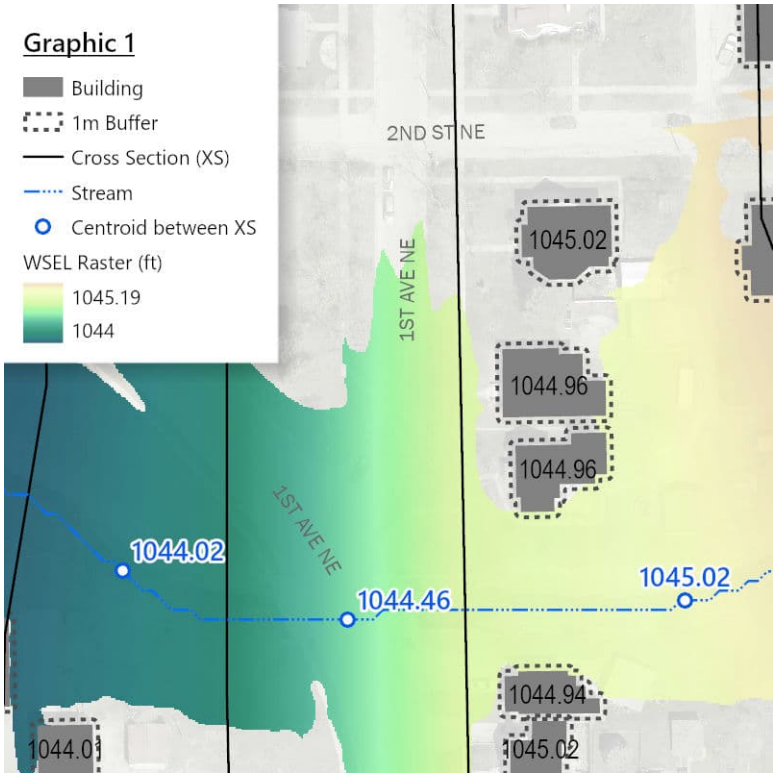
4.3 WSE and Discharge Before and After Mitigation

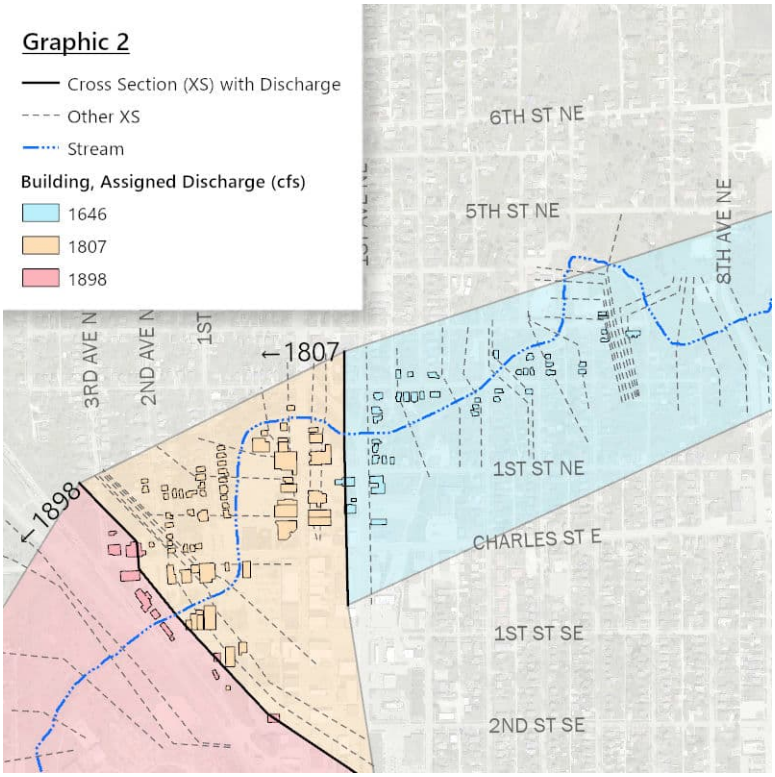
The BCA toolkit requires water surface elevations (WSEs) and discharge (cfs) at each property for four (4) different storm events. MSA used the default events in the BCA toolkit: 10-yr, 50-yr, 100-yr and 500-yr storms. Values for the WSE and discharge are required for each property Before and After the mitigation project is completed. Note that for Property Acquisition projects, WSE and discharge are not required for the "After mitigation" condition, as the structure no longer exists.

To streamline determining these values for a range of proposed projects, MSA wrote a series of ArcGIS python scripts to reference the WSE raster outputs from HEC-RAS and the discharge values from the HEC-RAS cross sections. MSA shared these python scripts with the City as part of this project, but the user must have ArcGIS

licensing to use the scripts. Note that the scripts were written for Oelwein specifically, as are the datasets available for this project. They cannot be readily applied to other projects without revisions.

To determine the WSE at a property, the GIS building footprint was buffered by 1 meter (the original resolution of the LiDAR DEM for the County) and the highest WSE value from the HEC-RAS inundation raster is assigned to the structure for each size storm event. The buildings are buffered to account for small inaccuracies in the traced building footprint. **Graphic 1** shows an example of how the WSE is assigned to a structure. If the WSE raster does not intersect the buffer around the building, the WSE elevation at the stream centroid between the upstream and downstream cross sections are assigned to the structure. This tool is used for the Existing Conditions and for each modeled alternatives if it was selected for further consideration.





Discharge rates within the model are assigned to only some of the modeled cross sections, and a detailed output for discharge at each structure is not available. Therefore, the modeled cross sections were converted to polygon shapes, and the discharge of the more upstream bounding cross section was assigned to the centroid of each structure. **Graphic 2** shows an example of how the discharge is assigned to a structure. This tool is used for the Existing Conditions and for each modeled alternative if it was selected for further consideration.

4.4 Discount Rate

The BCA Toolkit uses a discount rate when estimating the anticipated benefits. FEMA defines the discount rate as "...rate at which benefits decline in value each year." Using a lower discount rate of 3% generally results in higher benefits for a mitigation project but might not be available to all communities or projects. Therefore, this study provides the benefits associated with a 7% discount rate throughout. This is a more conservative approach, but if the City decides to move forward with a project (or if a project is near a benefit-cost ratio of 1), they should review the current FEMA guidelines for funding opportunities to determine if a 3% discount rate is available.

4.5 Costs for Mitigation Alternatives

For this study, the benefits associated with removing structures from the floodplain (or lowering the WSE and discharge) are captured on a property-by-property basis. To incorporate the cost of a mitigation alternative, all the project costs are put into a single mitigation action. For example, a proposed pond was added to the BCA toolkit as a single line item with the anticipated project costs. The Professional Expected Damaged Before and After Mitigation are left empty, as this information is captured on a property-by-property basis and should not be double counted in this section. MSA confirmed via email with the FEMA BCA Toolkit helpline on 2/26/24 that is "...acceptable to place all the project costs on a single mitigation action."

4.6 Ecosystem Services Benefits

For detention projects that create riparian areas, wetlands, or new open spaces, there is an added benefit in Ecosystem Services. For projects where water is captured and infiltrated rather than runoff through a drainage network or sewer system, there are added benefits for Green Infrastructure. For all the alternatives considered, natural infiltration was not feasible due to lack of space and retention time. Therefore, all the Pond alternatives were considered detention basins, and Ecosystem Services benefits were used within the BCA toolkit. Note that clear documentation for what is Riparian, Wetland, Urban Open Space, or Rural Open Space would be required prior to formal submission of the BCA toolkit to FEMA. The added benefits for restoring habitat as an Ecosystem Service can make a sizable difference in the benefit-cost ratio and might be the difference in whether a project is funded.

More information on the benefits of ecosystem services can be found in the 'FEMA Ecosystem Service Value Updates' document (June 2022).

4.7 Maximum Benefit for Structures Removed from Floodplain

To estimate the maximum benefit if all the structures were removed from the floodplain, the BCA toolkit was run using a "pie-in-the-sky" scenario. All the WSE and discharge rates under the existing conditions were loaded into the BCA toolkit. For the "After Mitigation" scenario, the WSE's were dropped to arbitrarily low values for the four (4) storm events: 1' for the 10-yr, 2' for the 50-yr, 3' for the 100-yr and 4' for the 500-yr event. The discharge rates were left the same as under existing conditions.

Based on this exercise, the maximum benefit for removing all the properties from the floodplain for **30-years** is $3.64M. The maximum benefit for removing all the properties from the floodplain for **100-years** is $4.02M.

This exercise is only theoretical and unrealistic but provides a maximum upper limit for how much benefit the perfect mitigation action would provide. Note that this does not include other benefits, like those of Ecosystem Services.

5 Flood Mitigation Alternatives Assessment

5.1 Considerations when Reviewing Alternatives

At the start of this study, the City provided context on what improvements would be most feasible based on local understanding from residents and historical efforts to implement changes within the City. The bullet summary below guided choices for modeling decisions:

- Only mitigation alternatives that were cost effective should be considered in more detail.
- Only mitigation alternatives that did not negatively impact other properties within the City or downstream. Any improvements could not "shift the problem elsewhere."
- The City initially reviewed all the alternatives proposed in the 2021 study and indicated that they were not interested in floodwalls.
- The City would like to model up to the 500-yr event, but upstream storage solutions would be designed for the 100-yr storm event.
- While increasing the size of the culvert underneath the railroad might provide a flood mitigation, it also would be very challenging to implement, as coordination with the railroad to revise train schedules (or only work when trains are not running) provide flagging and the length of the culvert (~350') would likely make it cost prohibitive to pursue. The City would like to see model results of this mitigation action but would not likely move forward with it unless the railroad indicated they strongly supported this solution.

5.2 Proposed Alternatives

A series of different design alternatives were considered, initially starting with the solutions presented within the 2021 study. Short descriptions of each alternative are outlined below, and the modeled 100-yr flood extents are included in **Figures 10-20**. Some alternatives included multiple ponds, to determine if ponds in series or in parallel would provide more mitigation benefits. All of the alternatives were not designed in detail; instead, the basics of each solution were integrated into the HEC-RAS model, and a high-level cost estimated based on qualities was developed for the City to review.

Mitigation alternatives that were selected for a more in-depth review and a cost benefit analysis are described in **Chapter 6**.

Please note that all the cost estimates included within this section are considered preliminary and are not based on a full design. A complete engineering design would be required for a formal cost estimate. Property acquisition costs and any costs for hauling material offsite were not included.

Table 4 provides a quick reference for seeing how many structures remain in the modeled 100-yr floodplain after the improvement is added to the model. More details on each alteratnive are described in the sections below.

Table 4: Number of structures removed from the modeled 100-yr floodplain for each mitigation alternative.

Modeled Alternative	# Structures Remaining within the Modeled 100-yr Floodplain	# of Structures Removed from the Modeled 100-yr Floodplain
Modeled Existing Conditions	**69**	**--**
Pond 1	5	64
Pond 2	68	1
Pond 3a	61	8
Pond 3b	3	66
Pond 4	68	1
Pond 1+2	2	67
Pond 1 + 3a	2	67
Pond 2 + 3a	58	11
Pond 1 + 2 + 3a	2	67
Pond 1 + 2 + 3b	2	67
Remove 1st Ave SW Bridge	63	6
Remove Charles St Parking Lot	69	0
Remove portion of RR Culvert	69	0
RR Upsize	59	10
Widen Channel	68	1

5.2.1 Pond 1

Proposed Pond 1 is located outside of the City limits and would cover ~35 acres of land and have 218-ac-ft of storage capacity (see **Figure 10**). It would be online to the existing drainage way through the field and capture only upstream runoff from the agricultural lands. Due to the topography in this area, the pond will have a storage capacity of greater than 50-ac-ft and height greater than 6-ft which is considered a dam in Iowa, and therefore would be subject to dam safety and regulations (per 567 Iowa Administrative Code Chapters 73). The pond would only have a small permanent pool of standing water, and most of the remaining space would be open space and riparian in nature except during high flow storm events.

To estimate the cost for this proposed pond, designers estimated approximately $1.16M for earthwork, $16K for storm sewers, $365K for outlet structures, $1.54M for sitework and landscaping, $309K for mobilization and $463K for engineering. With a 20% contingency factor, the construction costs were estimated to be $4.6M. The estimate did not include property acquisition values.

The modeling indicated that this solution would remove 64 properties from the 100-yr floodplain. The project would be located outside of the City limits, which could be a barrier to construction. City staff had historically

spoken with the current landowners about property acquisition, and it was deemed unlikely. Therefore, the City did not select this alternative for the next phase of analysis.

5.2.2 Pond 2

Proposed Pond 2 is located outside of the City limits and would cover ~16 acres of land and have 82-ac-ft of storage capacity (see **Figure 11**). It would be online to the existing drainage way through the field and capture only upstream runoff from the agricultural lands. Similarly to Pond 1, the pond would be considered a dam in Iowa. The pond would only have a small permanent pool of standing water, and most of the remaining space would be open space and riparian in nature.

To estimate the cost for this proposed pond, designers estimated approximately $503K for earthwork, $16K for storm sewers, $365K for outlet structures, $666K for sitework and landscaping, $155K for mobilization and $232K for engineering. With a 20% contingency factor, the construction costs were estimated to be $2.3M. The estimate did not include property acquisition values.

The modeling indicated that this solution would remove only 1 property from the 100-yr floodplain. The project would be located outside of the City limits, which could be a barrier to construction. City staff had historically spoken with the current landowners about property acquisition, and it was deemed unlikely. Due to the limited improvements provided by the pond, the City did not select this alternative for the next phase of analysis.

5.2.3 Pond 3a

Proposed Pond 3a is located within the City limits and would cover ~11 acres of land and have 42-ac-ft of storage capacity (see **Figure 12**). It would be offline from Dry Run Creek and online to the existing drainage way through the fields and capture upstream runoff from the agricultural lands north of 40th St. The Pond 3a was specifically sized to not be considered a dam in Iowa, because it has less than 50-ac-ft of storage capacity, and greater than 15-ac-ft of storage capacity but less than 25-ft of pond height (per 567 Iowa Administrative Code Chapters 73). The pond would only have a small permanent pool of standing water, and most of the remaining space would be open space and riparian in nature.

To estimate the cost for this proposed pond, designers estimated approximately $2.8M for earthwork, $16K for storm sewers, $15K for outlet structures, $1.5M for sitework and landscaping, $436K for mobilization and $655K for engineering. With a 20% contingency factor, the construction costs were estimated to be $6.5M. The estimate did not include property acquisition values.

The modeling indicated that this solution would remove 8 properties from the 100-yr floodplain. The project would be located within the City limits, which could make construction more feasible. City staff spoke with the property owners, and property acquisition might be feasible. However, due to the limited improvements provided by the pond, the City did not select this alternative for the next phase of analysis.

5.2.4 Pond 3b

Proposed Pond 3b is in the same location as Pond 3a (within of the City limits) and would cover ~33 acres of land and have 220-ac-ft of storage capacity (see **Figure 13**). It would be online to Dry Run Creek through the field and capture upstream runoff from the agricultural lands, both from the north and from the east. Due to the larger size, it would be considered a dam in Iowa, both for its storage capacity and height of 10-ft. The pond would only have a small permanent pool of standing water, and most of the remaining space would be open space and riparian in nature.

To estimate the cost for this proposed pond, designers estimated approximately $2.8M for earthwork, $16K for storm sewers, $365K for outlet structures, $1.5M for sitework and landscaping, $471K for mobilization and $707K for engineering. With a 20% contingency factor, the construction costs were estimated to be $7.1M. The estimate did not include property acquisition values.

The modeling indicated that this solution would remove 66 properties from the 100-yr floodplain. The property would be located within the City limits, which could make construction more feasible. City staff spoke with the property owners, and property acquisition might be feasible. The City selected this alternative for the next phase of analysis.

The pond sizing was reviewed in more detail (see **Section 6.1.1**) specifically to keep the pond within the property boundaries and attempt to keep all the fill onsite and eliminate hauling costs. It resulted in a smaller pond with a berm adjacent to the stream to protect properties south of the channel from flooding. The revised cost estimate in **Section 6.1.1** reflects these changes. This project did not include soil borings/testing of this site to determine the feasibility of construction. This would be ascertained during the formal design phase.

5.2.5 Pond 4

Proposed Pond 4 is located within the City limits in Wings Park and would cover ~2 acres of land and have 4.7-ac-ft of storage capacity (see **Figure 14**). It would be online to the existing drainage way the park, offline from Dry Run Creek, and capture upstream runoff from both agricultural lands and a portion of the City. Pond 4 would not be considered a dam in Iowa as it does not meet the size thresholds, nor would it be considered a high hazard. The pond would only have a small pool of standing water, and most of the remaining space would be open space and riparian in nature.

To estimate the cost for this proposed pond, designers estimated approximately $91K for earthwork, $6K for storm sewers, $15K for outlet structures, $214K for sitework and landscaping, $25K for mobilization and $37K for engineering. With a 20% contingency factor, the construction costs were estimated to be $370K. The parcel is owned by the City, but it would take away some of the current park amenities depending on site the grading plan.

The modeling indicated that this solution would remove only 1 property from the 100-yr floodplain. The pond could not be sized any larger, due to the limited undeveloped space within this area. Due to the limited improvements provided by the pond, the City did not select this alternative for the next phase of analysis.

5.2.6 Pond Combinations

A series of different alternatives combining ponds (in parallel or in series) was reviewed to determine if this arrangement would provide more effective flood mitigation to the downstream properties. The pond descriptions were provided earlier, and the estimated construction costs were added together for each combination.

For all the pond combinations, it was noted that a single pond (Pond 3b) would provide nearly the same flood mitigation benefits. This report does not include figures for the Pond Combinations.

Ponds 1 & 2: Removed 67 structures from the floodplain with an estimated cost of $6.9M. Since both ponds would be located outside of the City limits and property acquisition would be challenging, this alternative was not selected for the next phase of analysis.

Ponds 1 & 3a: Removed 67 structures from the floodplain with an estimated cost of $11.1M. One pond would be located outside of the City limits and property acquisition would be challenging. This alternative was not selected for the next phase of analysis.

Ponds 2 & 3a: Removed 11 structures from the floodplain with an estimated cost of $8.8M. One pond would be located outside of the City limits and property acquisition would be challenging. This alternative was not selected for the next phase of analysis.

Ponds 1 & 2 & 3a: Removed 67 structures from the floodplain with an estimated cost of $13.4M. Two of the ponds would be located outside of the City limits and property acquisition would be challenging. This alternative was not selected for the next phase of analysis.

Ponds 1 & 2 & 3b: Removed 67 structures from the floodplain with an estimated cost of $14M. Two of the ponds would be located outside of the City limits and property acquisition would be challenging. This alternative was not selected for the next phase of analysis as 80 of the 81 properties were removed solely with Pond 3b.

5.2.7 Remove 1st Ave SW Bridge

The 1st Ave SW bridge crosses over Dry Run Creek, immediately upstream of the railroad culvert in downtown Oelwein. There are other bridges for residents and businesses to reach this portion of the City, and therefore they are willing to sacrifice transportation infrastructure for flood improvements.

Cost estimates for removing the bridge were based on quantities and did not include a site survey. The clear span was estimated to be 28.4-ft, with an overall length of 35-ft. The deck width was estimated to be 45-ft, with a calculated total deck area was 2,380 sq-ft. Assuming $60 per sq-ft of removal, the cost to remove the bridge would be ~$150K.

Removing the bridge would remove 6 structures from the modeled 100-year floodplain (see **Figure 15**). The City selected this alternative for the next phase of analysis.

5.2.8 Remove Charles St Parking over Creek

A parking lot was constructed over the creek at the corner of W Charles St and 1st Ave NW. It effectively acts as a long-enclosed bridge, with open channel flow on the upstream and downstream ends. The City recently demolished the building adjacent to the parking lot (25 W Charles St) and would like to restore this portion of the channel to a more natural state. Note that the only change to the Charles St Bridge over Dry Run Creek would be to add a railing to the north side, similar to the railing on the south side of the bridge.

Cost estimates for removing the parking lot were based on quantities and did not include a site survey. The clear span was estimated to be 35.25-ft, with a deck width of 200-ft. The calculated total deck area was 7,050 sq-ft. Assuming $60 per sq-ft of removal, the cost to remove the parking structure and piers would be ~$450K.

Removing the parking lot would not remove any structures from the 100-year floodplain, see **Figure 16**. The City realizes that this improvement alone would not provide significant flood mitigation benefits, but it could be incorporated into later developments, potentially as riparian space immediately adjacent to the channel The City selected this alternative for the next phase of analysis, the parking lot is not necessary to serve the downtown and the City anticipates a future need to conduct major repairs to the structure.

5.2.9 Remove a Portion of the Railroad Culvert

The large culvert underneath the railroad is partially owned and maintained by the City (the portion east of the tracks, underneath the Railway Museum, while the rest is owned by the railroad). Documentation of the ownership (how much is owned by the City and how much by the railway) was not uncovered as part of this project.

However, MSA has knowledge of a recent culvert inspection of the culvert, where an individual walked the length of the culvert as part of the inspection. The portion under the railroad had been replaced in recent years and is in good condition. The portion close to the City was in poor condition, and portions of the culvert top have visible openings into the building above it (likely the railroad museum). This information was conveyed to the City as another potential flooding risk; if the culvert under the railroad track fails, the any floodwaters from Dry Run Creek would pass through the Charles St viaduct instead, causing more damage to the downtown area.

A copy of the culvert inspection report was not available to MSA staff, but the City can access the report through the Iowa Department of Transportation's (DOT) Structure Inventory and Inspection Management System (SIIMS) system.

Reconstructing the culvert would be costly, so this alternative includes simply removing the culvert segment that is owned by the City, effectively reducing the length of the culvert and restoring the creek in this area to a more natural condition.

A cost estimate for this improvement was not provided, as it would require a better understanding of how much of the culvert is officially owned by the City and would also require demolishing the structures that are on top of the culvert.

To estimate the impacts of this, the model was revised to shorten the railroad culvert by 120-ft, and no buildings were removed from the modeled 100-yr floodplain (see **Figure 17**). The City realizes that this would not provide much flood mitigation benefit, but it could be considered later if this portion of the culvert is in poor condition or at risk of failure. It is recommended that the City complete an inspection of this portion of the culvert and ask the railroad for any prior inspection reports.

5.2.10 Upsize the Railroad Culvert

The 10-ft wide by 9-ft high culvert that passes underneath the railroad tracks is the primary outlet for Dry Run Creek, and acts as the main flow restriction. However, replacing the culvert could be very time intensive and costly, and would also require close collaboration with the railroad. The 2021 study implemented the railroad culvert restriction by modeling a 100-ft wide by 14-ft high box culvert under the railroad, which provided substantial flood reductions. However, such a large culvert would be challenging to implement.

This alternative considered upsizing the full length of the box culvert to 4 cells of a 12'W x 9'H ft to match the top width of Dry Run Creek at the upstream inlet of the culvert. By matching the top width, also known as the bankfull width, the culverts would be able to convey the same flows as the stream itself. The model predicted that this new culvert would remove 10 structures from the 100-yr floodplain (See **Figure 18**).

Estimating the cost for replacing the railroad culvert is not feasible without a formal design and with direct communication with the railroad to gage their level of involvement and expectations. However, to provide at least a ballpark estimate, costs were generated using quantities. The culvert is 350-ft long and currently is ~50-ft wide. If it costs $50/linear foot, removing the existing culvert was estimated to be ~$900K. The estimated cost of the new box would be ~$2.8M with an additional ~$1M in flagging costs. This would be approximately $5M in costs, but it likely would deviate considerably.

The City noted the high price tag and the challenges associated with working in the railroad right-of-way and the uncertainties associated with estimating the cost of this project. Therefore, the City did not select this alternative for additional analysis, but they would be open to coordinating with the railroad if they were amendable to this large-scale project.

5.2.11 Widen the Stream Channel at Select Locations

There are some locations adjacent to the stream that are currently undeveloped and might provide additional storage capacity along the stream banks and restore more riparian habitat. This alternative expanded the stream channel at three (3) different locations:

- north of W Charles Street where there is currently a parking structure over the stream
- south of 2nd St NW, west of 3rd Ave NE in backyard areas
- within Wings Park

The total area of all three improvements is ~5 ac (see **Figure 19**) and would be classified as a mixture of urban open space and riparian.

Cost estimates for this improvement were not estimated since the amount of grading required would depend on the formal design and site limitations that are unknown at this time. The proposed improvement removed one property from the modeled 100-yr floodplain. However, this improvement could be coupled with other mitigation efforts to restore open space and riparian habitat for the City. This could provide ecosystem services benefits and improve the aesthetic quality of the downtown area.

If properties are acquired adjacent to the stream channel, it might be possible to widen the channel over a longer portion of the stream corridor, which could provide more flood mitigation benefits. This City can consider modeling this alternative if more land becomes available in the future.

5.2.12 Property Acquisition and Relocation of Critical Facilities

The final alternative considered was property acquisition or relocation. Some structures within Oelwein have flooded repeatedly, and property acquisition might be a more cost-effective solution. However, removing all the structures within the downtown area was not likely to be feasible, as landowners would need to volunteer for the program, and it would change the character of downtown Oelwein.

The City requested to look at those properties that flooded most frequently, and to develop a list of properties that should be considered to prevent flooding from reoccurring. Cost estimates for property acquisition were provided by the City on a property-by-property basis using assessment information and local knowledge of the market. The City selected this alternative for more detailed analysis, with the understanding that it is unlikely that all properties would be acquired. Property acquisition would likely occur in tandem with other improvements.

To provide guidance to the City, this study prepared a series of maps indicating which properties are impacted by each modeled storm event (10-yr, 50-yr, 100-yr and 500-yr). Those impacted by the smaller storm events could be considered first for acquisition. **Figure 20** is a composite of these maps, indicating which properties are touched by the inundation extents from each modeled event.

The Oelwein Fire Department is currently within the FEMA Flood Hazard Area. The building itself floods, and the adjacent streets also flood, making it more difficult for emergency responders to reach residents. It is recommended that the Fire Department is relocated to a less flood prone location. The City requested property acquisition to be included in the possible list of alternatives.

5.3 Limitations

All the modeled alternatives and associated cost estimates within this phase of the project are considered preliminary and will change if a project moves into the formal design phase. This effort was undertaken at a high level to help the City prioritize improvements and begin to use the FEMA BCA toolkit.

All the modeling was completed in HEC-RAS and is focused on Riverine flooding, not urban storm sewer flooding. Therefore, the impacts of local drainage infrastructure (outside of the riverine system) were not included within the model results. The updated HEC-RAS model has also not been submitted to FEMA as a Letter of Map Revision (LOMR). FEMA accepts the modeling outputs that are augmented from the current

effective model when applying for funding opportunities. However, MSA recommends coordinating with FEMA to discuss best practices when using updated modeling prior to submitting a request for funding.

Cost estimates for property acquisition and relocation of the Oelwein Fire Department were not included as part of this study. Acquisition of properties requires the resident/business owner to participate in the program, and the City has not yet approached landowners about this option. Property acquisition also requires a current assessment of the property, which was not completed as part of this study. Therefore, property assessment information from the local assessor's office was used to estimate these values. A cost estimate for the relocation of the Fire Department was also not prepared as part of this study. This would require careful site placement (to ensure the new location would provide a high level of service to the entire service area), property acquisition costs, and construction costs for the new facility.

Of the Recommended Solutions, only the Regional Pond 3b Revised reduces flow along Charles St such that the Viaduct is not flooded. Repair or replacement of the Viaduct is not included as part of this study. However, MSA is aware that the Viaduct is in poor condition. Any future improvements to the Viaduct should take into consideration the flooding along Charles St.

Finally, all the modeling completed within this study was based on the 2021 Atkins model provided to MSA by the City. As was stated earlier in this report, during the duration of this study, FEMA published a new FIS report in March 2024. The current effective mapped floodplain boundary delineated by FEMA is substantially larger than that determined by modeling completed for this study. Application of the current effective floodplain boundary to the findings of this study would likely make the cost-benefit ratios for the various alternatives more favorable (higher benefit for the same project cost); however, this would not be expected to change the recommendations made by this study. When the City selects a flood mitigation project for implementation, the design of that project will need to be based on the current effective floodplain model in existence at the time.

6 Recommended Alternatives

The City selected the following alternatives to be considered in more detail. Note that each alternative was considered individually. Implementing several alternatives and applying for grant funding as a collective group will sum the total costs but not necessarily the associated benefits. For example, two alternatives might remove the same property from flood risk. However, this benefit is only counted once – and therefore a complete cost-benefit analysis should be completed based on any combination of alternatives.

6.1 Regional Pond 3b Revised

The City would like to consider a large, regional detention storage option located within the City limits. The original concept discussed in **Section 5.2.4** was sized for maximum flood mitigation benefit but did not account for constructability. Therefore, a more detail concept layout was prepared, with several considerations:

- First, the proposed detention should not negatively affect properties immediately to the south. The residential homes adjacent to the Dry Run Creek on 3rd St NE do not currently flood during any of the modeled flood events, and any proposed design cannot make the flood conditions on these properties worse. The design would require putting a berm immediately north of these properties and relocate the stream channel to flow into the pond. Low flow conditions in the stream would remain the same in the relocated channel to create a new riparian corridor, but the berm and outlet structure would restrict water during the high flow events, to slowly release the contained water and reduce the flooding risk downstream.
- Secondly, hauling fill costs are widely variable, depending on the location of the haul site, soil conditions, and the road conditions adjacent to the site. Truck traffic can damage roads that were not designed to carry large loads and can be an added cost to repair. Therefore, the proposed design was intended to keep all soil onsite, and not hauled offsite. This reduced the potential size of the proposed pond, and the extra fill could be used to create an urban park area, with native plants and hiking trails.
- Thirdly, the proposed pond would only be used for flood mitigation; it would not have a large permanent pool of water. Creating a large permanent pool would be more costly, as it would require more soil removal. The City indicated that having a wet pond was not a priority and would prefer the most cost-effective solution.
- Fourthly, the proposed design would likely require relocating a portion of the Dry Run Creek channel and could require Stream Mitigation. The US Army Corp of Engineers was consulted as part of this project and presented a high-level overview of the project. Stream Mitigation fees would be much higher if the relocated stream were to become a permanent wet pool, more akin to a pond than a stream. However, if the relocated stream retains its riparian character, mitigation costs would be lower. This was another reason to keep the low flow conditions the same, allowing water to continue to flow through the stream, except during large rainfall events when the detention pond would provide flood storage.

A large regional detention basin would provide the most benefit to the downstream properties, and therefore should be considered a viable alternative for the City. **Figure 21** shows the proposed concept

layout covering ~17 acres with a total of ~46 acres within the grading area that would be converted to open space or a regional park. **Figure 22** shows the modeled 100-yr floodplain for this alternative. Fifty-seven (57) buildings would be removed from the 100-yr floodplain.

The cost for this regional solution would be high (see **Section 6.1.1**) and therefore would likely require funding from an outside agency to implement.

6.1.1 Cost Estimate

A cost estimate for the Regional Pond 3b Revised layout was based on quantities (**Table 5**), and did not include property acquisition costs, any hauling costs, Stream Mitigation fees, or permitting. A more accurate cost estimate would require a detailed design, a field survey including soil borings, assessment of the stream for the Army Corp review, and confirmation of land costs from property owners. The US Army Corp of Engineers would assist with estimating the stream mitigation costs, and indicated there were available credits for this region.

Table 5: Estimated construction cost based on concept design quantities for the Regional Pond 3b Revised.

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
Earthwork				
CLEARING AND GRUBBING	LS	1	40,000	$ 40,000
EXCAVATION, CLASS 10	CY	425,000	5.25	$ 2,231,250
Sewers and Drains				
STORM SEWER, TRENCHED, RCP, 36-INCH	LF	320	150	$ 48,000
PIPE APRON, RCP, 36-INCH	EA	8	4,000	$ 32,000
FOOTING FOR CONCRETE PIPE APRON, STORM, 36-INCH	EA	8	2,000	$ 16,000
Sitework and Landscaping				
RIP RAP, CLASS B	TON	800	40	$ 32,000
CONVENTIONAL SEEDING, FERTILIZING, AND MULCHING, TYPE 5	SY	100,000	0.50	$ 50,000
CONVENTIONAL SEEDING, FERTILIZING, AND MULCHING, NATIVE GRASS AND FORBS	SY	75,000	0.90	$ 67,500
SILT FENCE OR SILT FENCE DITCH CHECK	LF	5,200	2.50	$ 13,000
SILT FENCE OR SILT FENCE DITCH CHECK, REMOVAL OF SEDIMENT	LF	5,200	0.50	$ 2,600
SILT FENCE OR SILT FENCE DITCH CHECK, REMOVAL OF DEVICE	LF	5,200	0.10	$ 520
MOBILIZATION	LS	1	253,287	$ 253,287
SUBTOTAL				**$ 2,786,157**
Miscellaneous				
ADMINISTRATION, LEGAL, & ENGINEERING (15%)				$ 417,924
CONTINGENCY (20%)				$ 557,231
TOTAL ESTIMATED PROJECT COST				**$ 3,844,897**

ASSUMPTIONS

EROSION CONTROL 2-5%

MOBILIZATION 10%

SILT FENCE AROUND PERIMETER

100% CUT, NO HAULING

RIP RAP REFERS TO SUDAS SPEC FOR CHANNEL FLOW - FOR OUTLET STRUCTURES

ASSUMED DENSITY IS SIMILAR TO CLASS "A"

DIMENSIONS OF 10 'W X 10' L X 2' D FOR OUTLET STRUCTURE AND 10' W X 20' L X 2' D FOR SPILLWAYS

This regional detention basin would also be classified as a dam and would require compliance with the Iowa Administrative Code Environmental Protection Commission [567], Chapter 73. This would likely include a dam inspection every 10-yrs. Long term maintenance for the site would likely require regular mowing or prescribed burns depending on the type of native plantings in the area. The City could use the space as a natural park area, with mowed trails if desired. Every 25-50 years it is prudent to anticipate a larger maintenance cost, such as a large repair to the earthen dam.

To estimate long term maintenance costs, it was assumed the site would have a dam inspection every 10-yrs ($10K), mowed annually ($5K), and undergo one large maintenance repair every 25-years ($75K). An inflation assumption was not included at this time. These assumptions should be reviewed in more detail and adjusted to include inflation if this project is selected for implementation.

If the project lifespan is 30-years, the expected maintenance would be an additional $255K.

6.1.2 Stream Mitigation

Any impacts to the stream that would reduce the quality or functionality of a stream channel needs review by the Army Corp of Engineers. Historically, channelization of streams has negatively impacted waterways, by increasing erosion, increasing water turbidity, and adversely impacting wildlife among other things. Therefore, the Army Corp requests that all project work first try to avoid or minimize impacting streams. When impacting a stream is unavoidable, the Army Corps requires compensatory stream mitigation. This entails purchasing "stream mitigation bank credits" from another entity within the region that has been restored and protected. The cost per credit will vary, but values between $75-100 per credit have been reported by Army Corp staff via personal communication.

The US Army Corps of Engineers Rock Island District website has more information about Stream Mitigation:

https://www.mvr.usace.army.mil/Missions/Regulatory/Stream-Mitigation/

The Regional Pond 3b Revised would require ~1,900 ft of stream channel to be relocated, so that low flow waters would now pass through the detention pond keeping the normal functionality of the stream. During high flow events, the detention basin would retain water, but release it more slowly to reduce the flooding impacts downstream, but not keep a permanent standing pool of water outside of the main channel. The draw down rate for the pond will depend on the size of storm event (quantity of water and duration of the storm) and the formal design of the outlet structure.

Communication with the Army Corp of Engineers indicated that if the final design maintained low-flow channel conditions through the detention basin, and did not have a larger permanent pool, Stream Mitigation credits would be significantly lower. If draw down time after a large storm event is 24-hours or less, mitigation credits are not required for the impoundment portion; if it is longer, more stream mitigation would be required. This is intended to keep streams in Iowa functioning as streams, rather than replacing streams with permanent pools or ponds.

Regardless of the draw-down time, the City would still likely be responsible for stream mitigation for any portion of the channel that was filled in, even if it was relocated and reconstructed. This would likely be the case if a berm is constructed south of the pond (filling the existing stream), even if the stream is shifted and restored to a natural channel through the 'typically dry' detention pond. If the design could keep the exiting channel, and create a secondary high flow channel, stream mitigation credits may not apply. Additionally, if there is a net aquatic increase mitigation will not be required; however, the City should be aware that it is unlikely that this will be the case for the Regional Pond 3b Revised.

The Army Corp has an Iowa Worksheet/Calculator tool to estimate the amount of mitigation credits that would be required for a project. It requires knowledge of the stream and a field survey of the site to determine the stream type, priority water type, and existing functional condition. **Table 6** is an example of this tool with assumptions on the conditions of the stream (as this study did not include a field survey) used to estimate the number of credits required for filling ~1900-ft of stream channel. *Note this is just provided as an example for how to estimate the number of stream mitigation credits; it is unknown how much of the stream would need to be filled to create a berm on the southern side of the detention basin.*

Assuming a cost of $100 per credit, this estimate would add approximately $760,000 of cost to the project for stream mitigation. This value will change based on the final design, a site survey, and with feedback from Army Corp staff.

It has not been confirmed if Stream Mitigation costs would be covered by FEMA or other funding sources, and the City might be responsible for covering these costs.

Table 6: Example of the Iowa Worksheet/Calculator tool for estimating Stream Mitigation Credit requirements. *Values included here are provided as an example only and would need to be updated with field verified stream classifications and the final project design.*

Factor	Type	Score
Stream Type	C) Perennial (1st and 2nd orders)	0.60
Priority Waters	A) Tertiary	0.10
Existing Conditions	B) Moderately Functional	0.80
Impact Activity	H) Complete Loss	2.50
Sum of Factors (M)		4.00
Linear Feet of Impact (LF)	1900	
Credits Needed (C)		
Compensation Ratio	A) Primary (Bank or released credit from ILF)	1.00
Total Credits Per Reach		**7,600**
Cost if Credits are $100		***$760,000***

Once a formal design for the area is completed, it is highly recommended to communicate with the Army Corp of Engineers early, to begin Stream Mitigation discussions and permitting. If the project is smaller (less than 2-acres of wetlands impacted and less than 1000-ft of stream loss) it might be possible to apply for a Regional Permit. If the project is larger, the permitting will have to move through the Federal process and could require

National Environmental Policy Act (NEPA) permitting. Permitting and review for Stream Mitigation is typically 60-120 days. It is recommended to have all NEPA permitting applications completed prior to submitting an application to the Army Corp of Engineers.

6.1.3 FEMA BCA Toolkit Results

The existing conditions HEC-RAS model was revised to incorporate the conceptual Regional Pond 3b revised, and the resulting WSE and discharge information was estimated for each structure following the methods described in **Section 4.3.** If the pond has a lifespan of 30-years, the total benefit for the impacted structures is **$2.71M**.

The proposed pond could provide Ecosystem Services for region, as the land area is currently used as an agricultural field. Although the project site is technically within the City limits of Oelwein, much of the parcel is currently outside of the US Census designated Urban Area (see **Figure 21**). Therefore, those areas would most likely be classified as Rural Open Space or Riparian. In general, transitioning land to riparian provides a higher level of Ecosystem Services than conversion to Open Space.

To be conservative with the Ecosystem Services estimate, the project area was all assumed to be classified as Rural Open Space. Using the BCA Toolkit, converting just the pond area (~17 acres) to Rural Open Space results in an added benefit of **$2.24M** for 30-years. If the entire grading area (~46 acres) is converted to Rural Open Space, the added benefits are **$6.07M** for 30-years.

Section 6.5 compares all the cost-benefit information for the recommended alternatives and includes a summary table of calculated benefits and estimated costs.

6.2 Remove 1st Ave SW Bridge

The 1st Ave SW bridge crosses over Dry Run Creek, immediately upstream of the railroad culvert in downtown Oelwein. The Iowa Department of Transportation (DOT) has measured the Annual Average Daily Traffic count for this street to be 1,350, based on their online Iowa Traffic Data webmap accessed March 28th, 2024. The bridge restricts the channelized flow, and forces water out of the channel onto the adjacent private properties. Note that the downstream restriction (the culvert under the railroad) still exists, therefore removing the 1st Ave SW bridge will not resolve all the flooding issues in the downtown area.

The City understands that maintaining the bridge is costly, and staff have indicated that traffic patterns within the downtown area could be adjusted to account for one removed structure. Removing the bridge would remove 6 buildings from the 100-year floodplain (**Figure 15)**. **Figure 23** is a zoomed in aerial of the bridge, with approximate measurements displayed.

6.2.1 Cost Estimate

Cost estimates for removing the bridge were based on quantities and did not include a site survey. Therefore, the cost estimates could not be improved from the initial review (see **Section 5.2.7**). However, these cost estimates can still be used in the BCA toolkit to evaluate the cost benefit of the alternative.

The clear span was estimated to be 28.4-ft, with an overall length of 35-ft. The deck width was estimated to be 68-ft, with a calculated total deck area of 2,380 sq-ft. Assuming $60 per sq-ft of removal, the cost to remove the bridge would be ~$150K.

Barriers on either side of the creek are recommended on both side of the creek. Concrete barriers are a simple and rugged option; they can be used until local traffic becomes acclimated to the traffic change. At that point, the City could install a barrier with a different style if preferred. Assuming pre-cast concrete blocks in 6-ft long sections ($500 per block) and nine blocks for either side, the design would require 18 blocks, totaling an additional $10,000, conservatively.

6.2.2 FEMA BCA Toolkit Results

Removing the 1st Ave SW bridge would remove several structures from the floodplain and lower the WSE for others. The existing conditions HEC-RAS model was revised to remove the 1st Ave SW bridge, and the resulting WSE and discharge information was estimated for each structure following the methods described in **Section 4.3**. Removing the structure would be permanent, but the BCA toolkit requires a lifespan for the project to estimate the benefits. Using a project lifespan of 100-years, the total benefit for the impacted structures is **$1.125M.**

There are no Ecosystem Services associated with this alternative mitigation action unless the adjacent land with the recently demolished building is converted to riparian. This study did not assume added riparian land.

Section 6.5 compares all the cost-benefit information for the recommended alternatives and includes a summary table of calculated benefits and estimated costs.

6.3 Remove Charles St Parking over Creek

There is a parking lot over Dry Run Creek at the corner of W Charles St and 1st Ave NW. It effectively acts as a long-enclosed bridge, with open channel flow on the upstream and downstream ends. The City recently demolished the building adjacent to the parking lot (25 W Charles St) and would like to restore this portion of the channel to a more natural state.

Removing the Charles St parking lot would not remove any structures from the 100-year floodplain (**Figure 16**), and it does not lower the water surface elevations or discharge rates in the stream. The project could be expanded to include restoration of riparian habitat and potential creation of urban open space, ideally a natural plantings park for residents. Adding Ecosystem Services for riparian land and/or urban open space would provide added benefits for the project, but the project area would need to be expanded to include portions of the City *not over* the creek. The City recently demolished a building adjacent to the creek, and this location is not used by businesses for parking. It covers approximately 0.3 acres, it could be converted to urban open space for additional ecosystem services, in conjunction with this project.

Figure 24 is a zoomed in aerial of the Charles St parking lot with approximate dimensions, and a callout indicating the structure that was recently demolished and could be converted to Urban Open Space. Some of the adjacent parking lot could also be converted to Urban Open space, but this would require coordination with

local residents and business owners. Creating more urban open space, perhaps with walking trails, trees and native vegetation could provide appealing aesthetic improvements in the downtown area.

6.3.1 Cost Estimate

Cost estimates for removing the parking lot structure were based on quantities and did not include a site survey. Therefore, the cost estimates could not be improved from the initial review (see **Section 5.2.8**). However, these cost estimates can still be used in the BCA toolkit to evaluate the cost benefit of the alternative.

The clear span was estimated to be 35.25-ft, with a deck width of 200-ft. The calculated total deck area was 7,050 sq-ft. Assuming $60 per sq-ft of removal, the cost to remove the parking structure and piers would be ~$450K.

The project would require a new barrier on the north side of the creek. Concrete barriers are a simple and rugged option; they can be used until local traffic becomes acclimated to the traffic change. At that point, the City could install a barrier with a different style if preferred, potentially to match the southern side of the road. Assuming pre-cast concrete blocks are available in 6-ft long sections ($500 per block) and the project requires nine blocks total, the new barrier would add an additional $5,000, conservatively.

Additional costs would be associated with creating Urban Open Space, either in the demolished building site or in existing parking lot areas were not included in the cost estimate, as it was unknown if the City had local support for this effort. Costs would include removal of the existing concrete, site grading work, and restoration of native plant species.

6.3.2 FEMA BCA Toolkit Results

Removing the Charles St Parking Lot would not remove structures from the floodplain and does not lower the water surface elevations or discharge rates. Therefore, it does not have benefits calculated in the BCA toolkit.

There are no Ecosystem Services associated with this alternative mitigation action unless the City decides to create Urban Open space as part of this project. A cost estimate for this addition to the project was not completed, as it was unknown what areas might be converted for Ecosystem Service Benefits. However, for a reference point, converting 1 ac of land to Urban Open Space would provide an additional $222K benefit and converting the entire 2 acres of land would provide additional $444K benefit.

Section 6.5 compares all the cost-benefit information for the recommended alternatives and includes a summary table of calculated benefits and estimated costs.

6.4 Property Acquisition and Relocation of Critical Facilities

Often property acquisition is the most cost-effective alternative to eliminate flooding risk, but it also comes with consequences of changing the character of a neighborhood and requiring residents to find new housing/business options elsewhere in the City. Residents and/or business owners also need to be amenable

to property acquisition, effectively volunteering for the program. FEMA funding will support property acquisition and property demolition or structure relocation, as it would remove a structure from the floodplain permanently and would not require any long-term maintenance cost.

More information on the FEMA property acquisition process can be found at this website: https://www.fema.gov/grants/mitigation/guide/part-12/b/1

City staff have carefully reviewed those properties that are regularly flooded and are also aware of which properties have been well maintained, despite the flooding events. City staff indicated that is unlikely that commercial properties would be available for acquisition, but some residential homeowners might be interested in the program. Based on this, the City estimated property acquisition costs and demolition costs for all residential properties within the modeled 500-yr floodplain.

FEMA funding for property acquisition is based on a property appraisal (not the assessed value). FEMA has special criteria for precalculated benefits, to make property acquisition easier for communities. If the property is currently located within FEMA's effective 100-yr floodplain (Special Flood Hazard Area), or if the property is outside of the 100-yr floodplain (Special Flood Hazard Area) but has documented Repetitive Lose, Severe Repetitive Loss or if the lowest floor elevations is below the Base Flood Elevation, pre-calculated benefits may apply. **Table 7** below is reproduced from FEMA's mitigation grants online guide. Note that these values do change over time, and current FEMA documentation should be referenced prior to moving forward with a property acquisition project.

Table 7: Eligibility for Pre-Calculated Benefits Based on Structure Type and Location, reproduced from FEMA's Hazard Mitigation Assistance Program and Policy Guide, accessed online on March 28th, 2024. *Note that the threshold for Acquisition was raised to $360,000 in 2023.*

Structure Location	Eligible Use Criteria
Acquisitions Within Special Flood Hazard Areas	
Single-Unit Residential Structure	The cost of the acquisition is less than or equal to $360,000.
Multi-Unit Residential Structure	The cost of the acquisition is less than or equal to $360,000 multiplied by the number of ground- or first-floor units.
Non-Residential Structure	The cost of the acquisition is less than or equal to $360,000, and the structure must be occupiable.
Acquisitions Outside Special Flood Hazard Areas	
Single-Unit Residential Structure Designated Repetitive Loss, Severe Repetitive Loss, or with the Lowest Floor Elevation below the Base Flood Elevation	The cost of the acquisition is less than or equal to $360,000.
Multi-Unit Residential Structure Designated Repetitive Loss, Severe Repetitive Loss, or with the Lowest Floor Elevation below the Base Flood Elevation	The cost of the acquisition is less than or equal to $360,000 multiplied by the number of ground- or first-floor units.
Non-Residential Structure Designated Repetitive Loss, Severe Repetitive Loss, or with the Lowest Floor Elevation below the Base Flood Elevation	The cost of the acquisition is less than or equal to $360,000, and the structure must be occupiable.

If the precalculated benefits do not apply, or the home is appraised for a higher value than the pre-calculated benefit, the BCA toolkit can be used with the appraised value for the home and the existing conditions WSE and discharge values. For Oelwein's residential properties within the FEMA Special Flood Hazard Area, the precalculated benefits would likely be used.

The Oelwein Fire Department is located within the FEMA Special Flood Hazard Area. The building itself is impacted by flooding, and the adjacent streets are also inundated, impacting the ability of fire responders to reach residents. If a large regional solution resolution (e.g. Regional Pond 3b Revised) is not implemented, it is recommended that this facility be relocated outside of the FEMA Special Flood Hazard Area. There are grant funding opportunities that support relocation of critical facilities available (see **Chapter 7**).

6.4.1 Cost Estimate

Estimating costs for property acquisition is challenging, as it is dependent on the property owner agreeing to participate within the program. However, to provide guidance to the City, this study prepared a series of maps indicating which properties are impacted by each modeled storm event (10-yr, 50-yr, 100-yr and 500-yr). Those

impacted by the smaller storm events could be considered first for acquisition. **Figure 20** is a composite of these maps, indicating which properties are touched by the inundation extents from each modeled event.

Properties that are currently mapped within the FEMA effective 100-yr floodplain (Special Flood Hazard Area) would quality for the pre-calculated benefit of $360,000 for single family homes (see **Table 7**) and this might make the acquisition process easier. *Note that FEMA's Special Flood Hazard Area is different from the modeling completed for this study (see **Chapter 3**).*

A cost estimate for relocating the Fire Department was not completed as part of this study but it would include a site placement study, property acquisition, construction of the new Fire Department, and potentially demolition of the old building. If a regional solution is not implemented to reduce flooding in the downtown area, it is recommended to pursue funding to move the Fire Department to flood resistant location.

There are 52 residential properties, 26 non-residential properties, and 1 Critical Facility within the FEMA Special Flood Hazard Area. **Figure 25** shows the current mapped FEMA floodplain showing the impacted properties.

The City has also been contacted by the Department of Homeland Security about a FEMA funding opportunity called 'Swift Current'. This is intended to expedite property acquisition for structures that are identified as Repetitive Loss (RL) and Severe Repetitive Loss (SRL) and the funding applications are reviewed at the state level, rather than at the federal level. Eight (8) properties were identified by the National Flood Insurance Program (NFIP) to be Repetitive Loss and are shown in **Figure 26**.

6.4.2 FEMA BCA Toolkit Results

The City indicated that residential properties would be more likely to participate in an acquisition program, therefore the FEMA BCA Toolkit was completed for just those properties within the FEMA Special Flood Hazard Area, and the pre-calculated benefit was applied for each property. The City's reviewed acquisition costs for all 52 of the residential homes within the Special Flood Hazard Area were less than $360,000 (ranging from $14K – $238K per property). Using the BCA toolkit, and assuming all the residential properties within the Special Flood Hazard Area are acquired, the calculated benefit is **$18.72M** ($360K x 52 properties).

6.5 Cost-Benefit Comparison of Alternatives

Selecting a mitigation alternative is dependent on the City's flood resiliency goals, costs, and public support for the project. To better facilitate conversations about the recommended alternatives**, Table 8** lists the BCA toolkit benefits and estimated costs for each alternative. All are dependent on the estimated project lifetime, and two values were selected: 30-yrs and 100-yrs. The FEMA BCA toolkit recommends 30-years for detention basins (but this can be increased with documentation supporting that the project will function beyond this time) and the default for structure removal is 100-years.

Note that the benefits for each project cannot be simply added together, as some of the benefits are the same across projects. Therefore, a new BCA toolkit needs to be run for any combination of alternatives. The costs, however, can be considered stand-alone and can be added together.

Table 8: Benefits and Costs associated withrecommended flood mitigation alternatives. Benefits were calculated using the FEMA BCA Toolkit (as described in Chapter 4) and costs were based on concepts only. *This table includes benefits and costs for the regional detention basin using a 30-yr lifespan. Mitigation alternatives that remove structures were only reviewed for the 100-yr lifespan.*

Alternative	**Regional Pond 3b Revised**		**Remove 1st Ave SW Bridge**			**Remove Charles St Parking over Creek**			**Residential Property Acquisition within FEMA Special Flood Hazard Area (52 Structures @ 360K)**	
Assumed Project Lifespan	*30-yr*		*100-yr*			*100-yr*			*100-yr*	
Structure/Social Benefit*	$2.710 M		$1.125 M			$0.000 M			$18.720 M	
Ecosystem Service	17 ac, Rural Open Space	46 ac, Rural Open Space	*None. Unless the project creates urban open space*			*None. Unless the project creates urban open space*			*None. Unless the project creates urban open space*	
Ecosystem Services Benefit*	$2.243 M	$6.069 M								
Total Benefits*	**$4.953 M**	**$8.779 M**	**$1.125 M**			**$0.000 M**			**$18.720 M**	
One-Time Cost Description**	Construction Costs (see Table 5)	Property Acquisition, Hauling Costs, Permitting, Stream Mitigation Fee	Bridge Removal	Guard Rail	Contingency (20%)	Parking Lot Removal	Guard Rail	Contingency (20%)	Property Acquisition (based on tax assessment)	Demolition (15K per Structure)
Individual One Time Cost	$3.845 M	Unknown	$0.150 M	$10,000	$32,000	$0.450 M	$5,000	$91,000	$3.178 M	$0.780 M
Total One Time Cost	$3.845M + Unknown Costs		$0.192 M			$0.546 M			$3.958 M	
Maintenance Costs***	$0.255 M		*none*			*none*			*none*	
Total Cost	**$4.100 M + Unknown Costs**		**$0.192 M**			**$0.546 M**			**$3.958 M**	

**Calculated using BCA Toolkit and methods outlined in Chapter 4 and 7% Discount Rate*

***Based on concept only. Costs would need to be updated upon completion of a formal design.*

****Assumes a dam inspection every 10-yrs ($10K), mowed annually ($5K), and undergo one large maintenance repair every 25-years ($75K). Inflation is not accounted for in this calculation*

6.6 Project Recommendations

This study recommends the City consider **(1)** construction of the Regional Pond 3b Revised or **(2)** a combination of the other three alternatives: Removing the 1st Ave SW Bridge, Removing the Charles St Parking Lot, and/or Property Acquisition and possible relocation of the Fire Department. The cost-benefit ratios for the Regional Pond 3b Revised, Removing the 1st Ave SW bridge and Property Acquisition are favorable (greater than 1.0). Removing the Charles St Parking Lot would require a larger project scope, likely converting land to Urban Open Space to received Ecosystem Services Benefits to have a favorable cost-benefit ratio. Additional notes about each alternative are listed below.

- **The Regional Pond 3b Revised** alternative provides the most benefit to the downstream structures. However, it also includes some costs that might not be eligible for funding, such as property acquisition, permitting costs, and stream mitigation costs. This would have to be reviewed carefully, as the rules for funding will vary by program. Any stream mitigation costs will be dependent on the final design of the pond. The current landowner would also have to agree to sell the property to the City at an agreed upon price. In addition, there are regular maintenance costs for maintaining the new facility, including regular mowing and/or burning of native vegetation in the new rural open space, dam inspections, and potentially large infrequent costs for repairs to the earthen dam. This mitigation effort would provide more benefit that the other alternatives, and therefore it is not recommended to be combined with other mitigation alternatives, save for property acquisition of any properties that remain within the floodplain post-construction.

- **Removing the 1st Ave SW Bridge** would be a long-term solution that could be entirely eligible for funding. This improvement could be coupled with the Charles St Parking Lot removal, select property acquisition, and possible relocation of the Oelwein Fire Department.

- **Removing the Charles St Parking Lot** would not remove any structures from the modeled 100-yr floodplain. However, this improvement is still recommended because the City does not feel this parking lot is necessary to serve the downtown and the City anticipates a future need to conduct major repairs to the structure. Because removing this structure does not lower the flood elevations or discharge rates within Dry Run Creek it is not awarded any benefits per the BCA toolkit. However, if the City decided to implement this improvement in tandem with work that restores the creek and surrounding lands to a more natural state (e.g. creating urban open space) the project could have ecosystem service benefits.

- **Property Acquisition** is likely to be the most easily funded alternative, particularly for those properties that have been classified as Repetitive Loss locations (see **Figure 26**). This alternative would require residents to participate in the program, and the City has indicated that non-residential properties would not be as likely to participate in the program.

It is recommended that the City review the alternatives, gather public feedback, and then consider funding opportunities that would support engineering design and implementation.

7 Funding Opportunities & Next Steps

Oelwein has experienced consistent flooding and past studies (see **Section 1.4**) have recommended flood mitigation measures to remove homes and businesses from the floodplain. However, mitigation projects are often costly to implement and often require outside funding agencies' support through grants and cost-sharing agreements. They also require public acceptance, particularly if it requires property acquisition or affects the neighborhood aesthetics of the City.

The alternatives included in **Chapter 6** vary in cost and scale. It is recommended that the City staff present this information to public officials and at public meetings prior to moving onto the next phase of implementation.

7.1 Possible Funding Opportunities

The Justice40 Initiative is a federal government-wide goal that aims to bring resources to communities most impacted by climate change, pollution, and environmental hazards. The initiative establishes that 40 percent of the overall benefits of certain Federal investments flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution. This means that communities that qualify as disadvantaged have priority for federal and state funding, technical assistance, and other opportunities that fall under Justice40 investment categories.

The City of Oelwein is designated as a disadvantaged community due to its comparatively large low-income population which reaches the 75th percentile. This designation identifies the significant need of the community and greatly improves the City's likelihood of receiving funds from federal programs. In addition, with community support demonstrated in the recently updated Comprehensive Plan, the City has a competitive advantage when applying for state and local grants as well.

7.1.1 FEMA's Hazard Mitigation Grants

7.1.1.1 Building Resilient Infrastructure and Communities (BRIC)

The Building Resilient Infrastructure and Communities (BRIC) initiative aids states, local communities, tribes, and territories in implementing hazard mitigation projects to diminish their vulnerability to disasters and natural hazards. BRIC operates based on key principles, including fostering community resilience through skill and capacity development, fostering innovation, fostering partnerships, facilitating major infrastructure initiatives, maintaining adaptability, and ensuring continuity.

The cost share for the BRIC program is 75% federal and 25% non-federal. It will be important to identify the 25% non-federal match when developing an application.

Iowa Homeland Security and Emergency Management (HSEMD) administers FEMA programs for the state of Iowa. A notice of interest may be submitted at any time to EMGrants, but it is better to alert HSEMD to potential projects as soon as possible. Applications are typically due to early to mid-January. HSEMD reviews

applications and determines which projects are recommended to FEMA in the State's sub-application by mid-February. FEMA's review follows that submission.

BRIC could be a target funding source for Regional Pond 3b, Removal of 1st Ave. SW Bridge, Removal of Charles St. Parking over Creek, and/or Relocation of Critical Facilities

https://homelandsecurity.iowa.gov/grants-overview/grants/

7.1.1.2 Flood Mitigation Assistance (FMA) Grant

The Flood Mitigation Assistance (FMA) grant program operates on a competitive basis, offering financial support to states, federally recognized Tribal governments, U.S. territories, and local governments. Since the enactment of the National Flood Insurance Reform Act of 1994, these funds have been allocated for initiatives aimed at minimizing or eradicating the threat of recurrent flood-related damage to structures covered by the National Flood Insurance Program.

Recipients of FEMA's assistance are selected through a rigorous evaluation process, considering the project's prioritization, eligibility, and its cost-effectiveness.

FMA could be a target funding source for Property Acquisition.

The Cost share for FMA varies based on project type. For Individual Flood Mitigation Projects federal share options:

- Up to 100% federal cost share funding for FMA defined Severe Repetitive Loss (SRL) (B)(i) or (B)(ii) properties in 42 U.S.C. §4104c(h)(3). Or,
- Up to 90% federal cost share funding for FMA defined Repetitive Loss (RL) properties in 42 U.S.C. § 4121(a)(7). Or,
- Up to 90% federal cost share funding for each NFIP-insured property located within a census tract with a CDC SVI score is not less than 0.5001, and the activity must be funded by the BIL. FEMA will determine the CDC SVI score using the following three SVI themes: Socioeconomic Status, Household Characteristics, and Housing Type and Transportation. Or,
- Up to 75% federal cost share funding if a higher federal cost share is not available.

Application timing mirrors the BRIC program (see **Section 7.1.1.1**).

7.1.1.3 Safeguarding Tomorrow Revolving Loan Fund (STRLF)

Congress passed the Safeguarding Tomorrow through Ongoing Risk Mitigation Act, better known as the STORM Act, in 2021. This act enables FEMA to provide capitalization grants for state revolving loan funds that would be used to finance local natural hazard mitigation projects and activities at low interest (<1%). This would be very similar to the existing revolving loan funds in Iowa managed by the Department of Natural Resources and known as the Clean Water SRF and the Drinking Water SRF.

In 2022, FEMA developed guidance for this program (known as the Safeguarding Tomorrow Revolving Loan Fund, or STRLF), and began piloting the program with relatively small grants to a handful of states. Iowa did not (and does not yet) have the enabling legislation that would allow the state to operate the revolving loan program. However, FEMA's capitalization grant application period is currently open and would provide funding to begin the program over the next two years as of the publishing of this study.

Importantly, the funds may be combined with other FEMA grant programs and used as local matching funds (thus allowing a local government to pay off their local cost share over a period of 20 to 30 years).

Loans up to $5M may be available, but total project cost could exceed that amount.

This could be a targeted funding source to match any BRIC or FMA applications.

7.1.1.4 Flood Mitigation Assistance Swift Current (Swift Current)

The Flood Mitigation Assistance Swift Current (Swift Current) effort provides funding to mitigate buildings insured through the National Flood Insurance Program (NFIP) after a major disaster declaration following a flood-related disaster event to reduce risk against future flood damage.

Swift Current funds Individual Flood Mitigation Projects for Flood Mitigation Assistance and/or NFIP-defined Repetitive Loss (RL), Severe Repetitive Loss (SRL), or properties deemed Substantially Damaged after the applicant's disaster declaration incident period start date.

Eligible Individual Flood Mitigation Projects include the following project types which may be referenced in the Hazard Mitigation Assistance Program and Policy Guide:

- Property acquisition and structure demolition/relocation
- Structure elevations
- Dry floodproofing of historic residential structures or non-residential structures
- Non-structural retrofitting of existing structures and facilities
- Mitigation reconstruction
- Structural retrofitting of existing structures

7.1.2 Environmental Protection Agency (EPA)

7.1.2.1 Community Change Grant

EPA's new Environmental and Climate Justice Community Change Grants program (Community Change Grants) funds environmental and climate justice activities to benefit disadvantaged communities through projects that reduce pollution, increase community climate resilience, and build community capacity to address environmental and climate justice challenges. These place-based investments will be focused on community-driven initiatives to be responsive to community and stakeholder input.

This program is unique in that it will fund a wide-variety of activities that may enhance flood mitigation efforts including development of park and open space, vegetative barriers, stream stabilization, and redevelopment of brownfields.

https://www.epa.gov/inflation-reduction-act/inflation-reduction-act-community-change-grants-program

7.1.3 Iowa Department of Natural Resources (IDNR)

7.1.3.1 Resource Enhancement and Protection (REAP)

REAP funds are derived from gaming revenues and are appropriated by the Iowa Legislature and signed into law by the Governor. A portion of those funds are allocated to City Parks and Open Space projects. Parkland expansion and multi-purpose recreation developments are typical projects funded under this REAP program.

City Park and Open Space grant applications are due annually on August 15th.

https://www.iowadnr.gov/Conservation/REAP/REAP-Funding-at-Work/City-Parks-Open-Spaces

7.1.3.2 State Revolving Fund (SRF)

The General Nonpoint Source program offers communities affordable financing for a variety of nonpoint source water quality projects.

This may be a target source if water quality elements are incorporated into a project such as stream stabilization or bioretention cells. Note that the Proposed Pond 3b design will not have a permanent water pool, and therefore will not likely provide water quality benefits.

https://www.iowasrf.com/general-non-point-source/

7.2 Next Steps

The City can review the alternatives presented in **Chapter 6**, and identify the preferred alternative(s) based on the cost-benefit analysis, availability of funding, long-term maintenance costs, resident feedback, and local support. Next steps would include seeking funding for PE and Design services for the selected alternative(s); note that some funding sources are inclusive of design services and construction. These funding opportunities

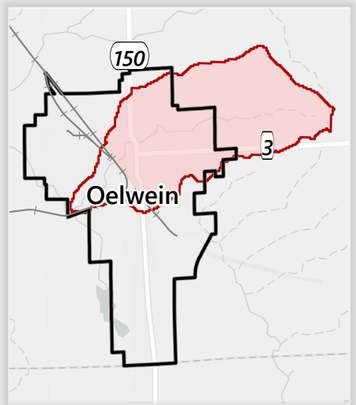
might be considered first. The City has been in communication with the Department of Homeland Security throughout the course of this study and is an excellent resource if the City moves into an implementation phase for any of the recommended alternatives.

Study Area

Figure 1
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA

- Oelwein
- Study Area
- Focus Area
- Railroad
- Intermittent Stream/River
- Perennial Stream/River; Artificial Path



Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Aerial: Iowa State
Railroads: US Census (2023)
Watersheds: USGS StreamStats
Inset Map Basemap: Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS

MSA

0 0.13 0.25 Miles

N

FEMA Flood Hazard Area

Figure 2
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA

- Oelwein
- Study Area
- Railroad
- Intermittent Stream/River
- Perennial Stream/River; Artificial Path

FEMA Flood Zone Designations

- 1% Annual Chance of Flooding
- Regulatory Floodway
- 0.2% Annual Chance of Flooding

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Railroads: US Census (2023)
Flood Hazard Area: FEMA (2021/05/17)
Basemap: Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

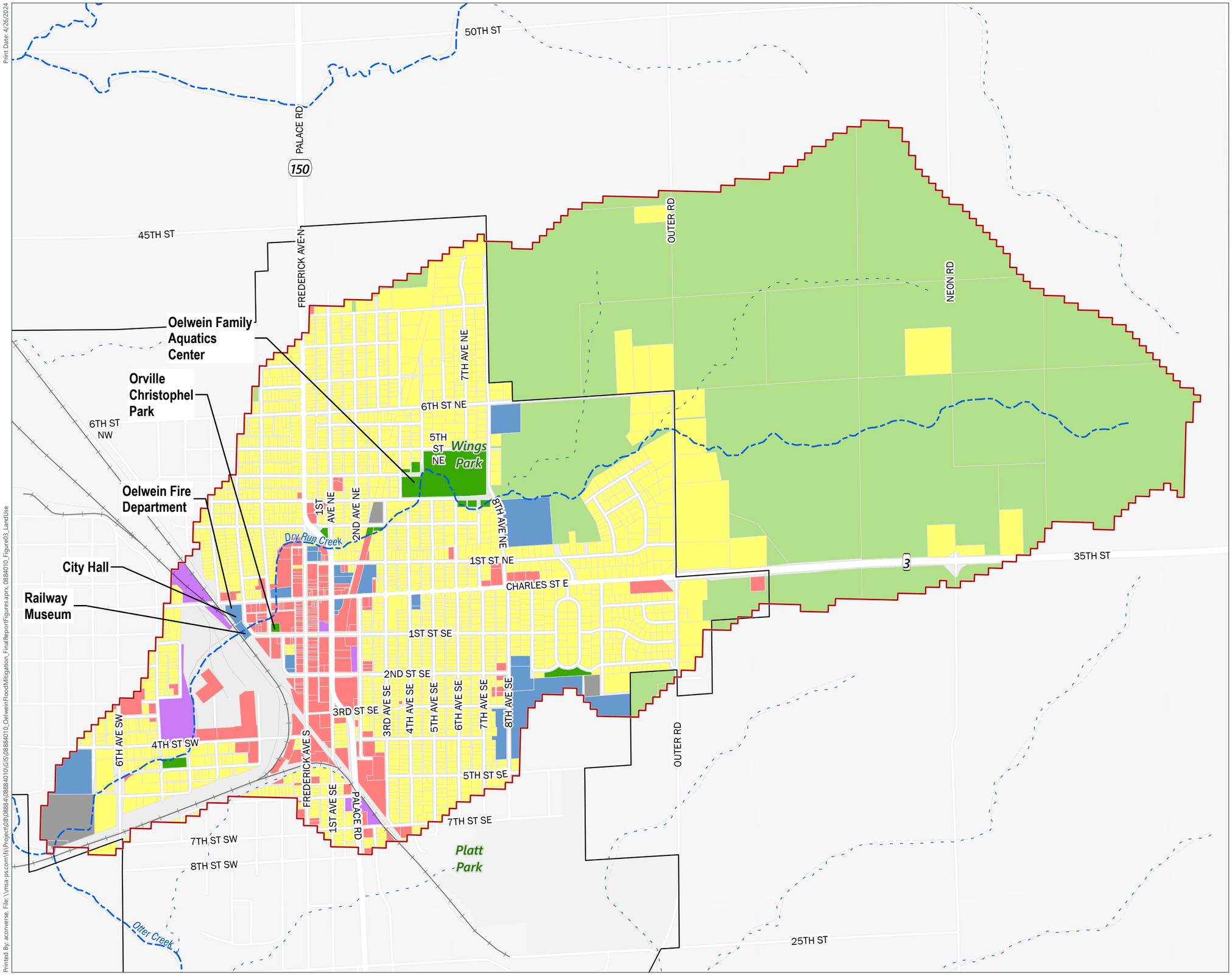
0 0.07 0.15 Miles

N

Land Use

Figure 3
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Study Area
- Railroad
- Intermittent Stream/River
- Perennial Stream/River; Artificial Path

Existing Land Use

- Agricultural Production
- Commercial
- Industrial
- Institutional
- Parks and Open Space
- Residential
- Utility

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Railroads: US Census (2023)
Land Use: Oelwein Comprehensive Plan
Basemap: Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

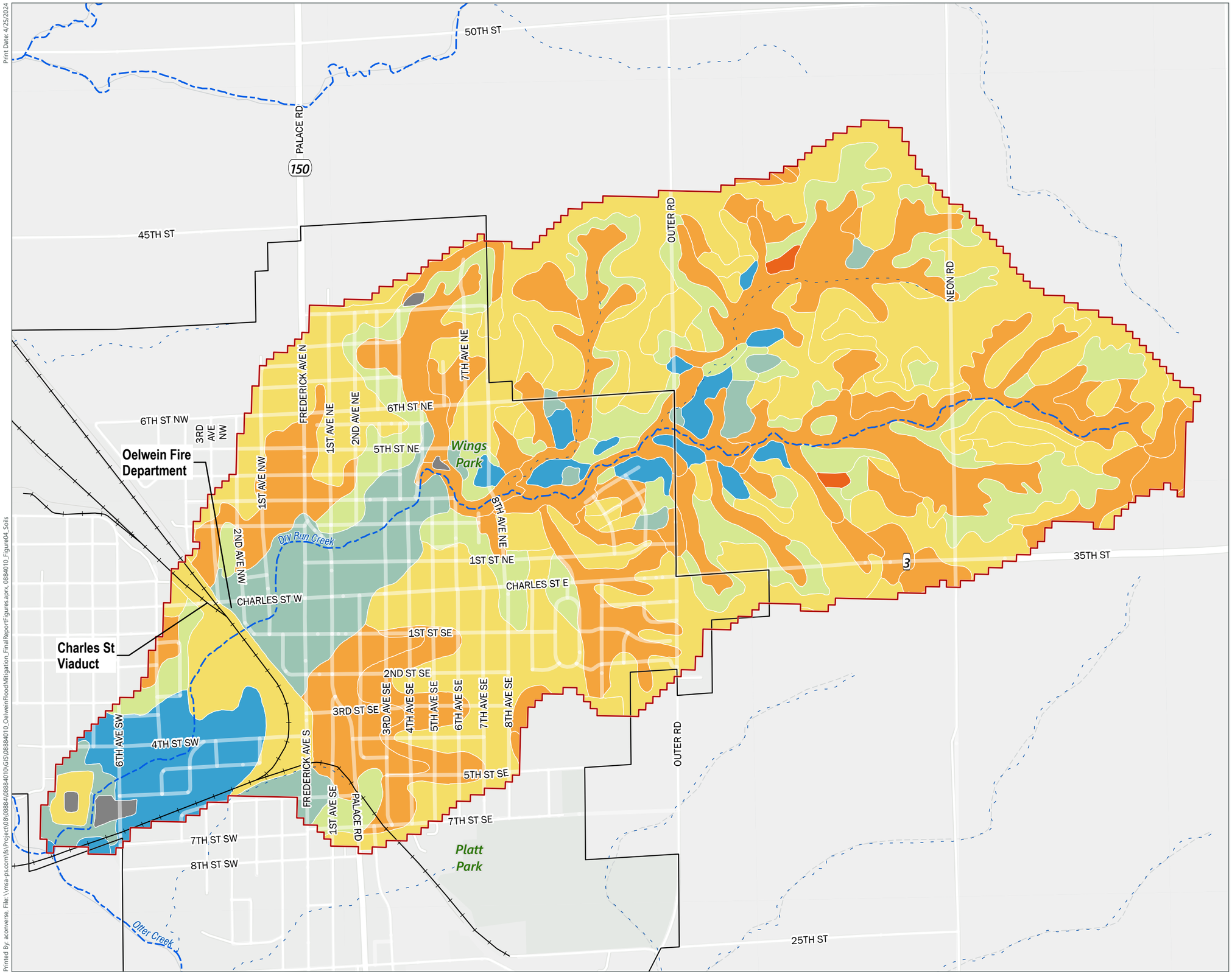
0 0.07 0.15 Miles

N

Soils

Figure 4
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Study Area
- Railroad
- Intermittent Stream/River
- Perennial Stream/River; Artificial Path

Hydrologic Soil Group

- A
- B
- B/D
- C
- C/D
- D
- NA

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Railroads: US Census (2023)
Soils: USDA NRCS (SSURGO)
Basemap: Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

0 0.07 0.15 Miles

Topography

Item 1.

Figure 5
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA

- Oelwein
- Study Area
- Railroad
- Intermittent Stream/River
- Perennial Stream/River; Artificial Path
- 10-ft Contour

Elevation (ft)

1190.52

997.277

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Railroads: US Census (2023)
LiDAR: Iowa State, DEM Download (2019)

MSA

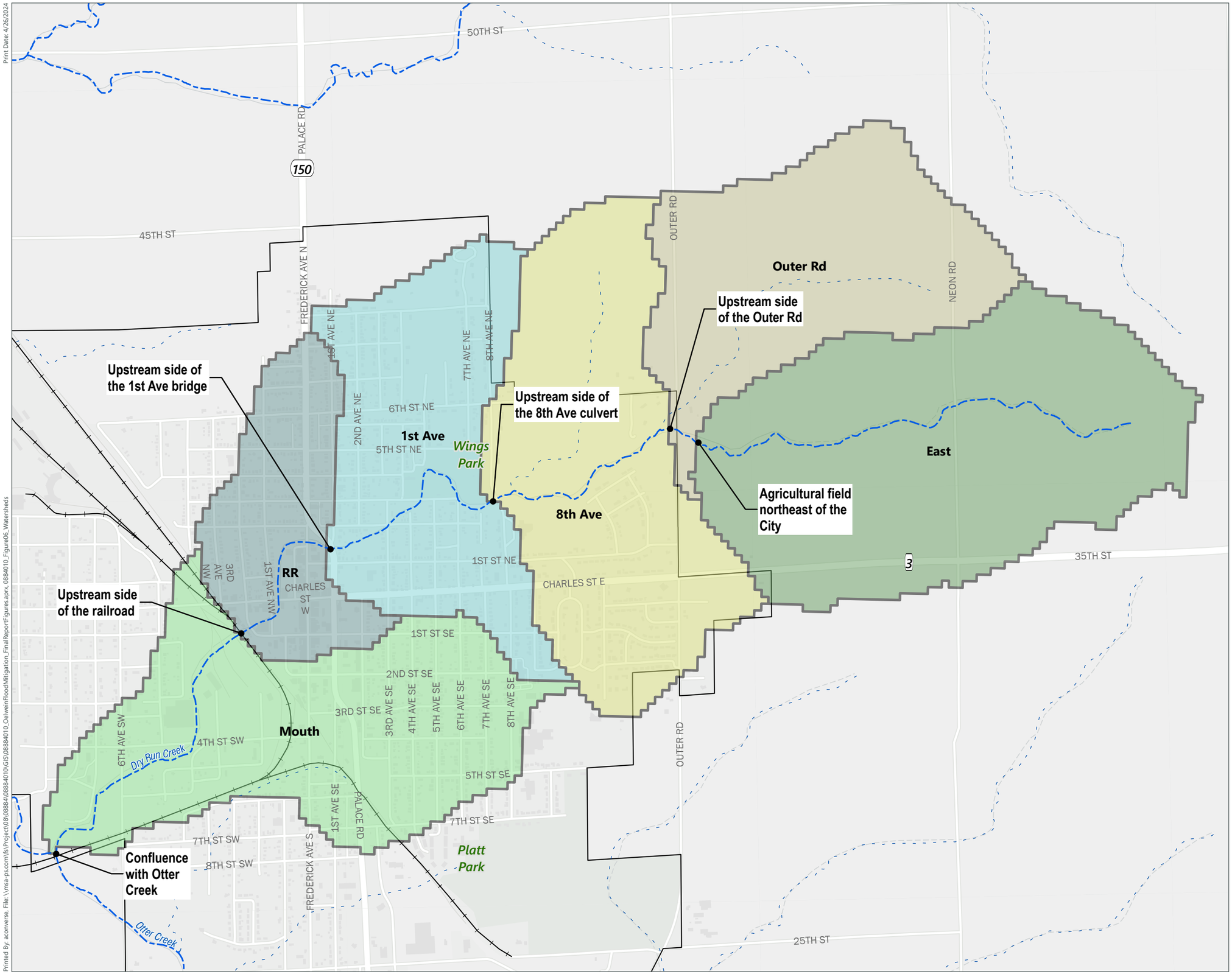
0 0.07 0.15 Miles

N

Watersheds

Figure 6
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Railroad
- Intermittent Stream/River
- Perennial Stream/River; Artificial Path

Watersheds

- 1st Ave
- 8th Ave
- East
- Mouth
- Outer Rd
- RR

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Railroads: US Census (2023)
Watersheds: L-THIA Watersheds, Purdue University for Great Lakes Watersheds
Basemap: Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

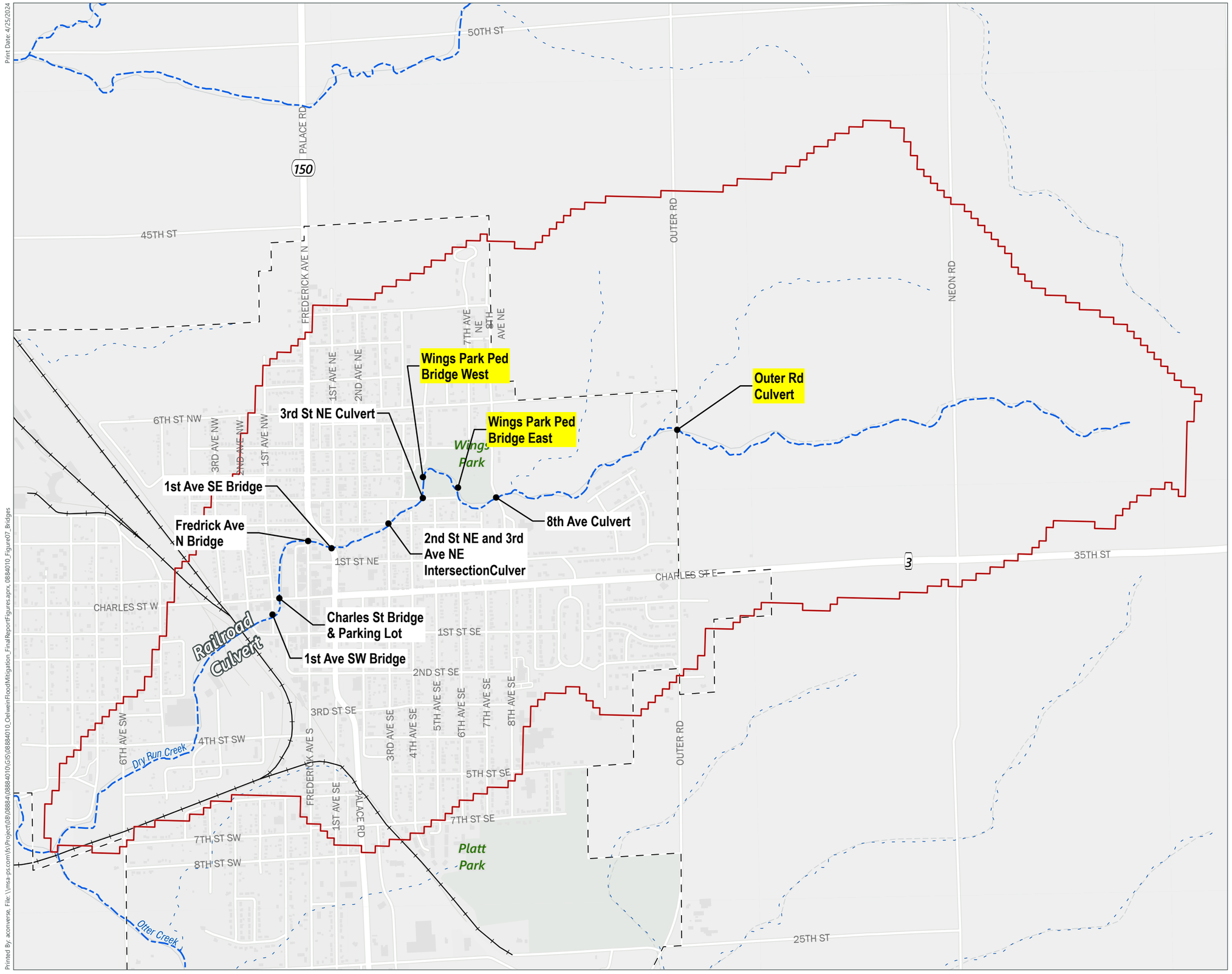
0 0.07 0.15 Miles

N

Bridges & Culv
Upstream of the Railroad

Figure 7
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Study Area
- Railroad
- Intermittent Stream/River
- Perennial Stream/River; Artificial Path

- **Bridge/Culvert Overtops in 10-yr Event**
- **Bridge/Culvert Overtops in 50-yr Event**

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Railroads: US Census (2023)
Watersheds: USGS StreamStats
Basemap: Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

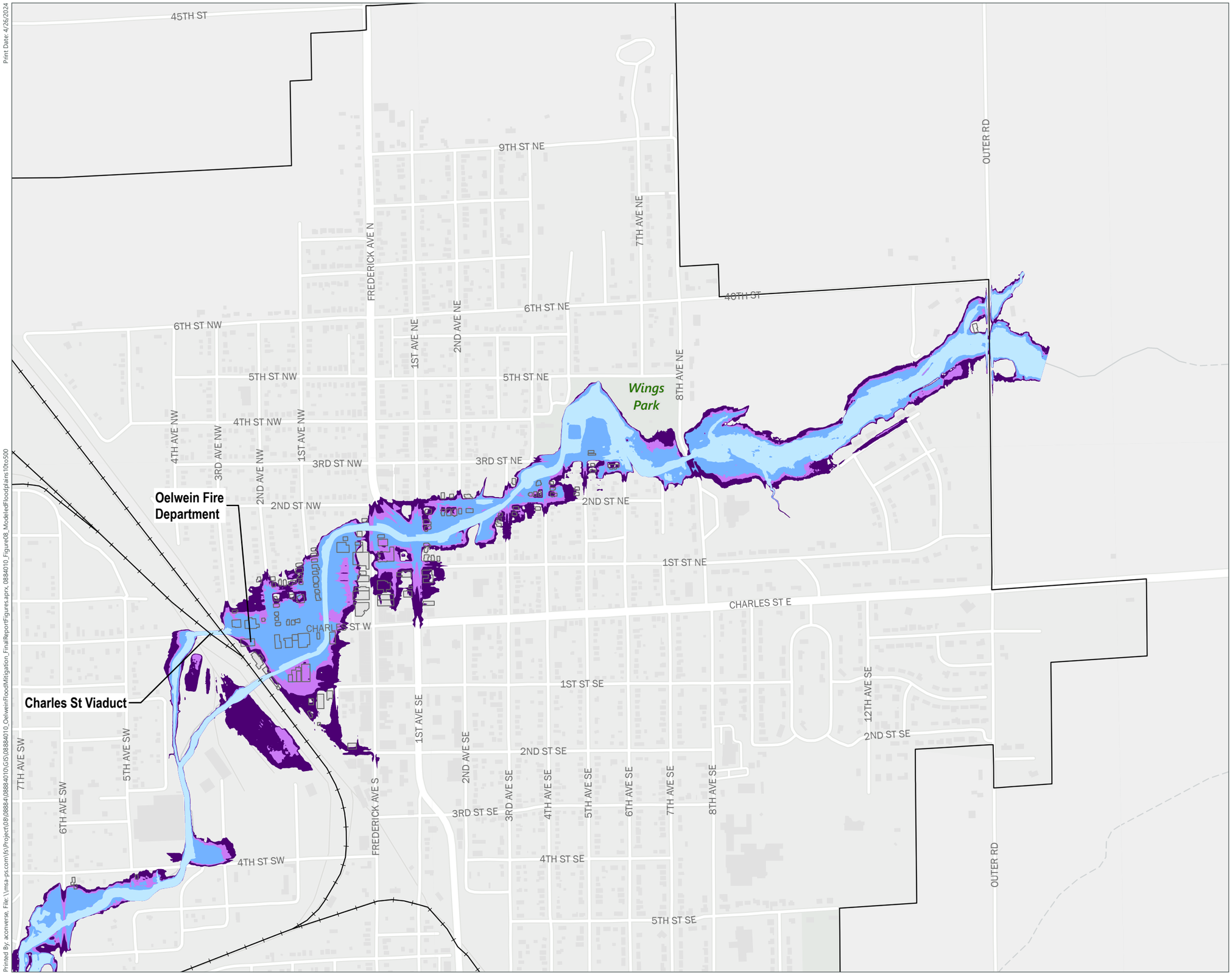
0 0.07 0.15 Miles

N

Modeled Floodplains

Figure 8
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Railroad
- Building within the 500-yr Floodplain
- Existing 10-yr Floodplain
- Existing 50-yr Floodplain
- Existing 100-yr Floodplain
- Existing 500-yr Floodplain

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Railroads: US Census (2023)
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

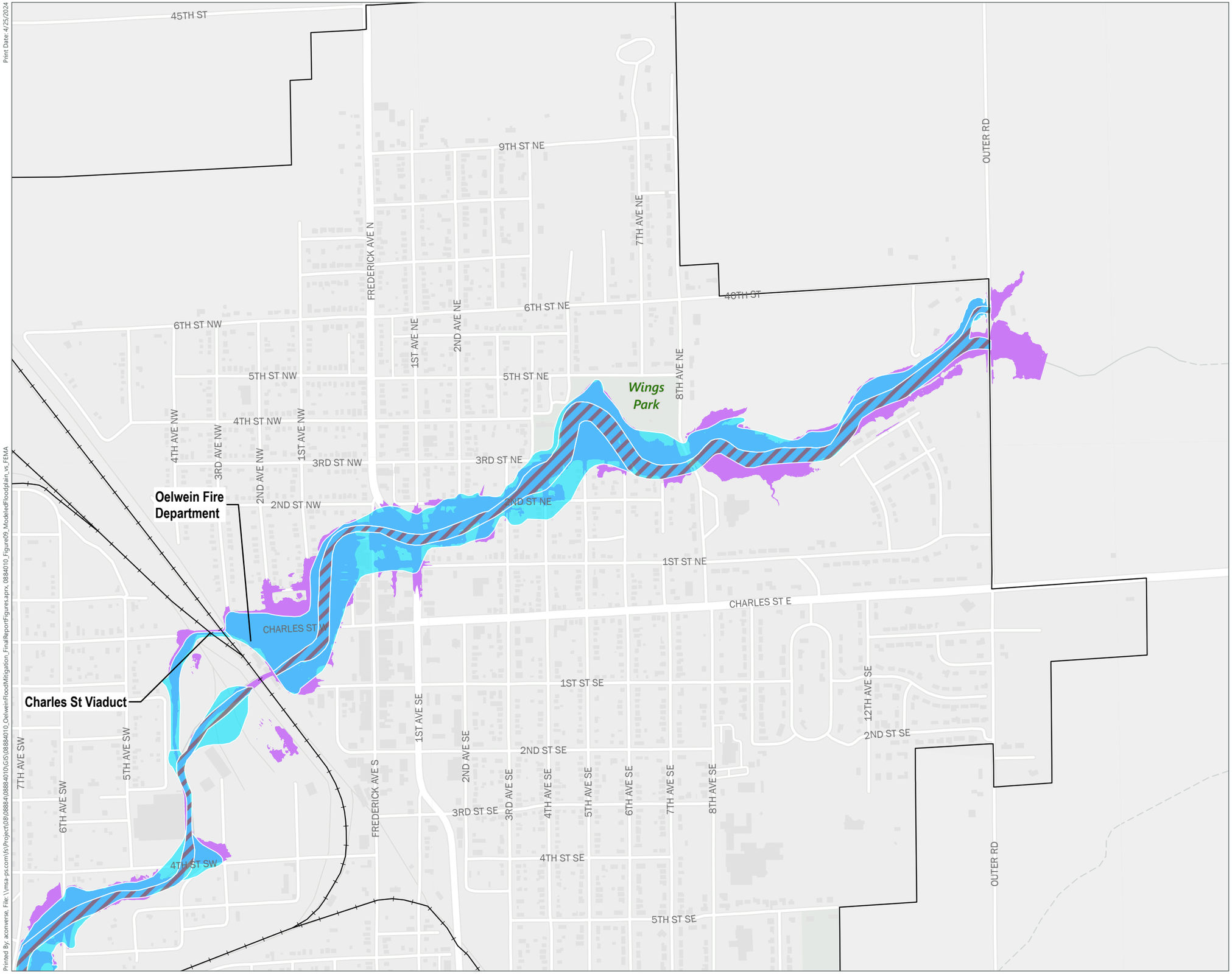
0 0.07 0.15 Miles

N

1% Annual Cha Floodplain Modeled vs. FEMA

Figure 9
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Railroad
- Modeled Existing 100-yr Floodplain

FEMA Flood Zone Designations

- 1% Annual Chance of Flooding
- Regulatory Floodway

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Railroads: US Census (2023)
Floodplain Extents: MSA and FEMA (2021/05/17)
Basemap: Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

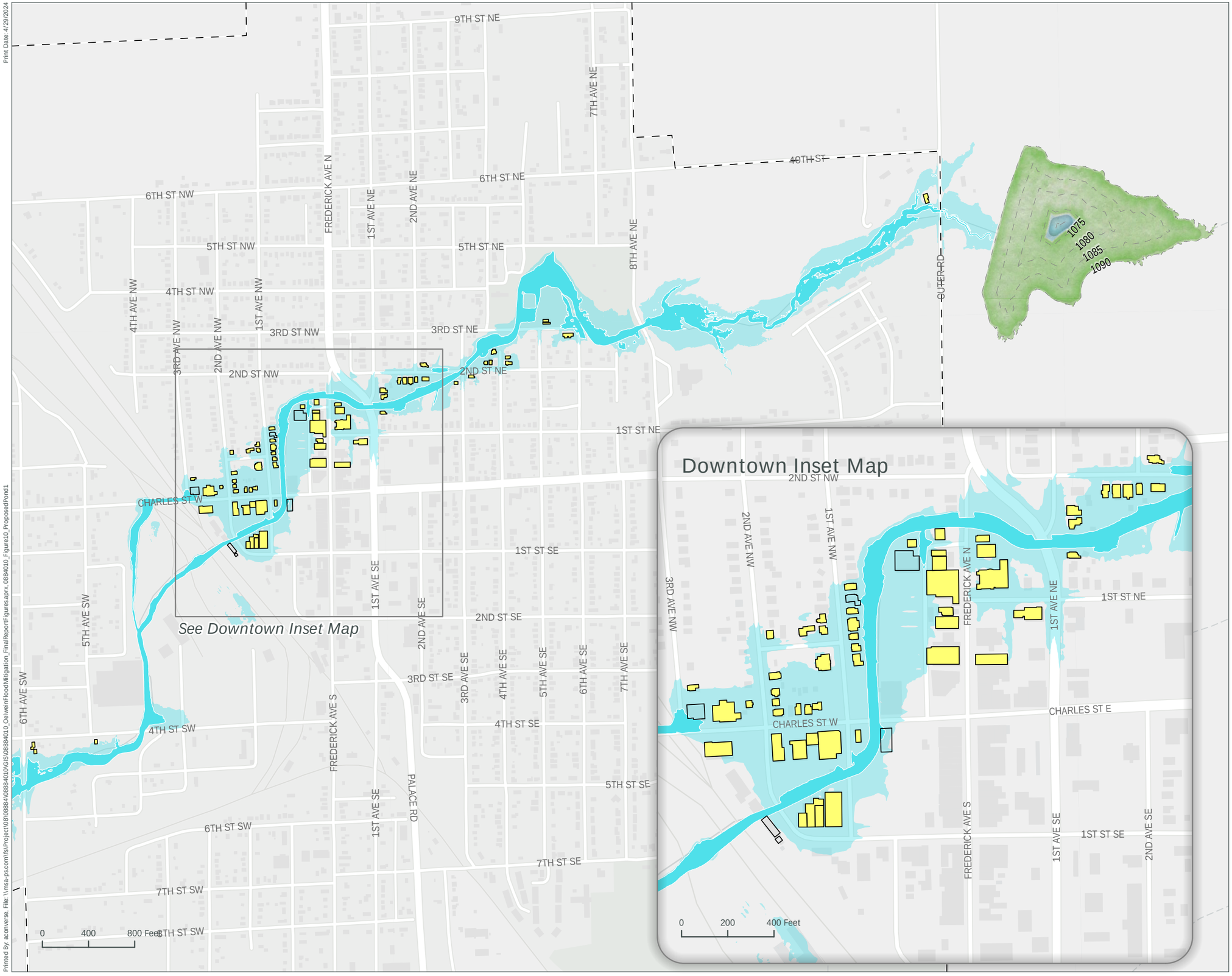
0 0.07 0.15 Miles

N

Proposed Pond 1 Floodplain

Figure 10
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Existing 100-yr Floodplain
- With Pond 1, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (64)

Proposed Pond 1

- Riparian
- Permanent Wet Pool
- Proposed Pond Contours

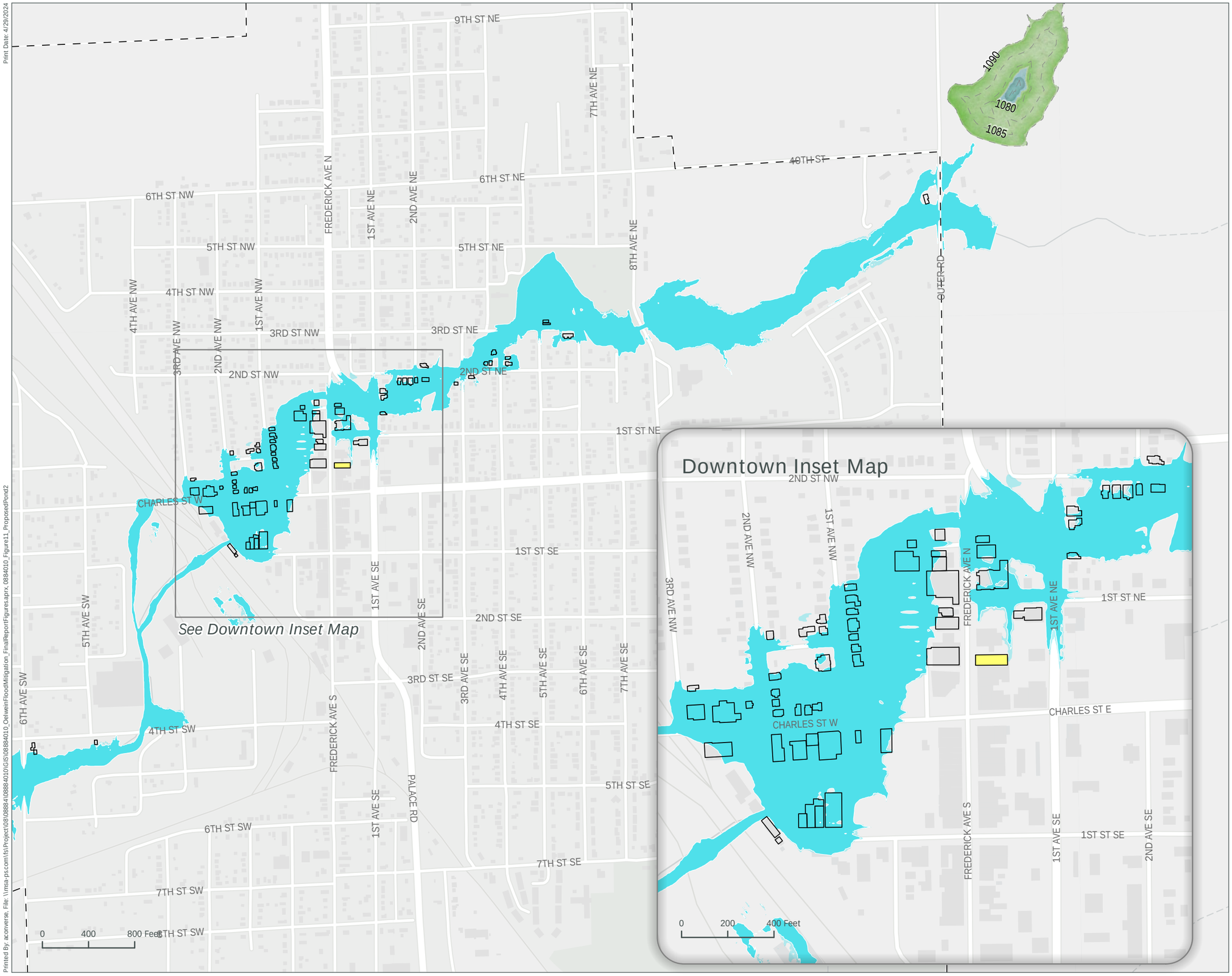
Note that Pond 1 would be classified as a Dam.

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Proposed Pond 2 Floodplain

Figure 11
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Existing 100-yr Floodplain
- With Pond 2, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (1)

Proposed Pond 2

- Riparian
- Permanent Wet Pool
- Proposed Pond Contours

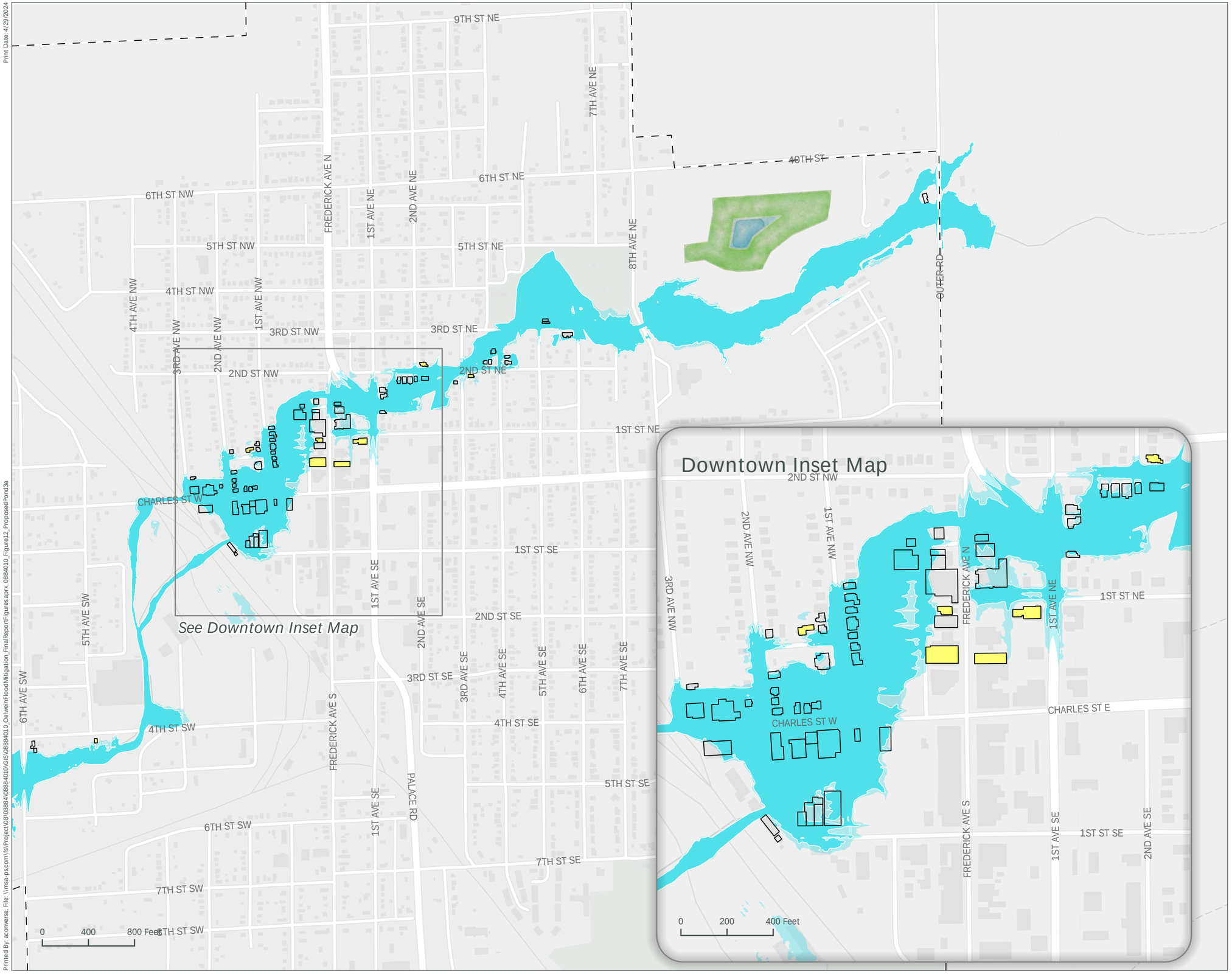
Note that Pond 2 would be classified as a Dam.

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Proposed Pond Floodplain

Figure 12
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Existing 100-yr Floodplain
- With Pond 3a, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (8)

Proposed Pond 3a

- Riparian
- Permanent Wet Pool

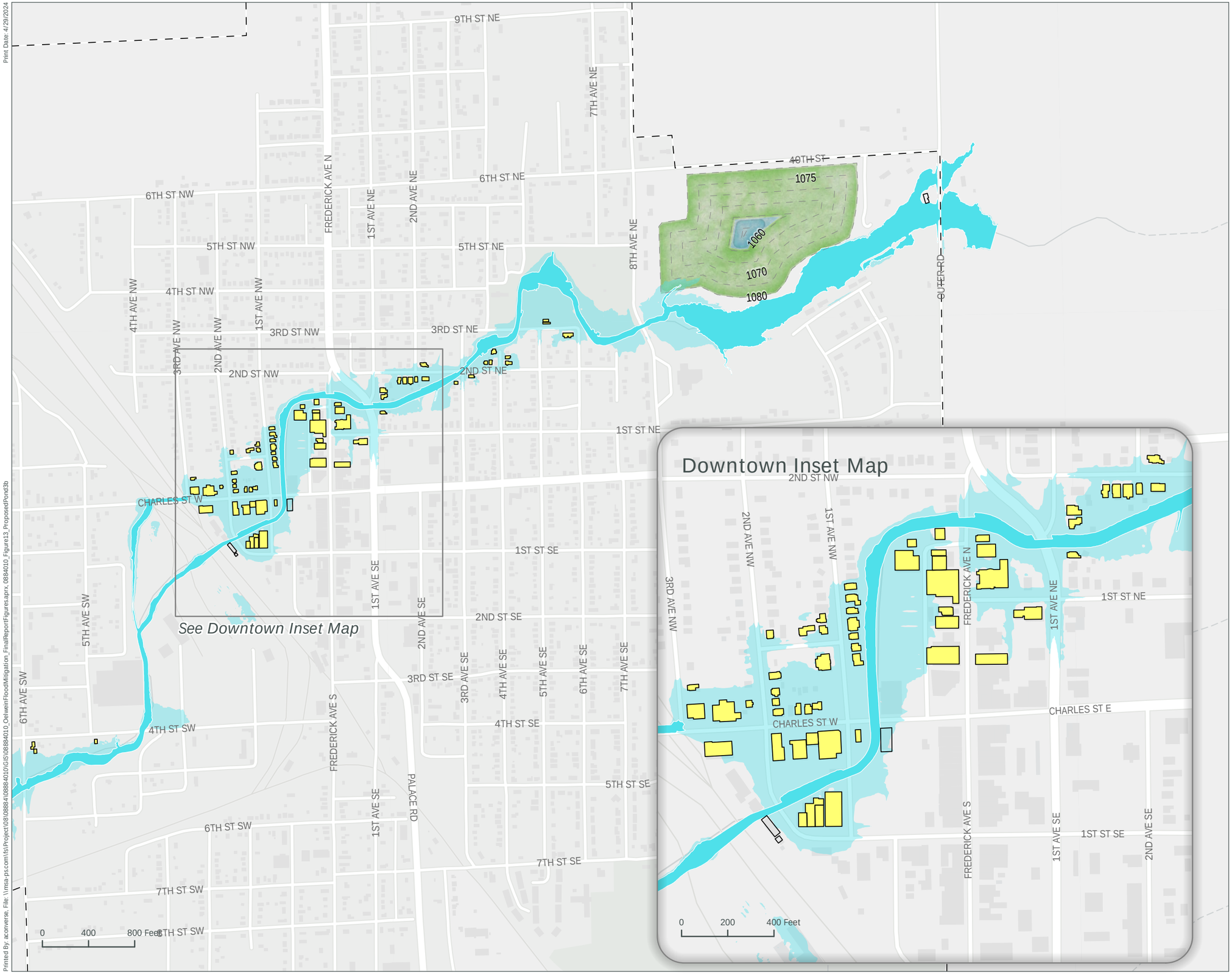
In this alternative, Pond 3a is not constructed as a Dam.

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Proposed Pond Floodplain

Figure 13
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Existing 100-yr Floodplain
- With Pond 3b as a Dam, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (66)

Proposed Pond 3

- Riparian
- Permanent Wet Pool
- Proposed Pond Contours

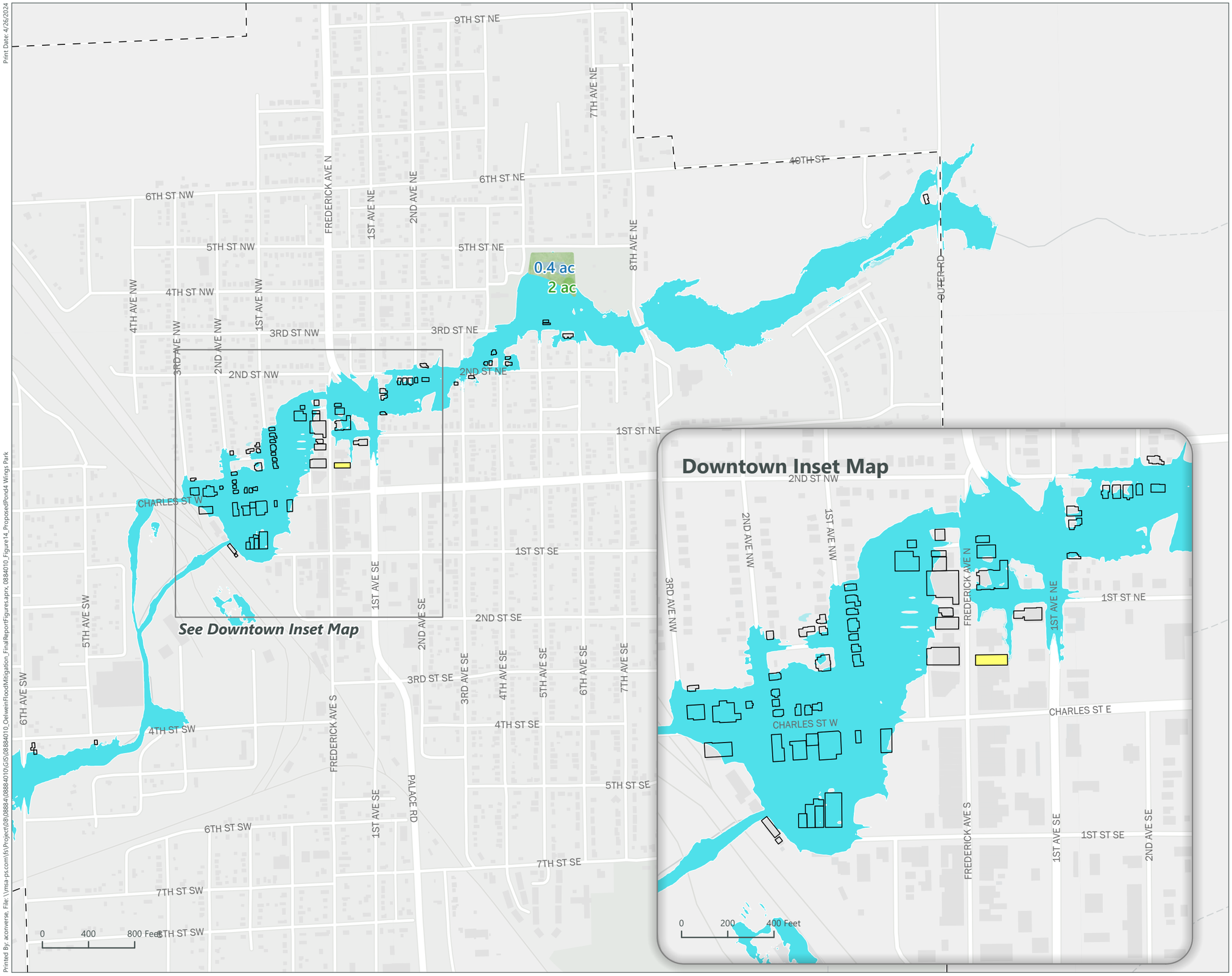
In this alternative, Pond 3b would be classified as a Dam.

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Proposed Pond 4 Wings Park Floodplain

Figure 14
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Existing 100-yr Floodplain
- With Pond 4, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (1)

Proposed Pond 4

- Riparian
- Permanent Wet Pool

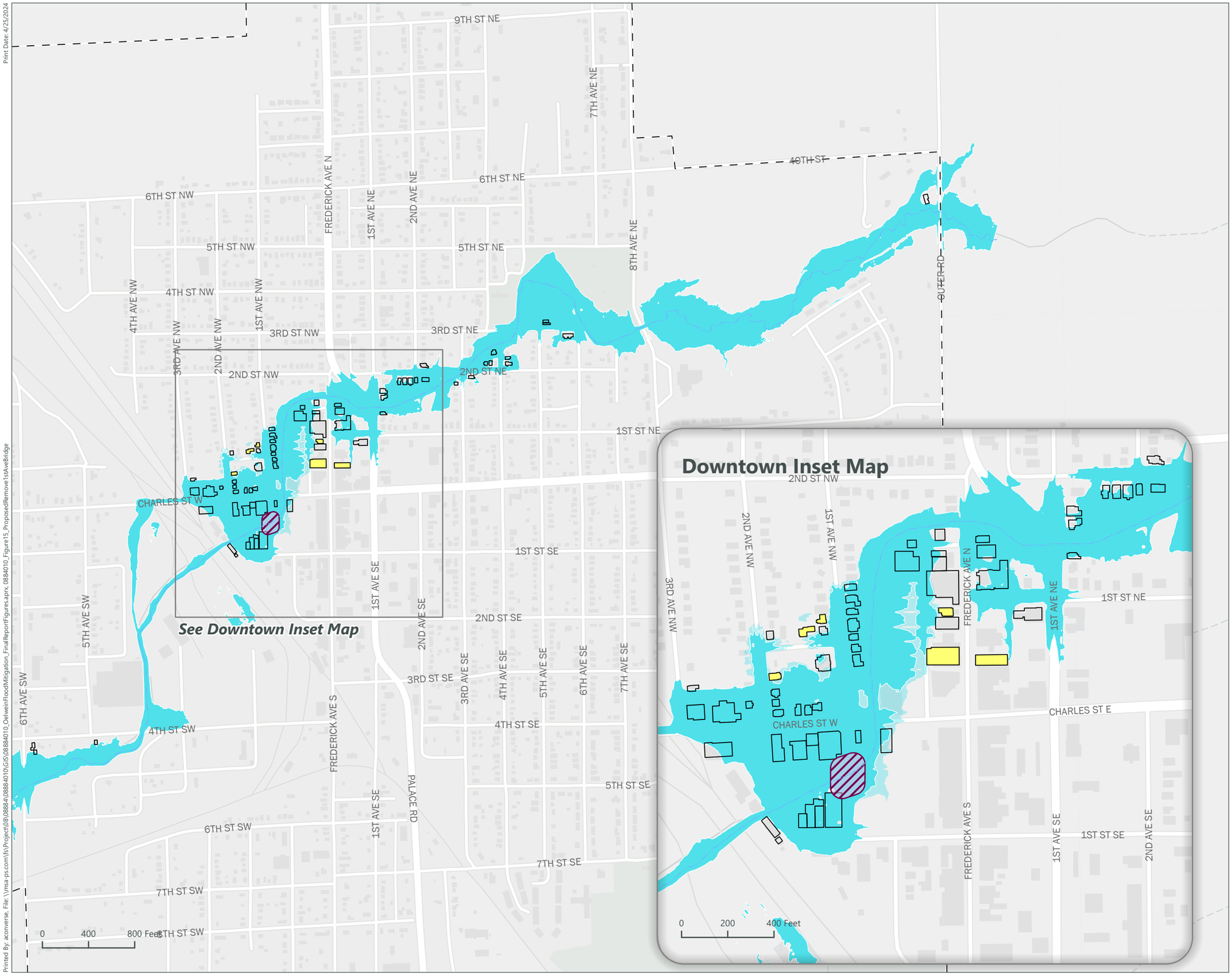
In this alternative, Pond 4 is not constructed as a Dam.

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Proposed Remo 1st Ave SW Bridge Floodplain

Figure 15
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Existing 100-yr Floodplain
- Remove 1st Ave NW Bridge, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (6)
- Remove 1st Ave SW Bridge
- Stream

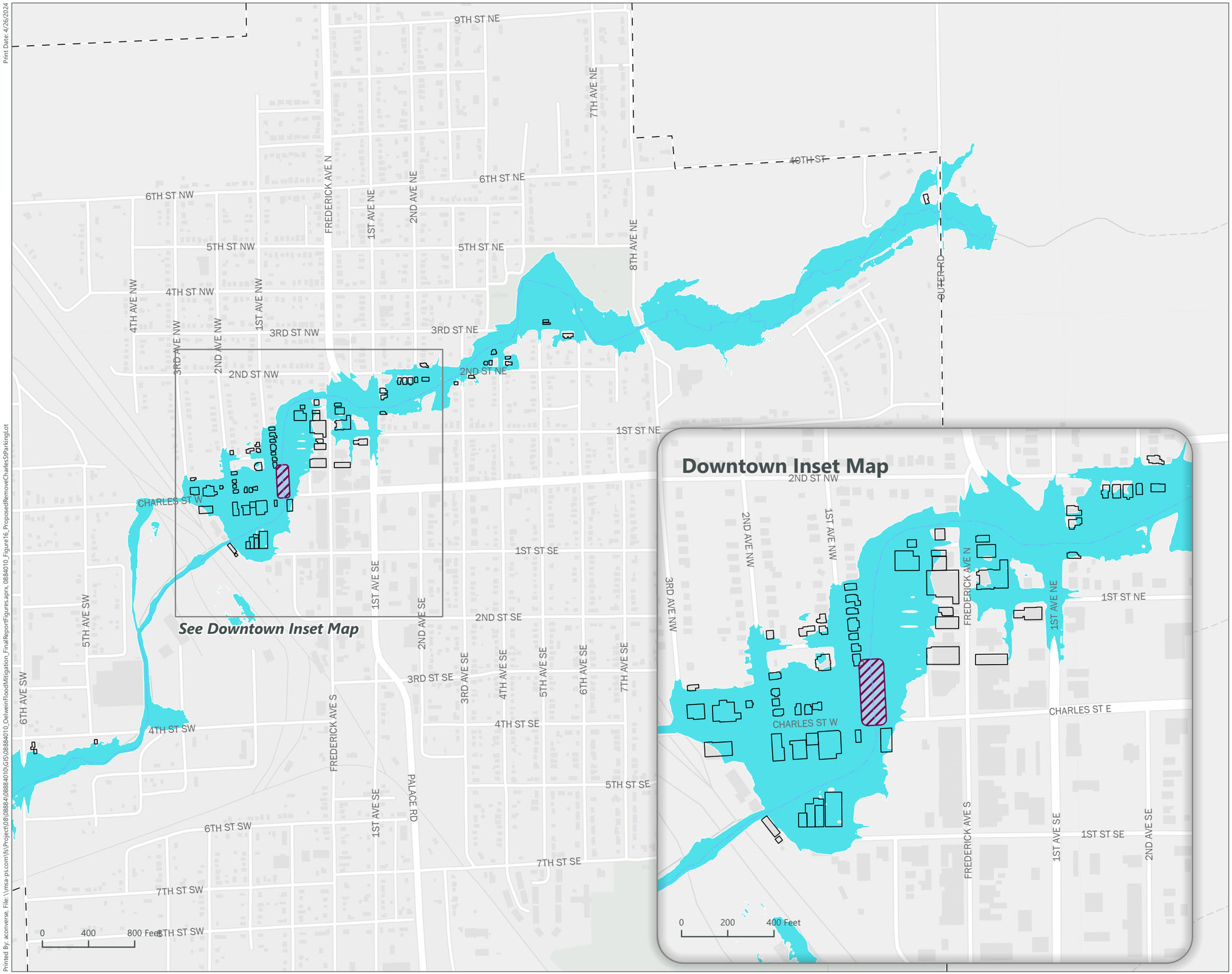
Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

Proposed Remo Charles St Parking Floodplain

Figure 16
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



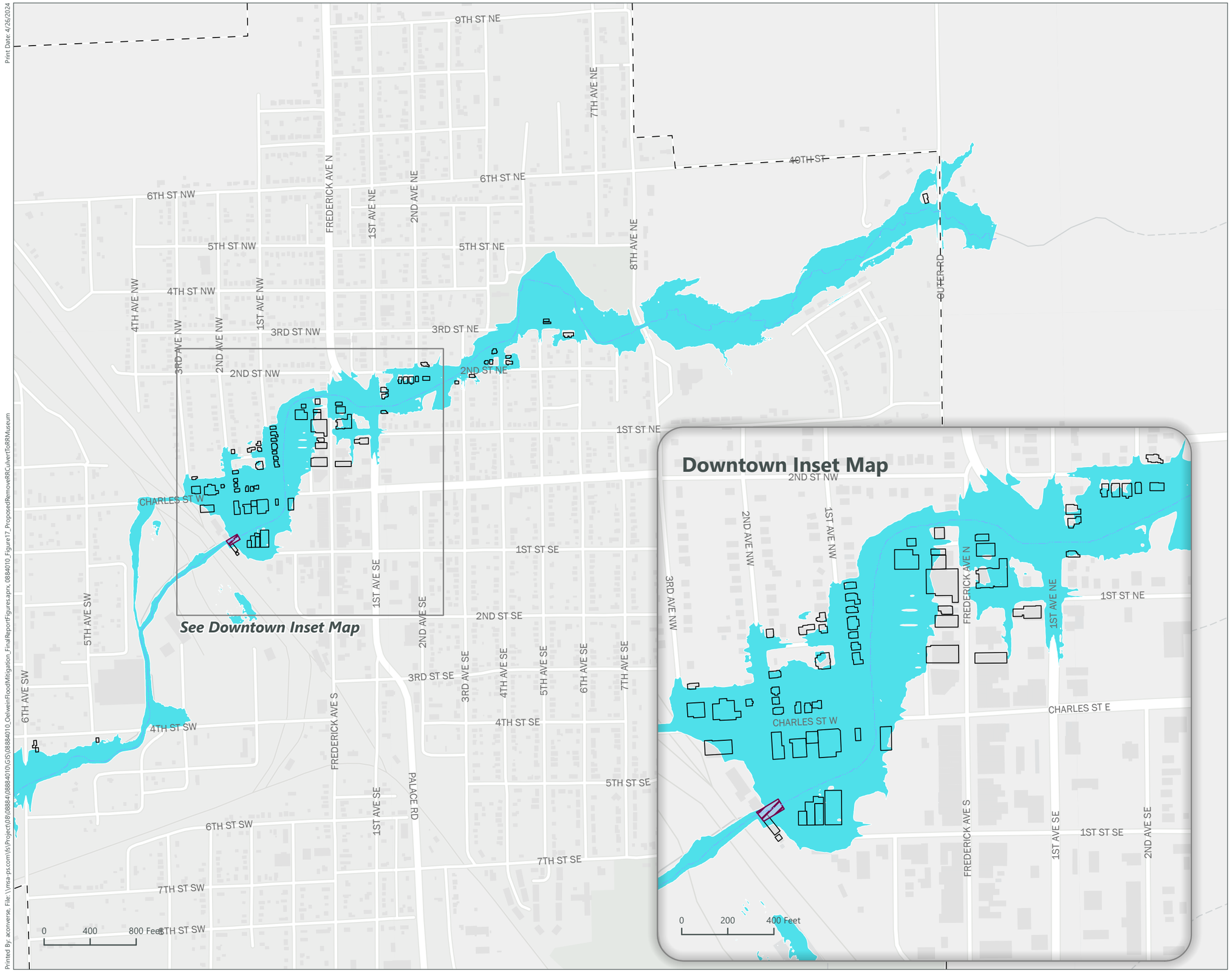
- Oelwein
- Existing 100-yr Floodplain
- Remove Charles St Parking Lot, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (0)
- Remove Charles St Parking Lot
- Stream

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Remove RR Culv from 2nd Ave SW to RR Museum

Figure 17
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Existing 100-yr Floodplain
- Remove portion of RR Culvert, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (0)
- Upsize RR Culvert
- Stream

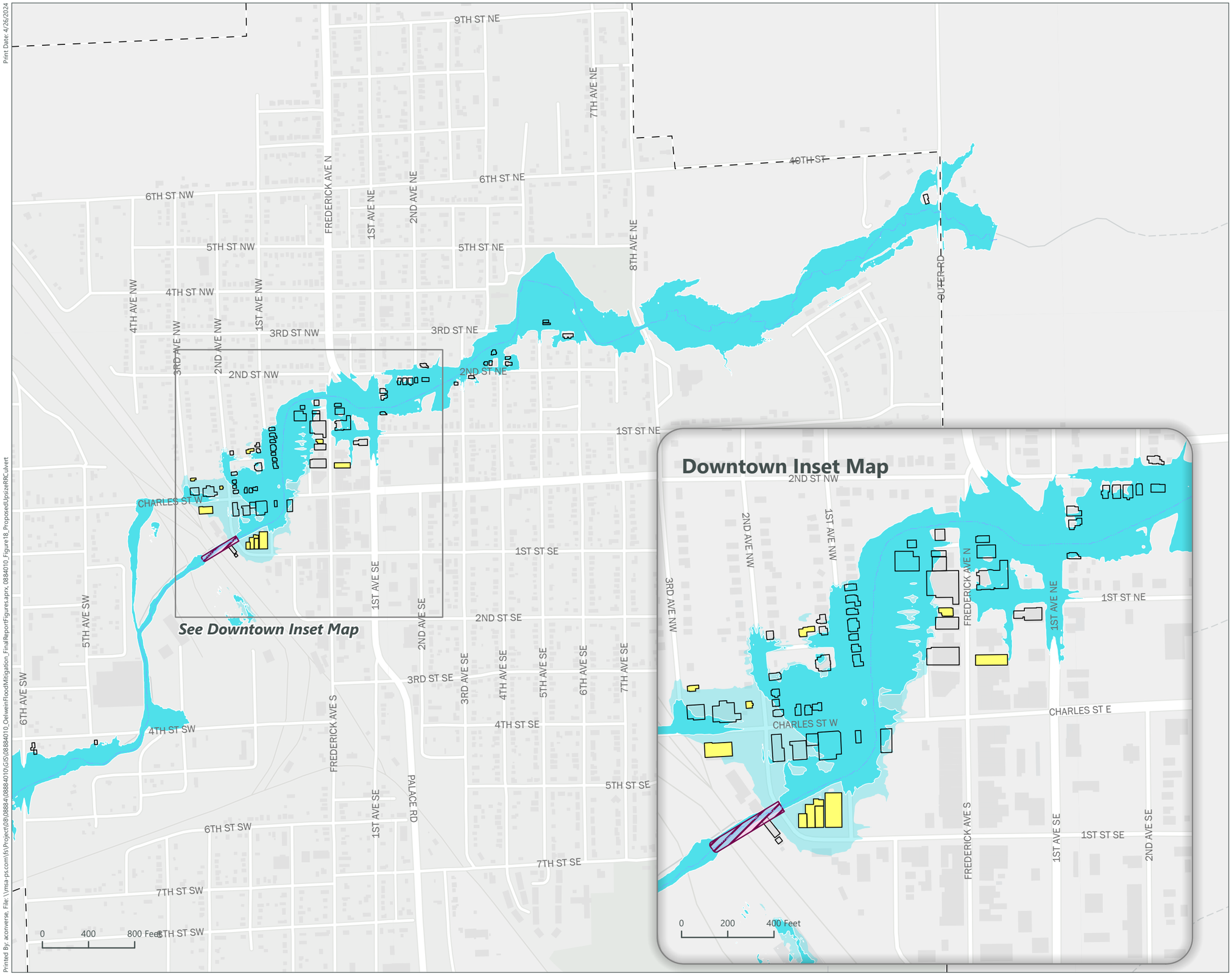
Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

Proposed Upsize RR Culvert Floodplain

Figure 18
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



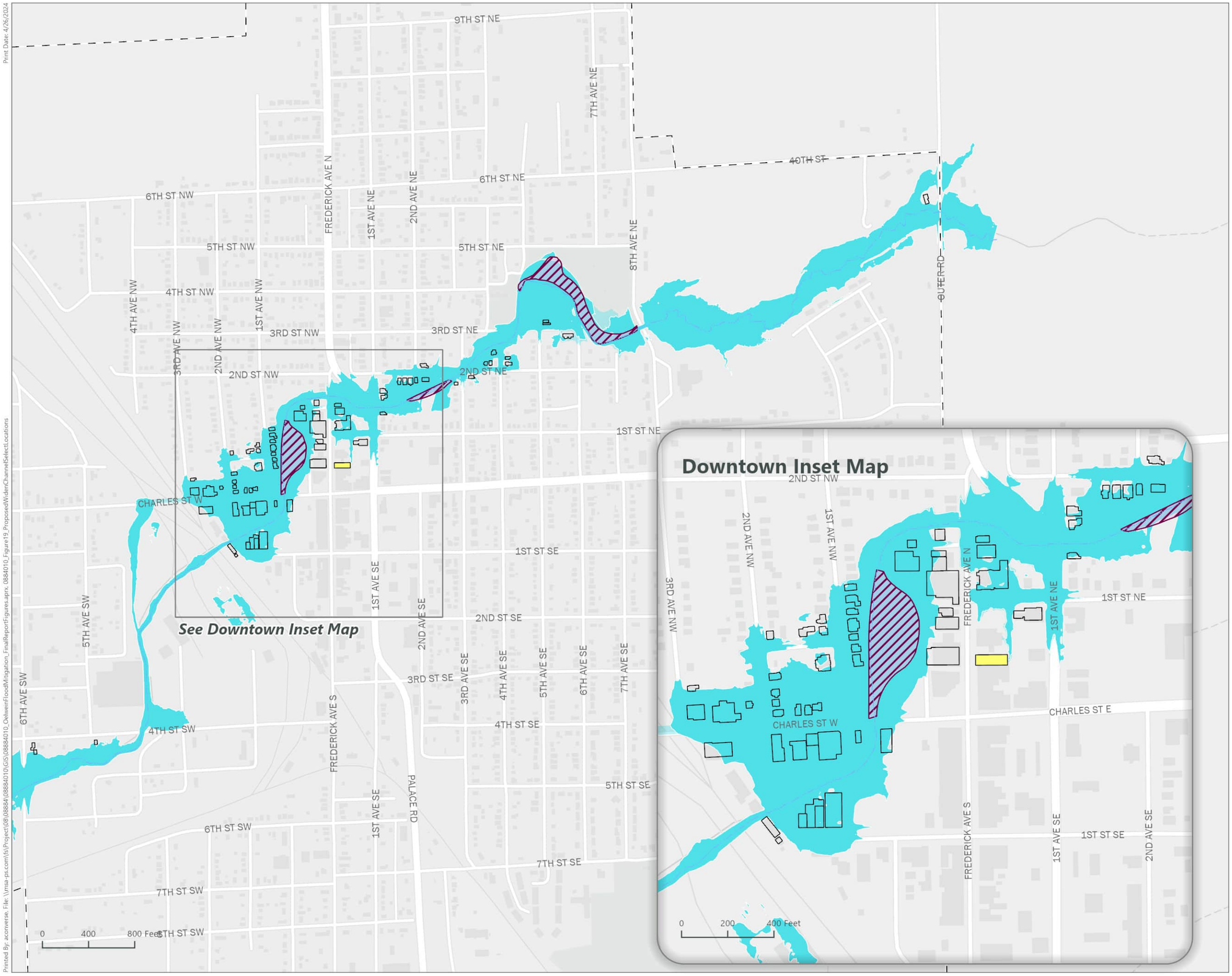
- Oelwein
- Existing 100-yr Floodplain
- Upsize RR Culvert, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (10)
- Upsize RR Culvert
- Stream

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Proposed Wid Stream Channel Floodplain

Figure 19
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Existing 100-yr Floodplain
- Widen Stream Channel, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (1)
- Building Add to 100-yr Floodplain (0)
- Widen Stream Channel
- Stream

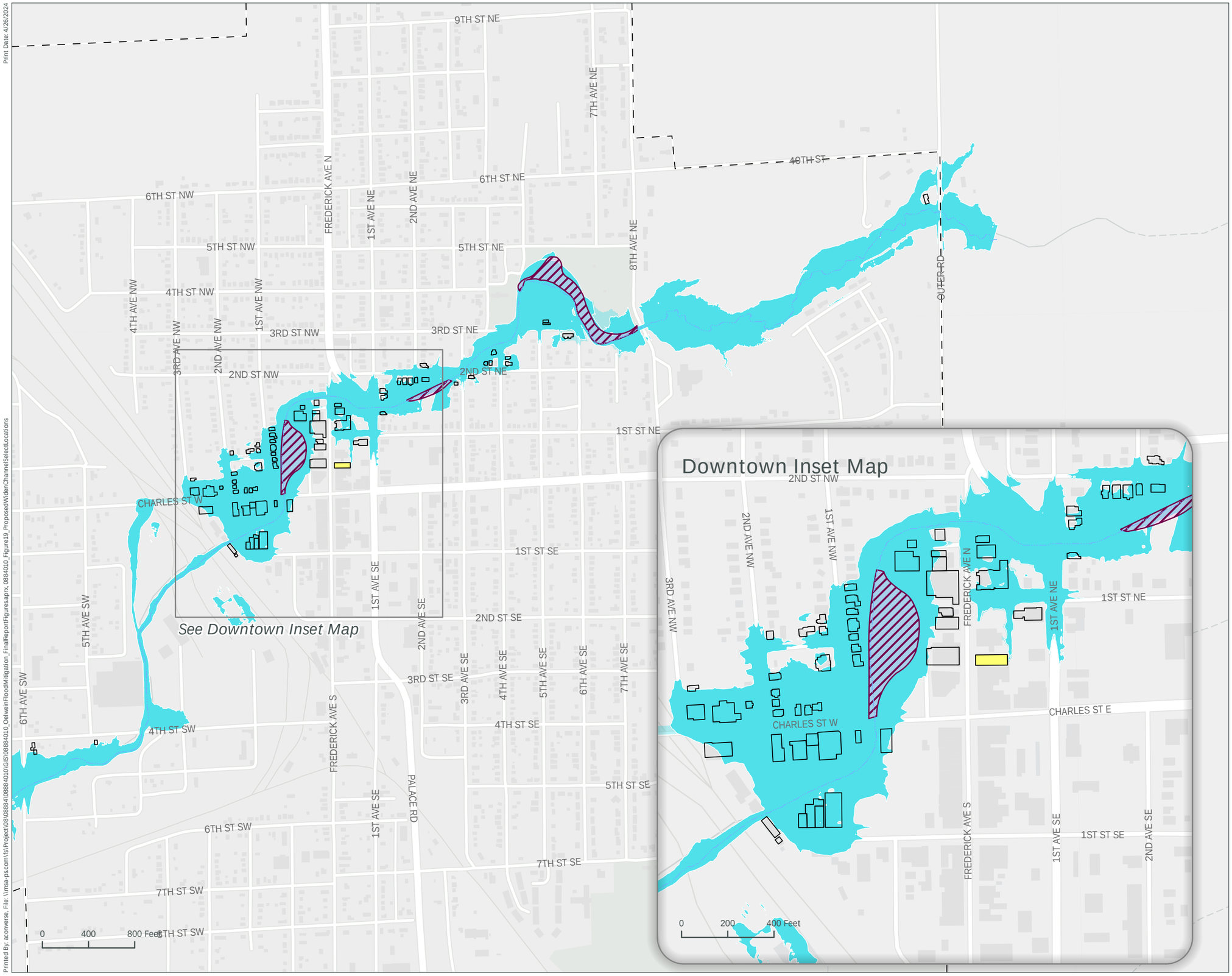
Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

Proposed Wid
Stream Channel Floodplain

Figure 19
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Existing 100-yr Floodplain
- Widen Stream Channel, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (1)
- Widen Stream Channel
- Stream

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Impacted Properties Downtown Area

Figure 20
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA

- Existing 10-yr Floodplain
- Existing 50-yr Floodplain
- Existing 100-yr Floodplain
- Existing 500-yr Floodplain
- Building within the 10-yr Floodplain
- Building within the 50-yr Floodplain
- Building within the 100-yr Floodplain
- Building within the 500-yr Floodplain

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

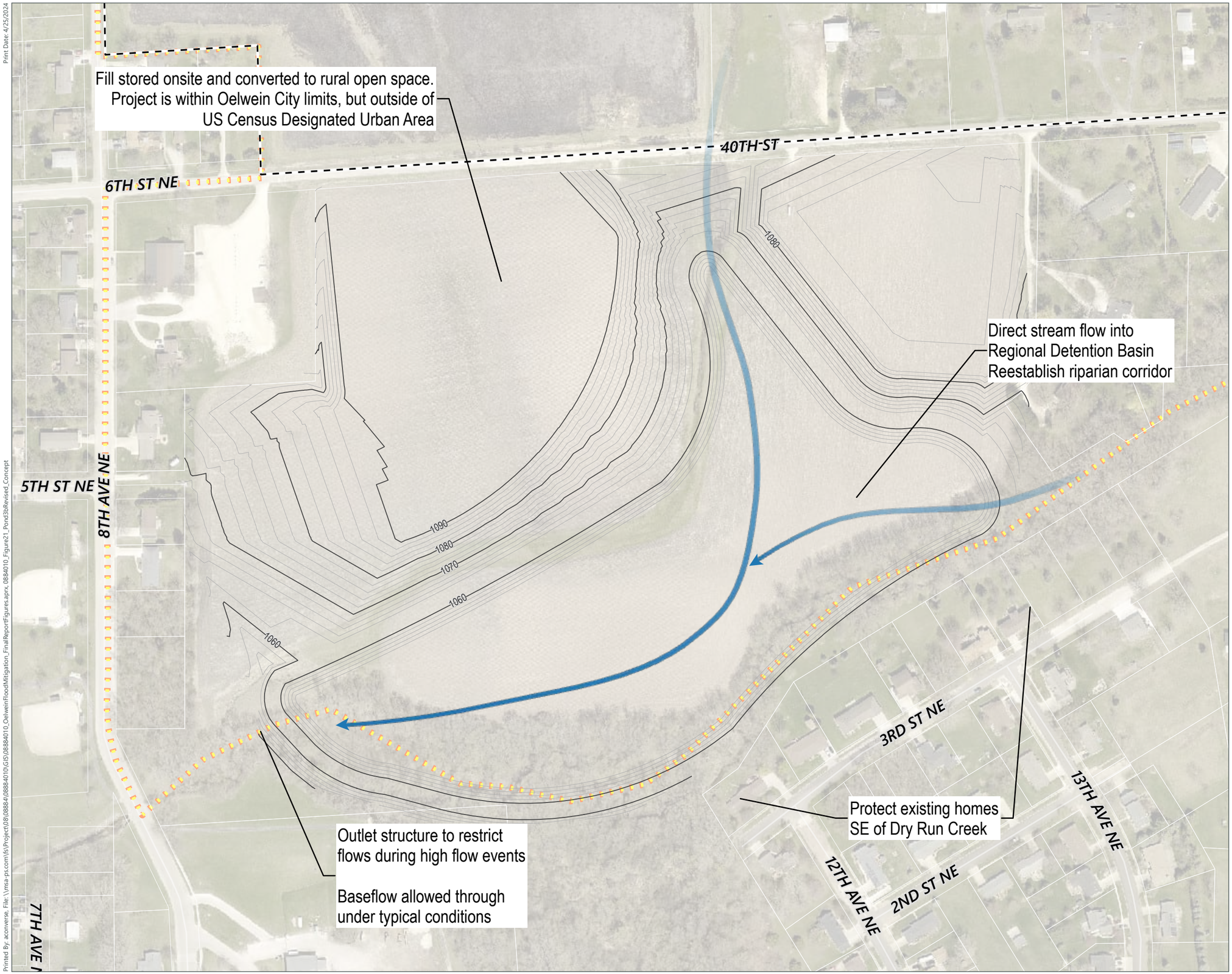
0 150 300 Feet

N

Proposed Pond Revised Concept

Figure 21
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



Oelwein

US Census Designated Urban Area

Preliminary Concept Pond

10-ft Contour

2-ft Contour

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Urban Area: US Census Tiger Shapefile (2020)
Aerial: Fayette County

MSA

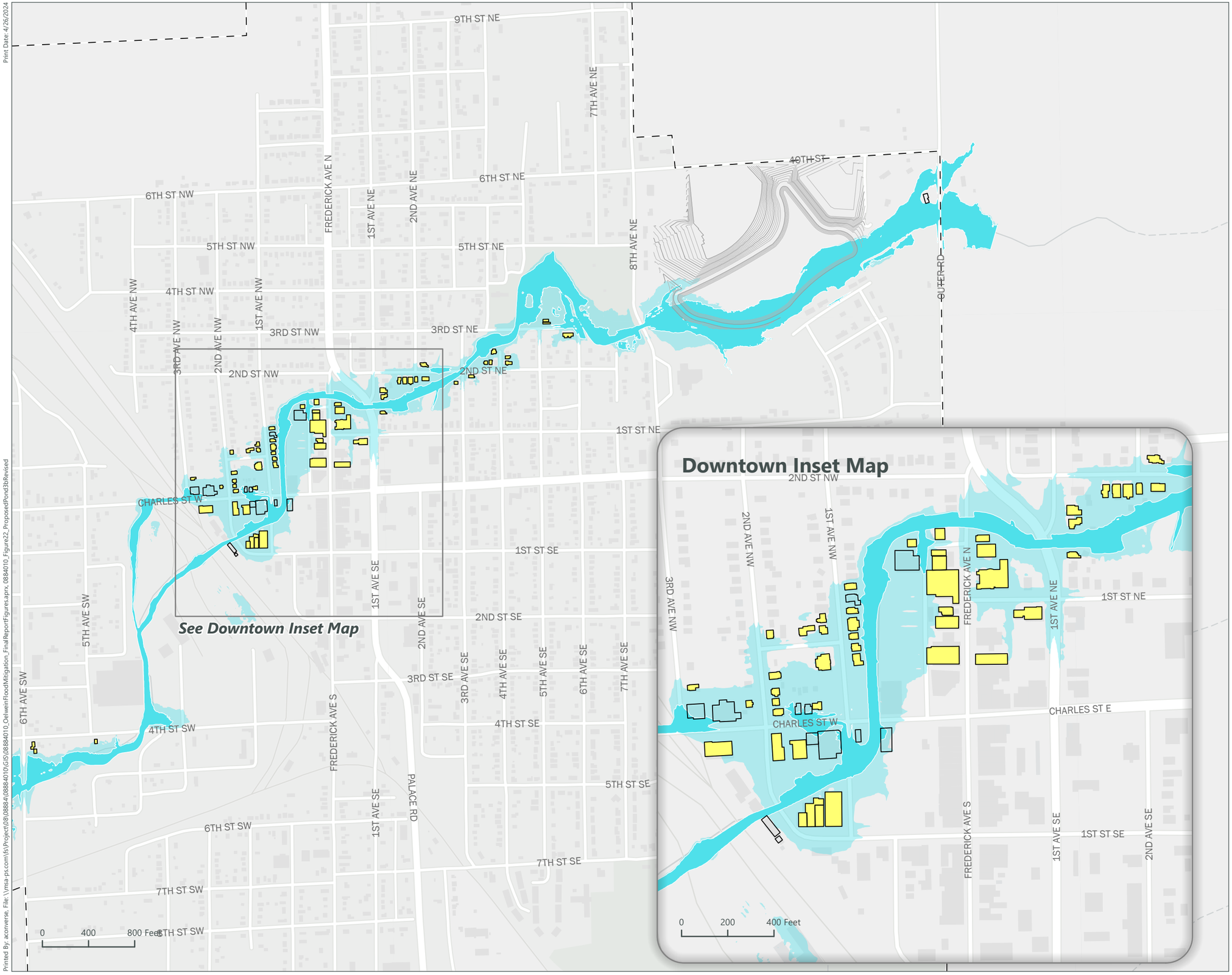
0 100 200 US Feet

N

Proposed Pond Revised Floodplain

Figure 22
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



- Oelwein
- Existing 100-yr Floodplain
- With Pond 3b as a Dam, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (57)

Preliminary Concept Pond

- 10-ft Contour
- 2-ft Contour

In this alternative, Pond 3b Revised would be classified as a Dam.

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Remove 1st Ave SW Bridge Concept

Figure 23
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Aerial: Fayette County

MSA

0 25 50 US Feet

N

Remove Charles Parking Structure Concept

Figure 24
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA

Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Aerial: Fayette County

MSA

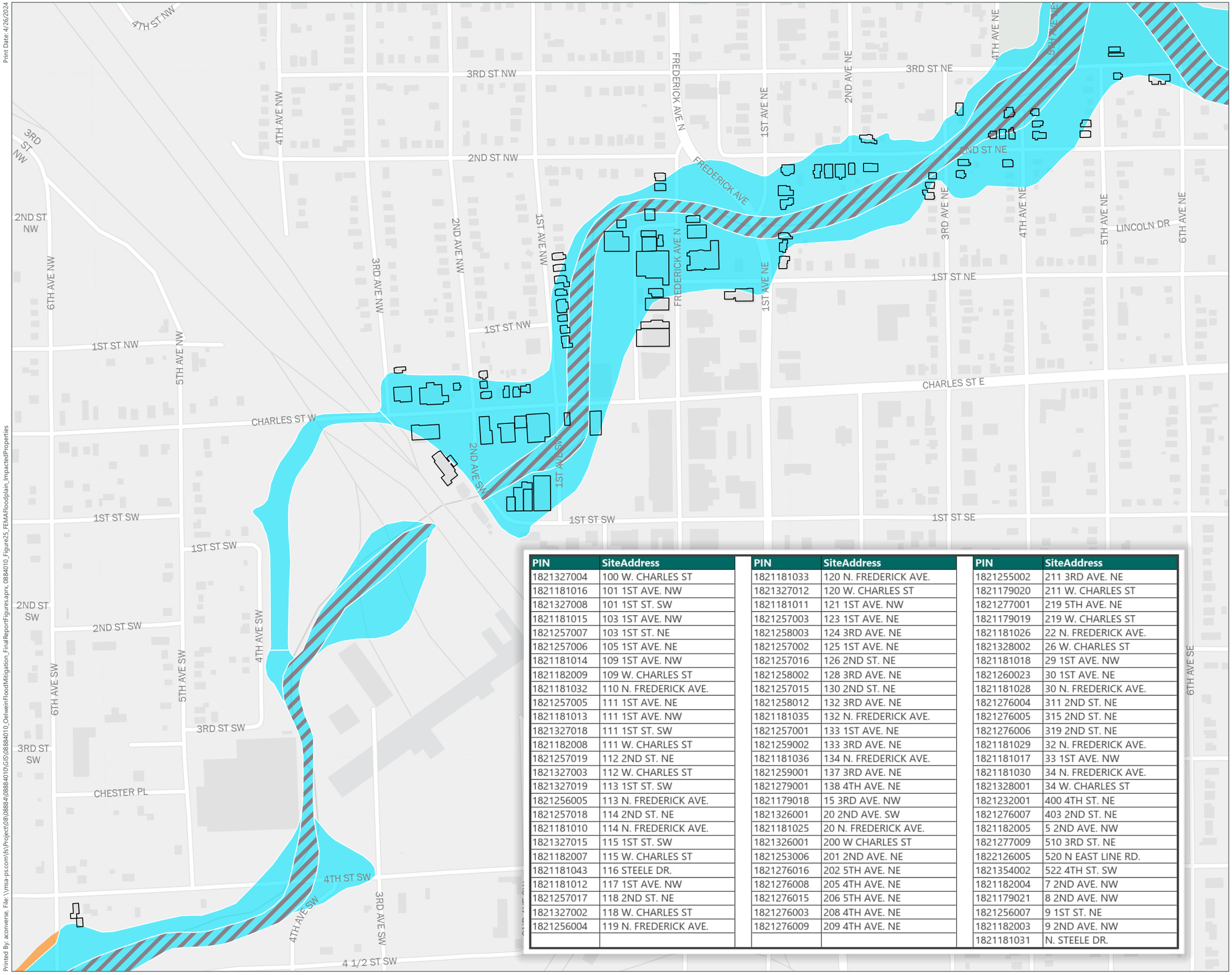
0 25 50 US Feet

N

FEMA Floodplain Impacted Structures

Figure 25
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



PIN	SiteAddress
1821327004	100 W. CHARLES ST
1821181016	101 1ST AVE. NW
1821327008	101 1ST ST. SW
1821181015	103 1ST AVE. NW
1821257007	103 1ST ST. NE
1821257006	105 1ST AVE. NE
1821181014	109 1ST AVE. NW
1821182009	109 W. CHARLES ST
1821181032	110 N. FREDERICK AVE.
1821257005	111 1ST AVE. NE
1821181013	111 1ST AVE. NW
1821327018	111 1ST ST. SW
1821182008	111 W. CHARLES ST
1821257019	112 2ND ST. NE
1821327003	112 W. CHARLES ST
1821327019	113 1ST ST. SW
1821256005	113 N. FREDERICK AVE.
1821257018	114 2ND ST. NE
1821181010	114 N. FREDERICK AVE.
1821327015	115 1ST ST. SW
1821182007	115 W. CHARLES ST
1821181043	116 STEELE DR.
1821181012	117 1ST AVE. NW
1821257017	118 2ND ST. NE
1821327002	118 W. CHARLES ST
1821256004	119 N. FREDERICK AVE.

PIN	SiteAddress
1821181033	120 N. FREDERICK AVE.
1821327012	120 W. CHARLES ST
1821181011	121 1ST AVE. NW
1821257003	123 1ST AVE. NE
1821258003	124 3RD AVE. NE
1821257002	125 1ST AVE. NE
1821257016	126 2ND ST. NE
1821258002	128 3RD AVE. NE
1821257015	130 2ND ST. NE
1821258012	132 3RD AVE. NE
1821181035	132 N. FREDERICK AVE.
1821257001	133 1ST AVE. NE
1821259002	133 3RD AVE. NE
1821181036	134 N. FREDERICK AVE.
1821259001	137 3RD AVE. NE
1821279001	138 4TH AVE. NE
1821179018	15 3RD AVE. NW
1821326001	20 2ND AVE. SW
1821181025	20 N. FREDERICK AVE.
1821326001	200 W CHARLES ST
1821253006	201 2ND AVE. NE
1821276016	202 5TH AVE. NE
1821276008	205 4TH AVE. NE
1821276015	206 5TH AVE. NE
1821276003	208 4TH AVE. NE
1821276009	209 4TH AVE. NE

PIN	SiteAddress
1821255002	211 3RD AVE. NE
1821179020	211 W. CHARLES ST
1821277001	219 5TH AVE. NE
1821179019	219 W. CHARLES ST
1821181026	22 N. FREDERICK AVE.
1821328002	26 W. CHARLES ST
1821181018	29 1ST AVE. NW
1821260023	30 1ST AVE. NE
1821181028	30 N. FREDERICK AVE.
1821276004	311 2ND ST. NE
1821276005	315 2ND ST. NE
1821276006	319 2ND ST. NE
1821181029	32 N. FREDERICK AVE.
1821181017	33 1ST AVE. NW
1821181030	34 N. FREDERICK AVE.
1821328001	34 W. CHARLES ST
1821232001	400 4TH ST. NE
1821276007	403 2ND ST. NE
1821182005	5 2ND AVE. NW
1821277009	510 3RD ST. NE
1822126005	520 N EAST LINE RD.
1821354002	522 4TH ST. SW
1821182004	7 2ND AVE. NW
1821179021	8 2ND AVE. NW
1821256007	9 1ST ST. NE
1821182003	9 2ND AVE. NW
1821181031	N. STEELE DR.

Structure within FEMA 1% Annual Change of Flooding

FEMA Flood Zone Designations

- 1% Annual Chance of Flooding
- Regulatory Floodway
- 0.2% Annual Chance of Flooding

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: FEMA (2021/05/17)
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

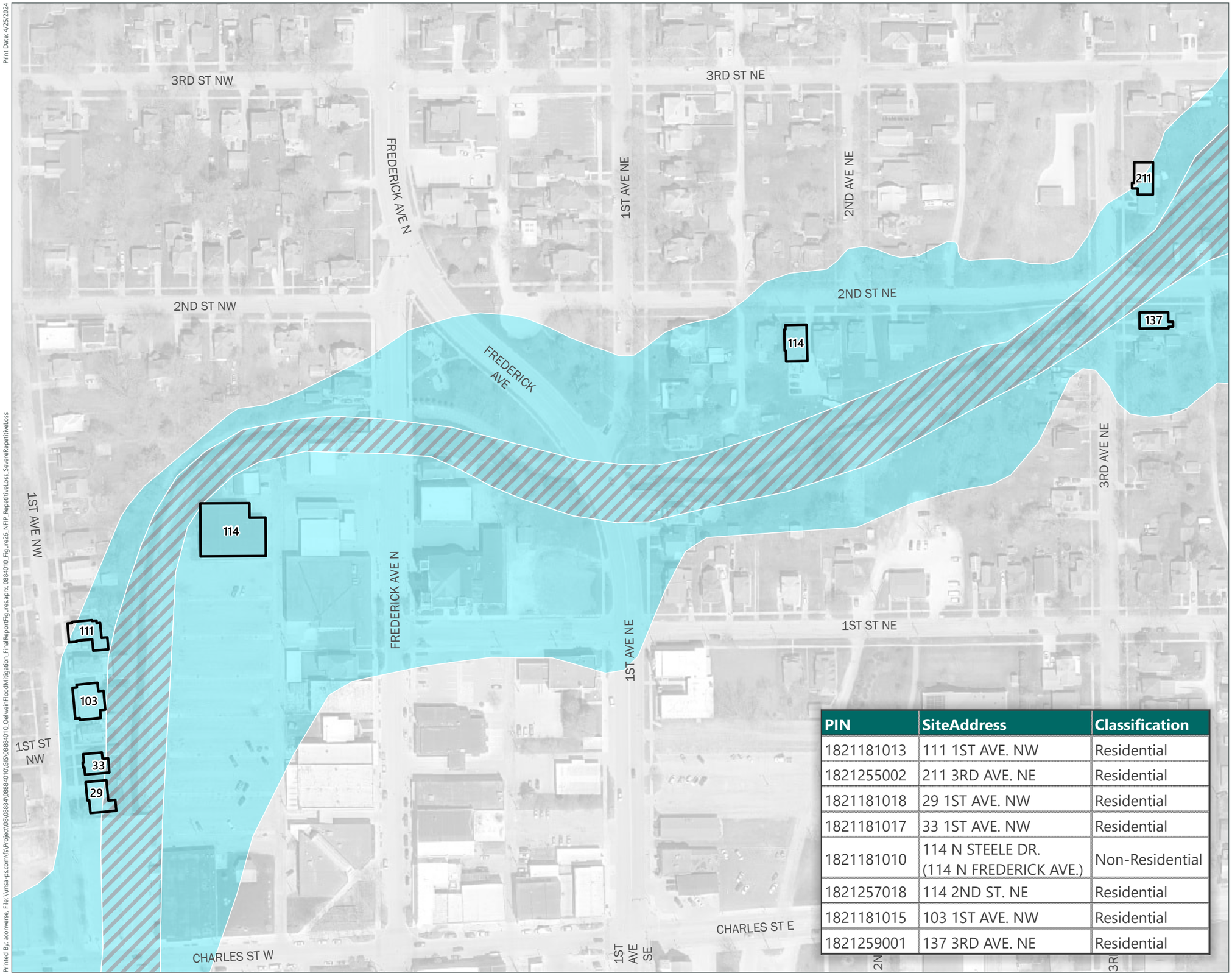
MSA

0 150 300 Feet

Repetitive Loss Structures

Figure 26
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA



PIN	SiteAddress	Classification
1821181013	111 1ST AVE. NW	Residential
1821255002	211 3RD AVE. NE	Residential
1821181018	29 1ST AVE. NW	Residential
1821181017	33 1ST AVE. NW	Residential
1821181010	114 N STEELE DR. (114 N FREDERICK AVE.)	Non-Residential
1821257018	114 2ND ST. NE	Residential
1821181015	103 1ST AVE. NW	Residential
1821259001	137 3RD AVE. NE	Residential

Structure with Repeitive Loss (NFIP)

FEMA Flood Zone Designations

1% Annual Chance of Flooding

Regulatory Floodway

Data Sources:
Municipal Boundary: Fayette County
Floodplain Extents: FEMA (2021/05/17)
Aerial: Fayette County

MSA

0 75 150 Feet

N

Appendix A

SNC·LAVALIN

ATKINS
Member of the SNC-Lavalin Group

Iowa CTP Real Time Technical Assistance

City of Oelwein, Fayette County, IA

01 November 2021

Contents

Background

The City of Oelwein, Iowa, has experienced repeated and significant flooding along Dry Run Creek upstream of the railroad crossing, downstream of 2nd Avenue SW, and especially from the railroad crossing to 3rd Avenue NE (see Appendix A). The City has expressed an interest in mitigation measures that would reduce or eliminate the flooding in this reach. The Iowa DNR, as a FEMA Cooperating Technical Partner (CTP), has offered to develop high level mitigation solution(s) through Real Time Technical Assistance (RTTA).

Problem Statement

Development of three or more high level mitigation solutions that reduce or eliminate the flooding along Dry Run Creek upstream of the railroad crossing to 3rd Avenue NE. In addition, the solutions should work to avoid or minimize flooding from Dry Run Creek in the West Charles Street underpass.

Technical Approach

The major contributing factor to flooding along Dry Run Creek is the culvert under the railroad embankment that cannot handle the flow from the now urbanized areas upstream.

In discussions with the City of Oelwein, the following mitigation measures were put forth as possible solutions:

- Removal of 1st Avenue SW bridge
- Removal of parking deck North of W. Charles Street
- Reconfiguration and replacement of W. Charles Street bridge
- Storage in Wings Park
- Storage upstream in watershed

However, during our analysis we found that these measures taken cumulatively did not provide the desired reduction in floodplain extents upstream of the railroad culvert. The following additional measures were also taken into consideration:

- Deepening, widening, and concrete lining of Dry Run Creek from 2nd Ave SW to 3rd St NW.
- Deepening, widening, and concrete lining of Dry Run Creek from 4th St SW to the railroad culvert.
- Addition of flood wall (i.e., levee) along the south bank (i.e., left bank) of Dry Run Creek immediately upstream of the railroad culvert to prevent flows extending to properties to the south[1].
- Addition of flood wall (i.e., levee) along the north bank (i.e., right bank) of Dry Run Creek immediately upstream of the railroad culvert to prevent flows northward to the West Charles Street underpass[1].

The models and GIS shapefiles used in this analysis are provided for City of Oelwein use.

[1] The terrain between the Dry Run Creek Culvert and the West Charles Street underpass is flat and the levee is needed to keep the flow in the Dry Run Creek channel.

Summary of Alternatives

The various mitigation measures (see Figures in Appendix B) considered in the various alternatives are listed below.

Feature	Option										
	1	2	3	4	5	6	7	8	9	10	11
Increased railroad culvert size	✓										
Removal of 1st Ave SW Bridge		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Removal of parking deck North of W. Charles Street		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Reconfiguration & replacement of W. Charles Street Bridge		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Storage in Wings Park			✓								
Storage reservoirs upstream of Outer Rd				✓		✓	✓	✓	✓	✓	
Lined rectangular channel, upstream of railroad					✓	✓					
Deepened & Lined rectangular channel, upstream of railroad							✓	✓	✓	✓	✓
Deepened & Lined trapezoid channel, downstream of railroad									✓	✓	✓
Small flood wall on left side of channel upstream of railroad								✓			
Small flood wall on right side of channel upstream of railroad								✓		✓	
Recommended	X	X	X	~	X	~	~	✓	✓	✓	X

Resulting Flood Extents from Recommended Alternatives

The figures in the Appendix display the flood extents for the 1% annual chance flood for Options 8, 9 and 10. Additionally, the reduction in flows resulting from the scenarios with storage basins can be found below.

River Station	Option		
	Effective Flows (cfs)	Flows with Wings Storage (cfs)	Flows with Upstream Storage (cfs)
15074.01	1041	1041	620
13944.2	2195	2195	1206
10931.86	3165	3098	1987
5165.161	3328	3260	2194

Conclusions

Urbanization in Oelwein upstream of the railroad culvert has resulted in increased runoff and exposed properties to flooding during frequent and infrequent flood events. Given the limitation of not being able to replace the railroad culvert, high level planning alternatives have been developed that address the flood hazard.

It is worth noting that the modeling used to develop these results are intended for a high-level planning discussion as opposed to design and construction. Additional detailed analyses to inform design decisions will be needed.

Furthermore, given the potential community acceptance of shallow flooding the identified measures may be further refined. For example, if a flood depth of 1.5 ft is acceptable then the levees identified for Options 8 and 10 may not be required.

Appendix A

(Source: City of Oelwein, Iowa)

PARKS / CEMETERY / AQUATICS / CAMPGROUND / TRAILS

Park and Recreation **www.oelwein.fun**

2016

CITY

WINGS

WINGS

WINGS

CITY

CITY

CITY

REDGATE

PARKS / CEMETERY / AQUATICS / CAMPGROUND / TRAILS

Park and Recreation **www.oelwein.fun**

2017

CITY

CITY

CITY

CITY

CITY

CITY

PARKS / CEMETERY / AQUATICS / CAMPGROUND / TRAILS

Park and Recreation **www.oelwein.fun**

CITY

CITY

CITY

DAM

DAM

PARKS / CEMETERY / AQUATICS / CAMPGROUND / TRAILS

Park and Recreation **www.oelwein.fun**

DAM

PLATT PARK - 1 INCH OF RAIN IN AN HOUR

PARKS / CEMETERY / AQUATICS / CAMPGROUND / TRAILS

Park and Recreation **www.oelwein.fun**

2018

FLOODING AT CITY PARK

FLOODING AT CITY PARK

CITY PARK FLOODING

CITY

PARKS / CEMETERY / AQUATICS / CAMPGROUND / TRAILS

Park and Recreation **www.oelwein.fun**

2019

WOODLAWN SPRING FLOODING

2020 + TORNADO

Diamond 1 – storm damage

City Park bridge

Diamond 1 fencing

City Park road

City Park road

Platt Park

1st Ave SW 10 block

2nd Ave SW to South Lot

150 to Chrysler Park

Viaduct

Appendix B

Oelwein, IA
Preliminary FEMA SFHA

N

1st Ave NW
2nd St NW
Railroad
1st St NE
W Charles St
4th St SW

Preliminary FEMA SFHA

- A
- AE
- AE, FLOODWAY
- X, 0.2 PCT ANNUAL CHANCE FLOOD HAZARD

0 0.1 0.2 Miles

0 0.05 Miles

Oelwein, IA RTTA
Location of All Possible Modifications

N

1st Ave NW

2nd St NW

Railroad

W Charles St

4th St SW

- Culvert Modification
- Removal of Structure
- Reconstruct W. Charles St. Bridge
- Wings Park Reservoir
- Reservoir 1
- Reservoir 2
- Upstream Channel Mod.
- Downstream Channel Mod.
- Left Levee
- Right Levee

0 0.1 0.2 Miles

0 0.05 Miles

Oelwein, IA RTTA
Option 8

N

1st Ave NW

2nd St NW

Railroad

1st St NE

W Charles St

4th St SW

Removal of Structure

Reconstruct W. Charles St. Bridge

Reservoir 1

Reservoir 2

Upstream Channel Modifications

Left Levee

Right Levee

Preliminary Zone AE Floodplain

Depth Grid

High : 12.56 feet

Low : 0

0 0.1 0.2 Miles

0 0.05 Miles

Oelwein, IA RTTA
Option 9

N

1st Ave NW

2nd St NW

Railroad

1st St NE

W Charles St

4th St SW

Removal of Structure

Reconstruct W. Charles St. Bridge

Reservoir 1

Reservoir 2

Upstream Channel Modifications

Downstream Channel Modifications

Preliminary Zone AE Floodplain

Depth Grid

High : 11.41 feet

Low : 0

0 0.1 0.2 Miles

0 0.05 Miles

Oelwein, IA RTTA
Option 10

N

1st Ave NW

2nd St NW

Railroad

1st St NE

W Charles St

4th St SW

Removal of Structure

Reconstruct W. Charles St. Bridge

Reservoir 1

Reservoir 2

Upstream Channel Modifications

Downstream Channel Modifications

Right Levee

Preliminary Zone AE Floodplain

Depth Grid

High : 11.41 feet

Low : 0

0 0.1 0.2 Miles

0 0.05 Miles

Appendix B

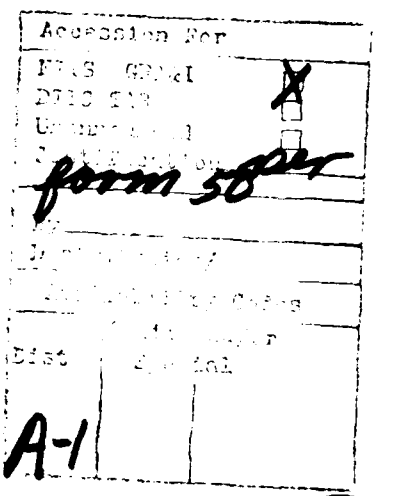
DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING – P.O. BOX 2004
ROCK ISLAND, ILLINOIS 61204-2004

REPLY TO
ATTENTION OF:
CENCR-PD-P

DETAILED PROJECT REPORT
FOR
SECTION 205
FLOOD CONTROL PROJECT

DRY RUN CREEK
FAYETTE COUNTY
OELWEIN, IOWA

WITH
ENVIRONMENTAL ASSESSMENT



JUNE 1987

ACKNOWLEDGEMENT

Many members of the Rock Island District assisted in the preparation of this report. Primary study team personnel who are familiar with the technical aspects of the study are listed below:

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SYLLABUS

The city of Oelwein, Iowa, requested assistance from the Rock Island District, Corps of Engineers, to determine a solution for the flooding problems along a drainage ditch called Dry Run Creek within the city's corporate limits, under Section 205 of the 1948 Flood Control Act, as amended.

The Rock Island District completed a Reconnaissance Study of flooding problems along Dry Run Creek in the fall of 1985. The study concluded that it was in the Federal interest to conduct more detailed studies of flood damage reduction measures for Oelwein.

This Detailed Project Report presents the evaluation of alternative solutions to Oelwein's flooding problems. The report recommends the construction of a Channel Modification project which would produce annual net economic benefits of $13,800, and has a benefit-to-cost ratio of 1.6 based upon a 50-year economic life and a discount rate of 8-5/8 percent. The estimated total construction cost is $250,300, of which $130,515 is a non-Federal cost. Environmental impacts of the project are not significant and are evaluated in the ~~attached~~ Environmental Assessment.

DETAILED PROJECT REPORT
FOR
SECTION 205
FLOOD CONTROL PROJECT

DRY RUN CREEK
FAYETTE COUNTY
OELWEIN, IOWA

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DETAILED PROJECT REPORT
FOR
SECTION 205
FLOOD CONTROL PROJECT

DRY RUN CREEK
FAYETTE COUNTY
OELWEIN, IOWA

SECTION 1 - INTRODUCTION

STUDY AUTHORITY

The authority for this report is Section 205 of the 1948 Flood Control Act, as amended. The authority, as amended, is presented below:

> That the Secretary of the Army is hereby authorized to allot from any appropriations heretofore or hereafter made for flood control, not to exceed $40,000,000 for any one fiscal year, for the construction of small projects for flood control and related purposes not specifically authorized by Congress, which come within the provisions of Section 1 of the Flood Control Act of June 22, 1936, when, in the opinion of the Chief of Engineers, such work is advisable. The amount allotted for a project shall be sufficient to complete Federal participation in the project. Not more than $5,000,000 shall be allotted under this section for a project at any single locality. The provisions of local cooperation specified in Section 3 of the Flood Control Act of June 2, 1936, as amended, shall apply. The work shall be complete in itself and not commit the United States to any additional improvement to ensure its successful operation, except as may result from the normal procedure applying to projects authorized after submission of preliminary examination and survey reports.

STUDY PURPOSE AND SCOPE

The purpose of each water and related land resources project undertaken by the Corps of Engineers is to contribute to the public interest through National Economic Development (NED).

The selected plan to alleviate flooding problems along Dry Run Creek in Oelwein, Iowa, must be economically and engineeringly viable, environmentally sound, and within the public interest to implement.

STUDY AREA

Oelwein is located in southwestern Fayette County in northeastern Iowa, about 40 miles northeast of Waterloo (plate 1). The study area is Dry Run Creek and its drainage basin within the city limits of Oelwein. Dry Run Creek flows southwesterly through an intensely urbanized portion of the city before converging with Otter Creek downstream of the corporate limits (plate 2). The drainage area at the mouth of Dry Run Creek is 3.0 square miles. Although damages from flooding have occurred in Oelwein along Otter Creek, local officials indicate that the areas of primary concern with respect to flood damages lie along Dry Run Creek between Eighth Avenue NE. and the Chicago and Northwestern (C&NW) Railroad culvert.

TYPE, DEPTH, AND DETAIL OF INVESTIGATIONS

This Detailed Project Report is the final feasibility investigation under the study authority. Its goal is to accomplish the following objectives:

a. Determination of the Federal interest and whether or not the study should proceed to plans and specifications, based on a detailed appraisal of costs, benefits, and environmental impacts.

b. Completion of plan formulation by optimization of the selected plan using detailed engineering, economic, and environmental consideration of the design.

c. An assessment of the level of support and the willingness of the local sponsor to share the cost of plans and specifications and project construction.

RELATED STUDIES AND REPORTS

The reports described below discuss aspects of the flood problems in Oelwein and are listed in order of publication.

Preliminary Storm Damage Survey, Oelwein, Iowa, 1979. This survey was conducted by Bert B. Hanson and Associates (now Jensen, Cary, and Shoff), consulting engineers in Cedar Falls, Iowa. Their report includes the results of a storm damage survey of public facilities in Oelwein conducted after a very severe storm in August 1979. They estimated a total of $305,550 in damages to public property due to the storm and resultant flood.

Storm Sewer Study, Oelwein, Iowa, 1981. The firm of Associated Engineers, Inc., Cedar Rapids, Iowa, was asked by the city of Oelwein to investigate the storm drainage systems in Oelwein. As a result of their investigation, Associated Engineers identified the area between the upstream corporate limits and the C&NW Railroad as presenting the most serious flood problem. They reported that since 80 percent of the contributing watershed is outside the Oelwein corporate limits, runoff control outside the city is necessary to alleviate the flood problem within the city. Flood control measures suggested in this report are: a detention basin located upstream of Eighth Avenue NE. immediately north of Wing's Elementary School, surface water interception and diversion, and soil stabilization techniques. The report recommended that some combination of the above runoff and flood control measures be implemented before additional development is permitted.

Flood Study Report, Dry Run, Oelwein, Iowa, 1982. This report was published by the Soil Conservation Service in Des Moines, Iowa. It delineates the 100-year floodplain for a 1.4-mile reach of Oelwein between Second Avenue SW. on the lower end to a point one-third of a mile upstream of Eighth Avenue NE. on the upper end. The 100-year flood profile, selected valley cross sections, flood frequency-elevation discharge data, and other flood data are included in this report. Alternatives suggested for flood damage abatement in Oelwein are: channel improvement, tile outlet terraces installed upstream of East Line Road, and a floodwater storage basin upstream of Eighth Avenue NE.

Initial Appraisal, City of Oelwein, Fayette County, Iowa, September 1983. This report, prepared by the Rock Island District, Corps of Engineers, concluded that it was in the Federal interest to conduct more detailed studies of flood damage reduction measures at Oelwein.

Reconnaissance Report, Dry Run Creek, Fayette County, Oelwein, Iowa, August 1985. This report, prepared by the Rock Island District, Corps of Engineers, concluded that a channel modification project was economically justified and recommended further analysis in the form of a Detailed Project Study.

SECTION 2 - PLAN FORMULATION

ASSESSMENT OF WATER AND LAND RESOURCES, PROBLEMS, AND OPPORTUNITIES

PROBLEMS, NEEDS, AND OPPORTUNITIES

Residents, businessmen, and community leaders have expressed their concern about the problem of overbank flooding from Dry Run Creek and the resulting damage to homes, businesses, and public facilities. They feel they need to take action to minimize future flooding damages and to lower future flood levels on Dry Run Creek.

The Dry Run Creek floodplain between Eighth Avenue NE. and the C&NW Railroad culvert suffers the most significant damages during floods. Plate 3 shows the limits of flooding attributable to the 10-year flood (10 percent chance of being equalled or exceeded in any given year) and 100-year flood (1 percent chance of being equalled or exceeded in any given year). Eight bridges or culverts span the creek in this area. Most of these bridges and culverts are overtopped by floodwater when flows reach the 100-year flood level. Many of the bridges obstruct flow at the 10-year flood level. Plate A-4 of appendix A displays water surface levels for the 10- and 100-year floods, along with the 2-year and 50-year floods and the Standard Project Flood (SPF) under existing conditions (including the Iowa Department of Transportation's bridge replacement at First Avenue NE., which was constructed in 1986, and assuming the bridge replacement at Frederick Avenue, scheduled for construction in 1988).

The restrictive bridges, coupled with high velocities, were contributing factors in the damaging flood experienced by Oelwein on 28 August 1979. The flood, which was estimated to be greater than a 50-year flood (2 percent chance of occurring in any given year), followed a storm in which 4.25 inches of rain fell in a period of about 1 hour. Similarly, on 22 June 1984, an estimated rainfall of 2.52 inches fell in a period of less than 30 minutes, producing a flood estimated to be a 25-year flood (4 percent chance of occurring in any given year). Minor flooding, necessitating traffic detours, occurs nearly every year in Oelwein.

The total damages attributed to the flood of August 1979 are estimated at $762,000. Correspondingly, a figure of $373,000 represents the estimate of total damages caused by the June 1984 flood which affected 13 homes and 25 businesses.

EXISTING CONDITIONS

Hydrologic and Hydraulic Conditions

Dry Run Creek is a principal drainage outlet for the central portion of the city of Oelwein. It forms in the northeastern part of the city where the runoff from 900 acres of farmland converges (plate 2). The flow path is generally southwestward through the city to its confluence with Otter Creek. Average watershed slopes are between 2 and 3 percent; the drainage area encompasses 3.0 square miles. Watershed soils have moderate water infiltration and transmission characteristics. Land use in the watershed is about 50 percent urban and 50 percent agricultural. Storm sewers, street gutters, and minor surface channels collect and convey runoff waters to the main stem of Dry Run Creek. This urban contribution appears to be the primary cause of flooding in Oelwein.

Environmental Setting and Natural Resources

The study area is primarily urban in character. The upstream area is scattered single-family residential and the drainage is aesthetically pleasing, with well-vegetated banks and a natural appearance to the channel. As the drainage courses further downstream through the city, the watershed becomes more densely urban and commercial near the center of the city where the channel is modified and takes on the appearance of a ditch. Near the downstream end of the study area, the drainage passes under the C&NW Railroad tracks into an industrial area. In the industrial area, filter and skimming devices have been stretched across the channel in an apparent attempt to filter or trap effluents which have entered the channel. Because of the urban character of most of the drainage area, its natural resource value is limited.

The northern wild monkshood (Aconitum noveboracense) is the only federally listed species for Fayette County and has a "threatened" status. The habitat requirements of the monkshood are generally described as north or east facing, shady slopes. These habitat conditions do not exist in the study area; consequently, the northern wild monkshood is not anticipated to be found in the area.

Following review of Special Reports 1 through 4 of the Iowa State Preserves Advisory Board and considering existing conditions in the study area (i.e., limited habitat, urban conditions, stream quality, and general disturbance), the potential for occurrence of any State-listed endangered species may be considered negligible.

Human Resources, Development, and Economy

Oelwein's population declined between 1960 and 1980, leaving it with a 1980 population of 7,564. The city has historically depended on the railroads for employment opportunities, but the merger of the Chicago Great Western Railroad with the C&NW Railroad reduced the number of city residents employed by the railroad. Local agricultural-related industries have since become a major source of employment.

In spite of the present decline in employment opportunities in Oelwein, local industry and business leaders remain optimistic about the city's future growth.

Based on an existing conditions frequency-damage analysis (appendix B), average annual damages due to flooding in Oelwein are approximately $71,900.

FUTURE CONDITIONS

Without a Flood Control Project

Without a flood control project, Oelwein will continue to be susceptible to flooding and resultant damages to private and public property. However, based on projected future urban growth (appendix B, section 5), the severity of Oelwein's present flood problem should not be intensified by increased runoff of rainwater associated with urban development.

With a Flood Control Project

With a flood control project, Oelwein's residents will be spared the social and financial hardships associated with frequent flooding. Residents will spend less time and money to clean up and perform repairs after flooding.

PLANNING OBJECTIVES

NATIONAL OBJECTIVE

The national objective of water and related land resources planning is to contribute to economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to National Economic Development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are direct net benefits and costs that accrue in the planning area and the rest of the Nation. Such contributions include increases in the net value of those goods and services that are marketed, and also of those that may not be marketed.

The plan formulation process to accomplish flood damage reduction is formulated and directed by the national planning objective:

* National Economic Development (NED) - To enhance the national economic development by increasing the value of the Nation's output of goods and services and by improving the national economic efficiency.

SPECIFIC OBJECTIVE WITHIN STUDY AREA

The specific planning objective for this study is as follows:

* To reduce the flood-related economic losses sustained by residents, businesses, industries, and public concerns along Dry Run Creek within the city of Oelwein, Iowa.

PLANNING CONSTRAINTS

The planning process provides the basis for selecting one of the developed plans and, if appropriate, recommending Federal participation to implement the plan. The selected plan is the one that is in the best public interest regardless of whether or not it is within the existing authority of the Corps to implement.

The planning constraints which have been developed for this study are as follows:

* This study is constrained by applicable laws of the United States and by the State of Iowa, all Executive Orders of the President, the Water Resources Council's Principles and Guidelines, and all engineering regulations of the Corps of Engineers.

* This study is constrained to formulate plans that are socially acceptable. Conversations with residents indicated that plans which are disruptive to Oelwein's central downtown business district and its established infrastructure would be unacceptable.

ALTERNATIVE PLANS

AVAILABLE MEASURES

Available measures for the development of alternative plans were considered to be those measures, both structural and nonstructural, which could be constructed in compliance with existing statutes, administrative regulations, and established common law.

DEVELOPMENT OF ALTERNATIVE PLANS

To assist in the preliminary evaluation of the following alternatives, costs were annualized and then compared to the total average annual damages. The total average annual damages are the calculated average annualized damages

that are expected to occur from all possible flood events. Therefore, if a project's total annual costs meet or exceed the total average annual damages, the resulting benefit-to-cost ratio would be significantly less than 1. Hence, in the preliminary evaluation of alternative plans, if annual costs exceeded the total average annual damages of $71,900, the alternative was deemed economically infeasible and dropped from further analysis. (See appendix B.)

NONSTRUCTURAL ALTERNATIVES

Floodproofing

Description

Floodproofing is a combination of structural changes and adjustments to properties subject to flooding used primarily to reduce or eliminate flood damage. This alternative involves raising existing structures or future structures above flood heights or providing panels that can be placed over building doors and windows. Although it is more simply and economically applied to new construction, floodproofing is also applicable to existing structures.

Preliminary Evaluation

Raising existing commercial and industrial structures above flood heights would yield annual costs greatly in excess of the total annual damages considering the heavy construction of the buildings. Also, problems of access to buildings and homes would be created by raising these structures.

Placing panels over doors and windows is a viable solution where there is adequate warning time prior to flooding. However, most flooding is caused by intense storms in which the peak runoff occurs in approximately 2 hours (see plate A-6 of appendix A). With such a limited time to respond, it is unlikely that temporary floodproofing measures could be sufficiently implemented to significantly reduce damages. Hence, this alternative was dropped from further analysis.

Flood Forecasting and Flood-Warning Systems

Description

Flood Forecasting System. The National Oceanic and Atmospheric Administration (NOAA) issues warnings of potential flood-producing storms. Frequently, the flood warnings are preceded by a "severe weather

or flood watch." The flood warnings and statements on flood conditions are transmitted to city officials as well as to newspapers and radio and television stations in the area. The services available include flash flood warnings and major flood forecasts based on radar coverage, numerous rainfall reporting stations, river gages, anticipated weather conditions, and hydraulic factors.

Flood-Warning System. A flood-warning system is a water level sensing device or devices which are connected to an alarm. As water levels rise and reach a potentially threatening level, the alarm is activated. These systems provide increased safety to area residents by furnishing evacuation time.

Preliminary Evaluation

The physical characteristics of Dry Run Creek and its watershed are such that the value of flood forecasting and flood warning are greatly reduced. As stated earlier, the runoff hydrograph reaches its peak within 2 hours (plate A-6). With such a limited time available in which to respond, few damages would be prevented with a flood-warning system. Hence, this alternative was not pursued.

Evacuation and Relocation

Description

Permanent evacuation and relocation of the residents and structures in the Dry Run Creek floodplain in Oelwein would require removal and relocation of all structures currently within the areas which are susceptible to flooding.

Preliminary Evaluation

With about 60 homes and 30 businesses in the 100-year floodplain, the annual cost associated with purchasing all the structures would be significantly greater than $71,900. Removal of these buildings, especially the businesses, would disrupt the central downtown business district and its established infrastructure. Although the cost of such a disruption is intangible, conversations with Oelwein residents indicate that it would carry a very high cost.

Also considered was removal of all the structures that would be damaged by a flood of similar magnitude to the 1984 flood. Of the 25 businesses that would be inundated, all are of heavy construction (brick, concrete block, steel, etc.). Evacuation or relocation costs would greatly exceed

the average annual damages for these buildings. Also, 13 homes would be inundated by this flood. With annual evacuation/relocation costs of $36,000 and annual benefits of $8,000, the resulting benefit-to-cost ratio for evacuating or relocating these homes is about 0.2. Consequently, total evacuation and relocation and less comprehensive versions of this alternative were not pursued.

STRUCTURAL ALTERNATIVES

Upstream Floodwater Storage Basin

Description

This alternative evaluated the potential for detention of floodwater in an upstream storage basin. Design of the storage basin would consist of an earthen embankment to detain floodflows with an outlet structure to allow passage of flows up to the capacity of the downstream channel. The storage basin would be dry until flow exceeded the capacity of the outlet structure.

Preliminary Evaluation

Based on topographic mapping, three sites were selected for analysis as having the most natural storage potential. These sites, each located upstream of East Line Road, would have the potential to store floodwaters up to a 10-year occurrence (a 10-year flood).

The annual cost of an embankment detention structure of a very simplistic design for the smallest of these three sites is $83,000. An upstream floodwater storage basin of this magnitude is economically infeasible and was eliminated from further consideration.

Concrete Floodwall

Description

This alternative consists of a concrete floodwall on both sides of Dry Run Creek within the flood problem area (plate 3) and appropriate closure structures for each opening in the walls. Riverfront property would be acquired to construct this alternative.

Preliminary Evaluation

A concrete floodwall designed to protect Oelwein from a 100-year flood could be constructed at an annual cost of about $200,000. Somewhat less expensive floodwalls offering lower levels of protection could be constructed, but all floodwalls through Oelwein would require the same number of street closures and pump stations. These items account for over 50 percent of the cost of the 100-year floodwall.

For the 50-year level of protection, annual costs would exceed $150,000. Hence, this alternative was eliminated from further consideration.

Levees and Floodwalls

Description

This alternative consists of an integrated system of levees and floodwalls aligned along both sides of Dry Run Creek, through the flood problem area (plate 3). Levees would be constructed of earthen embankment with an 8-foot top width and 1 on 3 side slopes. Floodwalls would be made of concrete and constructed where structures limit right-of-way necessary for levee construction. Riverfront property would be acquired, and appropriate closure structures would be constructed where major thoroughfares intersect the levee or floodwall alignment.

Preliminary Evaluation

With annual costs of $200,000 and $139,000 for the 100- and 50-year levels of protection, respectively, and annual damages of $71,900, the resulting benefit-to-cost ratios would be much less than unity. Consequently, levees and floodwalls were not considered for further analysis.

Earthen Levee

Description

This alternative consists of levees, as described in the previous alternative, aligned along both sides of the channel through the flood problem area (plate 3). However, contrary to the previous alternative, structures that encroach on right-of-way necessary for construction would be acquired and removed from the project alignment.

Preliminary Evaluation

The annual cost of a levee system built to 50-year level of protection exceeds $80,000. Hence, the preliminary benefit-to-cost ratio is 0.9. Therefore, this alternative was not considered further.

Excavated Pit Storage Basin

Description

An excavated pit storage basin was evaluated for storing floodwaters. Flows greater than a 2-year flood (assumed existing channel capacity) up to the design capacity would be diverted to and stored in the pit. The floodwater would be stored until the flood subsides and then pumped out of the pit and back into the channel at a rate which the channel could safely convey.

Preliminary Analysis

A 5-year flood design excavated pit was analyzed. The volume of storage necessary is approximately 132 acre-feet, corresponding to a minimum of 213,000 cubic yards of excavation (based on flat topography). Hence, the annualized project costs far outweigh the total annual damages. Therefore, this alternative was dropped from further consideration.

Concrete-Lined Widened Rectangular Channel

Description

This alternative evaluated a channel widened to a 40-foot bottom width, with vertical concrete retaining walls. This size channel would be capable of passing a 100-year flood with 1 foot of freeboard.

Preliminary Evaluation

The annual cost of such an alternative would be in excess of $134,000. The cost of a 20-foot-wide channel of similar design is still greater than the total annual damages. Hence, this alternative was dropped from further consideration.

Railroad Culvert Modification

Description

When the flows of Dry Run Creek approach a level somewhere between those associated with the 5- and 10-year flood events, a backwater effect is created by the twin box culvert under the C&NW Railroad tracks near Second Avenue SW. This backwater effect extends upstream to a commercial business parking lot located between First Avenue NW. and North Frederick Avenue. Modification of this restriction by constructing a third culvert similar in size to the two already in place would delay the creation of a backwater effect until flows reach the level of approximately the 100-year flood.

Preliminary Evaluation

This alternative would reduce flood damages in the area between the C&NW Railroad tracks and the parking lot, but would have little effect on areas farther upstream. It would not reduce the force of the floodwater upstream and might actually increase the force downstream and induce damages in southwest Oelwein by permitting a free flow of water.

According to a preliminary analysis of this alternative, the culvert under the C&NW Railroad tracks could be made less restrictive at an annual cost of approximately $25,000. Benefits from this expenditure would accrue only in the area immediately upstream of the culvert, reaches 2 and 3 (appendix B, plate B-1). The annual damages in those reaches would be $20,000. Therefore, the resulting benefit-to-cost ratio would be less than unity, and this alternative was not considered further.

Channel Modification

Description

Without modifying many of the bridges spanning Dry Run Creek, there would be little benefit in enlarging the channel to greater than a 20-foot bottom width. Annual costs associated with raising, replacing, or enlarging the bridges to provide greater channel capacities were found to be much greater than the total annual damages of $71,900. Also, enlarging the channel to a capacity less than that of the bridges was not considered to be cost effective. Hence, it was determined that the optimal Channel Modification project would involve widening the channel to the capacity of the existing bridges.

Channel modification would involve clearing the channel of debris, realigning and widening the channel bottom, and reshaping the channel side slopes. The channel bottom would be widened to a 20-foot width and the

side slopes would be reshaped to a 1V on 2H slope (plate 4). The modified channel will be slightly realigned such that the project right-of-way will not necessitate any residential, commercial, or industrial relocations. Channel modifications would begin just downstream of Third Street NE. and end at the upstream side of the C&NW Railroad culvert (plates 5 and 6).

Preliminary Evaluation

A preliminary analysis indicates channel modification to have an annual cost of $24,500, which is significantly less than the total annual damages of $71,900. Hence, channel modification was analyzed in greater detail.

Combination of Alternatives

Description

Since reaches 6 and 7 (appendix B, plate B-1) suffer a good percentage of the damages during flooding, a combination of channel modification and levee construction was analyzed for these areas.

Preliminary Evaluation

Benefit-to-cost ratios for this alternative were significantly less than unity for a 10-year level of protection. Higher levels of protection would have revealed annual costs greater than annual damages for these individual reaches. Therefore, this alternative was not considered further.

EVALUATION OF ALTERNATIVE PLANS

Based on a preliminary evaluation of effectiveness and acceptance, channel modification was evaluated in greater detail. The plan is evaluated below.

CHANNEL MODIFICATION

The Channel Modification plan would reduce damages by 13 percent for a 50-year event (1979 flood) and by 46 percent for a 25-year event (1984 flood). The Channel Modification plan would reduce the stage of floods, up to a 50-year frequency event, by 0.5 to 1.5 feet (as shown on plates 7, 8, and 9). Overall, the average annual damages would be reduced by 46 percent, but damages from flooding would still occur with this plan. Although minimal, these damages would occur between a 1- to 2-year frequency event.

The total first cost of this plan is $250,300, with a benefit-to-cost ratio of 1.7 and annual net benefits of $13,800. Detailed cost estimates of this plan are listed on tables 1 and 2.

It should be noted that this Channel Modification plan is optimized. Enlarging the channel to greater than a 20-foot bottom width would exceed the capacity of the existing bridges. A smaller channel would not utilize the capacity of the bridges. Hence, economic optimization is inherent in the design of this plan.

TABLE 1

Cost Estimate - Channel Modification

Channel Modification Component	Unit	Quantity	Unit Price ($)	Federal Cost ($)	Non-Federal Cost ($)
Tree Removal	Ac	0.2	4,800	960	
Clear & Grub	Ac	0.9	1,500	1,350	
Seeding	Ac	4.7	1,800	8,460	
Excavation/Spoil	yd^3	4,840	8	38,720	
Riprap	Ton	790	20	15,800	
Guard Rail	LF	650	20	13,000	
Utility Pole Reloc.	Item	12	500		6,000

TABLE 2

Cost Estimate - Channel Modification

Cost Summary Component	Unit	Quantity	Unit Price ($)	Federal Cost ($)	Non-Federal Cost ($)
Subtotal of Construction Costs				78,300	6,000
Contingencies	(%)	20		15,700	1,200
Total Construction Cost				94,000	7,200
E & D				32,000	800
S & A	(%)	7		6,300	N/A
Lands and Damages, Relocation Asst., Cost of Acquisition, and Contingencies	1	Job	Sum	0	110,000
Subtotal				132,300	118,000
Total Combined Project Cost ($250,300)					
5% Non-Federal Cash Contribution				-12,515	+12,515
Total First Cost (Cost-Sharing w/LERR >20%)				119,785	130,515
Reimbursement of Costs >50%				+5,365	-5,365
Final Project Costs				125,150	125,150
Annual Operation and Maintenance					1,600

CONCLUSION

Various structural and nonstructural measures, along with a No Federal Action plan, were considered to alleviate the flooding problem along Dry Run Creek in Oelwein, Iowa. A screening methodology was applied to the various measures to produce logical alternatives for evaluation and plan selection.

Based on NED criteria, Channel Modification is the selected plan. Various social and environmental factors are evaluated in both appendix B and the Environmental Assessment in support of this conclusion.

Although the Channel Modification plan provides significant economic benefits, flooding will still occur rather frequently. Water surface profiles for most flood events are generally reduced by less than 1 foot (see plates 7, 8, and 9 or compare plates A-4 and A-5, appendix A), and residual damages are relatively high (54%) with the Channel Modification plan. Overbank flooding would occur for floods greater than the 2-year event (plate 7) in some reaches. Hence, over time, the stage reduction effect of the project may not be perceived as significant by some property owners.

PRESENTATION OF FINAL ARRAY OF PLANS

The Channel Modification plan is environmentally sound and economically justifiable. Based on a detailed analysis of net benefits, Channel Modification is the NED plan. This plan maximizes net benefits, as described in appendix B.

SECTION 3 - DESCRIPTION OF THE SELECTED PLAN

INTRODUCTION

Based on economic, environmental, and social considerations previously described, the selected plan is the Channel Modification plan.

PLAN COMPONENTS

GENERAL

The selected plan of Channel Modification consists of approximately 3,500 lineal feet of channel improvement. Project layout and details of the selected plan are revealed on plates 4 through 6 and described in the paragraphs that follow.

The Channel Modification project would involve clearing the channel of debris, realigning and widening the channel bottom, and reshaping the channel side slopes. The channel bottom would be realigned and widened to a 20-foot width (plate 4) such that the project's right-of-way will not necessitate any residential, commercial, or industrial relocations.

The project would begin just upstream of the C&NW Railroad culvert (plate 5) and end at the downstream side of Third Street NE. (plate 6).

Components of the Channel Modification project include 0.9 acre of clearing and grubbing, 0.2 acre of tree removal, 4,840 yd3 of excavation and spoil, 4.7 acres of seeding, and 790 tons of riprap to line the channel. These components are listed on the project cost estimate, table 1.

REAL ESTATE REQUIREMENTS

For this Channel Modification project, it is estimated the city will acquire permanent easements for channel improvements and maintenance (4.1 acres). A temporary easement will be required for spoil disposal (0.6 acre). The lands affected by the project are primarily residential and commercial. The cost of right-of-way and acquisition is currently estimated at $110,000.

BEAUTIFICATION

Revegetation, an integral part of the beautification process, includes the seeding of all areas within the project right-of-way limits. In general, visibly disturbed areas within the project right-of-way will be landscaped to provide an asthetically pleasing appearance.

DESIGN AND CONSTRUCTION CONSIDERATIONS

The Channel Modification project would involve excavating approximately 4,840 yd^3 of material from the channel. This material would be hauled and spoiled at the site proposed on plate 10. Areas of the channel which are modified or disturbed by construction equipment would be seeded. To reduce the potential for erosion, riprap or grass pavers will be placed to 500 lineal feet downstream of the Frederick Avenue bridge (plate 5) and to 100 lineal feet downstream of the Second Street/Third Avenue bridge (plate 6). In developing plans and specifications, design engineers will determine if grass pavers should be used in place of riprap. Grass pavers may beautify the channel and allow safer access to and from the water's edge. The channel bottom slope, or "thalweg," would not be altered by project construction, as shown on plates A-4 and A-5.

A permanent right-of-way, which would extend to 10 feet on either side of the improved channel, would be required for construction and operation and maintenance.

GEOTECHNICAL CONSIDERATIONS

A geotechnical analysis of the selected plan was conducted and is included as appendix C. The analysis concludes that geotechnical considerations such as depth to bedrock, groundwater, and channel slope stability should not present a problem during project construction.

SCHEDULE

Plans and specifications are scheduled to be completed in the fall of 1987, and, assuming appropriation of funds, construction could begin as early as 1988 and require about 7 months to complete.

OPERATION AND MAINTENANCE CONSIDERATIONS

Assurance would be obtained from the city of Oelwein that it would maintain and operate the completed works in accordance with the requirements of the Secretary of the Army.

The project would be transferred to the city for operation and maintenance after completion. Subsequent to completion, an operation and maintenance manual would be completed by the Rock Island District, Corps of Engineers, and furnished to the city which would be assigned the responsibility for operation and maintenance.

Grassed channels should be mowed once a year (in September) to prevent trees and brush from restricting channel capacity. Riprap sections may require replacement after flood events. It may be necessary to annually clear bridge openings which may be restricted due to sedimentation.

PLAN ACCOMPLISHMENTS

The selected plan accomplishes the major planning objectives. The structural elements of the plan will provide an economically feasible and socially acceptable method of reducing flood damages. The plan will allow preservation and enhancement of existing open space and limited wildlife habitat to the extent possible. Major economic benefits that would result from the selected plan would be the reduction of existing and future flood damages. The major social benefit of the plan is a reduction in the mental anxieties of the residents as a result of the reduction of flood potential. Environmental values will be maintained to a major extent.

ECONOMIC CONSIDERATIONS

Cost estimates for the selected plan include costs for engineering, design, supervision, and administration and a 20 percent contingency factor. The period of analysis for the plan was selected as 50 years. Interest and amortization changes are based on a discount rate of 8-5/8 percent. The estimated first costs of the selected plan are summarized in table 3 and the annual costs are summarized in table 4.

ENVIRONMENTAL CONSIDERATIONS

The attached Environmental Assessment concludes that the selected plan for channel modification would have no significant environmental or cultural resource impacts.

TABLE 3

Summary of First Costs
Channel Modification Project

Item	Amount($) Federal	Non-Federal
Construction of Channel Modifications	94,000	7,200
Engineering and Design	32,000	800
Supervision and Administration	6,300	-
Lands and Damages (Value of Land, Relocation Assistance, and Cost of Acquisition)	-	110,000
FIRST COST a/	132,300	118,000
NON-FEDERAL CASH CONTRIBUTION (5%)	-12,515	+12,515
TOTAL FIRST COST (COST-SHARING)	119,785	130,515
COMBINED FEDERAL AND NON-FEDERAL FIRST COSTS	250,300	

NOTE: Figures include 20 percent contingencies.

a/ Assumes only Lands, Easements, Right-of-Way, and Relocations (LERR) as a non-Federal cost.

TABLE 4

Summary of Annual Costs
Channel Modification Project

Description	Amount ($)	Annual Cost ($)
Estimated First Cost	250,300	
Interest During Construction	10,800	
TOTAL FIRST COSTS	261,100	
Interest and Amortization (.08765)		22,900
Operation and Maintenance		1,600
TOTAL ANNUAL CHARGES		24,500

NOTE: Figures include 20 percent contingencies.

SECTION 4 - PLAN IMPLEMENTATION

INSTITUTIONAL REQUIREMENTS

Before construction of the selected plan, the following steps must be completed:

* After funding is initiated, detailed design plans, specifications, and an engineering estimate are prepared by the District Engineer. Bids are then solicited and a construction contract awarded. Local action is implemented during this same time.

* Following construction of the project, local interests assume responsibility for operation and maintenance.

IMPLEMENTATION RESPONSIBILITIES

Federal and non-Federal responsibilities and cost apportionment policies concerning construction and operation and maintenance for federally constructed projects have been set out by legislative and administrative guidance.

This action presents the pertinent information regarding the cost apportionment and Federal and non-Federal responsibilities involved in the construction of a local flood protection project for Oelwein, Iowa.

FEDERAL RESPONSIBILITIES

The Federal Government will design and construct the various features of the protection works. The work generally charged as a Federal cost includes that for the channel improvements.

Recently, the Congress and the Administration passed the Water Resources Development Act of 1986, Public Law 99-662 (PL 99-662). Public Law 99-662 requires project cost-sharing and financing across the entire spectrum of water resource development functions. The basic principle governing the development of specific cost-sharing policies is that, whenever possible, the cost of services produced by water projects should be paid by their direct beneficiaries. It is also recognized that the Federal Government can no longer bear the major portion of the financing of water resource projects. New sources of financing, both public and private, will have to be found.

Specific policies concerning the Oelwein project have been established. The cost-sharing formulas applicable to flood control projects are summarized in table 5.

TABLE 5

Cost-Sharing & Financing Requirements
as Contained in
The Water Resources Development Act of 1986 (PL 99-662)
17 November 1986

Project Purpose	Cost of Construction Participation		Non-Fed Financing		Responsibility LERR Lands, Easements ROW, Relocations	O&M
	Fed	Non-Fed	Cash	Amortize (1)		
Flood Control (including LERR)						
° Local Protection						
. LERR>20%	TBD	LERR + 5% (1)(2)	5%	None	non-Fed	non-Fed
. LERR<20%	75%	25% (1)	5%	None	non-Fed	non-Fed
. LERR<20%	65%	35% (1)	5%	30% less LERR	non-Fed	non-Fed

1/ Credit can be given for value of lands, easement, ROW, dredged material disposal areas, and relocations acquired or accomplished by non-Fed's.

2/ Non-Federal sponsor will not pay more than 50% of the total project cost.

At Oelwein, the cost of Lands, Easements, Right-of-Way, and Relocations (LERR) is $118,000 (table 3). This amount is greater than 20 percent of the combined total first cost of $250,300. Thus, as shown on table 5, the non-Federal share of the construction cost would be the LERR plus 5 percent of the total cost, or $130,515. The Federal first cost is $119,785. The Government will refund to the city the value of any LERR which exceeds 45 percent of the total project costs, such refund currently being estimated at $5,365.

NON-FEDERAL RESPONSIBILITIES

The estimated total first cost (Federal and non-Federal costs) of this project is estimated at $250,300. In accordance with the cost-sharing policies of Congress and the Administration, the city must pay a minimum of 25 percent ($62,575) of the total project costs, with at least 5 percent thereof being in the form of a cash payment. Based on the value of rights-of-way and other items, however, it is estimated that the city's cost will be approximately $130,515. In this connection, prior to the start of construction, and in accordance with Section 221 of Public Law 91-611, the city must enter into a written agreement with the United States that it will:

a. Provide without cost to the Government all lands, easements, and rights-of-way, including suitable borrow and dredged material disposal areas, as may be determined by the Chief of Engineers to be necessary for construction and maintenance of the project, currently estimated at $110,000.

b. Hold and save the Government free from all damages arising from the construction, operation, and maintenance of the completed project, except for damages due to the fault or negligence of the Government or its contractors.

c. Operate, maintain, and rehabilitate the project upon completion in accordance with regulations or directions prescribed by the Secretary of the Army.

d. Accomplish without cost to the Government all alterations and relocations of buildings, streets, storm drains, utilities, highway bridges, and other structures and improvements made necessary by construction of the project, currently estimated at $8,000.

e. Prevent encroachment on any of the flood protection structures, including the ponding areas, and if ponding areas are impaired, provide substitute storage capacity or equivalent pumping capacity promptly without cost to the Government.

f. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, approved 2 January 1971, in acquiring lands, easements, and rights-of-way for construction and subsequent operation and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

g. Provide a minimum of 25 percent of the total project costs, with not less than 5 percent (currently estimated at $12,515) of total project costs to be in the form of a cash payment.

h. Contribute all project costs in excess of the Federal statutory limitation of $5,000,000.

i. Publicize floodplain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to ensure compatibility between future development and protection levels provided by the project.

j. At least annually, notify persons in the affected area that the project will not provide complete protection.

k. Comply with Section 601 of Title VI of the Civil Rights Act of 1964 (P.L. 88-352) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, in connection with the maintenance and operation of the project.

The Agreement also will grant the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the city owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, repairing, and maintaining the project. If an inspection shows that the city for any reason is failing to complete, operate, repair, and maintain the project in accordance with the assurances hereunder, the Government will send a written notice to the city. If the city persists in such failure for 30 calendar days after receipt of the notice, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon lands the city owns or controls for access to the project for the purpose of completing, operating, repairing, or maintaining the project. No completion, operation, repair, or maintenance by the Government shall operate to relieve the city of responsibility to meet its obligations as set forth in the Agreement, or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to the Agreement.

A draft of this agreement is included on page D-24, in Appendix D - Pertinent Correspondence.

SECTION 5 - SUMMARY OF COORDINATION, PUBLIC VIEWS, AND COMMENTS

VIEWS OF FEDERAL AGENCIES

This Detailed Project Report and Environmental Assessment are being furnished to pertinent Federal agencies for their review. Letters previously received from Federal agencies expressing views and recommendations are included in Appendix D - Pertinent Correspondence.

As recommended by the Soil Conservation Service in their Flood Study Report, dated March 1982, landowners upstream of East Line Road are encouraged to practice land conservation techniques, such as installing tile outlet terraces. Measures such as these may not only slow the loss of topsoil but may reduce the frequency of flooding along Dry Run Creek.

VIEWS OF NON-FEDERAL AGENCIES

The alternative plans of improvement were coordinated with officials of the city of Oelwein and with interested local and State agencies. A public meeting was held to obtain views and comments from local interests. Preliminary support of the Channel Modification plan was expressed by city officials. Letters and comments received are contained in appendix D.

PUBLIC VIEWS

Public involvement seeks to create awareness and stimulate interest in a Corps of Engineers study. It is designed to encourage two-way communication and public participation in the planning and decisionmaking process of the study. The major objectives of the Public Involvement Program for the Detailed Project Study are to:

a. Continually identify affected and interested individuals and groups within the study area.

b. Be responsive to the level of interest and concern expressed by the public.

c. Keep the Public Involvement Program visible and understood by the participating publics.

A public workshop was held in February 1986 to present an overview of the Detailed Project Study and to obtain public views on the alternative flood damage reduction measures to be studied. The meeting was attended by 17 individuals, including city council members, agency representatives, and city residents.

Comments from the public were solicited on the Draft DPR and Environmental Assessment by providing agency representatives, city officials, and concerned citizens copies of the report. In February 1987, the Rock Island District met with agency representatives, city officials, and the public to discuss comments and project features in detail. The city was in favor of the Channel Modification project, as evidenced by its Letter of Intent dated April 1, 1987 (see appendix D).

PUBLIC ACCEPTANCE

Project success is sensitive to public acceptance. For the selected plan, Channel Modification, the proposed channel is too small in cross section to have well-defined levels of flood protection or levels where all waters of a certain level of flooding are contained within the banks of the channel.

Although it is possible that the project would be acceptable in the short term, the perceptions of the damage reduction in the long term may result in negative attitudes. Table B-16 (page B-23 of the economic appendix) shows the damage and water surface reductions expected from the project. Although there are significant economic benefits, the residual damage is very high (54%) and the water surface is reduced generally less than 1 foot (as shown on plates 7, 8, and 9). Hence, the reduction in damage attributable to the Channel Modification project will probably not be perceived by the majority of property owners as being significant.

SECTION 6 - RECOMMENDATION

I recommend that the NED plan, which would reduce damages from flooding on Dry Run Creek in Oelwein, Iowa, be approved for construction with such modification as, in the discretion of the Chief of Engineers, may be advisable.

The Channel Modification plan includes 3,500 lineal feet of improved channel, of which 2,850 lineal feet is grass-lined and 650 lineal feet is riprap-lined. The project would produce net annual benefits of $13,800 and has a benefit-to-cost ratio of 1.6, based on a 50-year economic life and a discount rate of 8-5/8 percent. The estimated total cost of the project is $250,300.

The Water Resources Development Act of 1986 (PL 99-662) requires that flood control projects be subject to cost-sharing. Based on these requirements, the non-Federal cost of the Oelwein project is $125,150 ($130,515 first cost less $5,365 refund after final audit). In the event that cost-sharing requirements are changed or modified, the specific cost-sharing of the project shall be acceptable to the President and the Congress.

Accordingly, I recommend authorization to construct and otherwise implement the project subject to cost-sharing and financing arrangements which are satisfactory to the President and the Congress.

Neil A. Smart
Colonel, U.S. Army
District Engineer

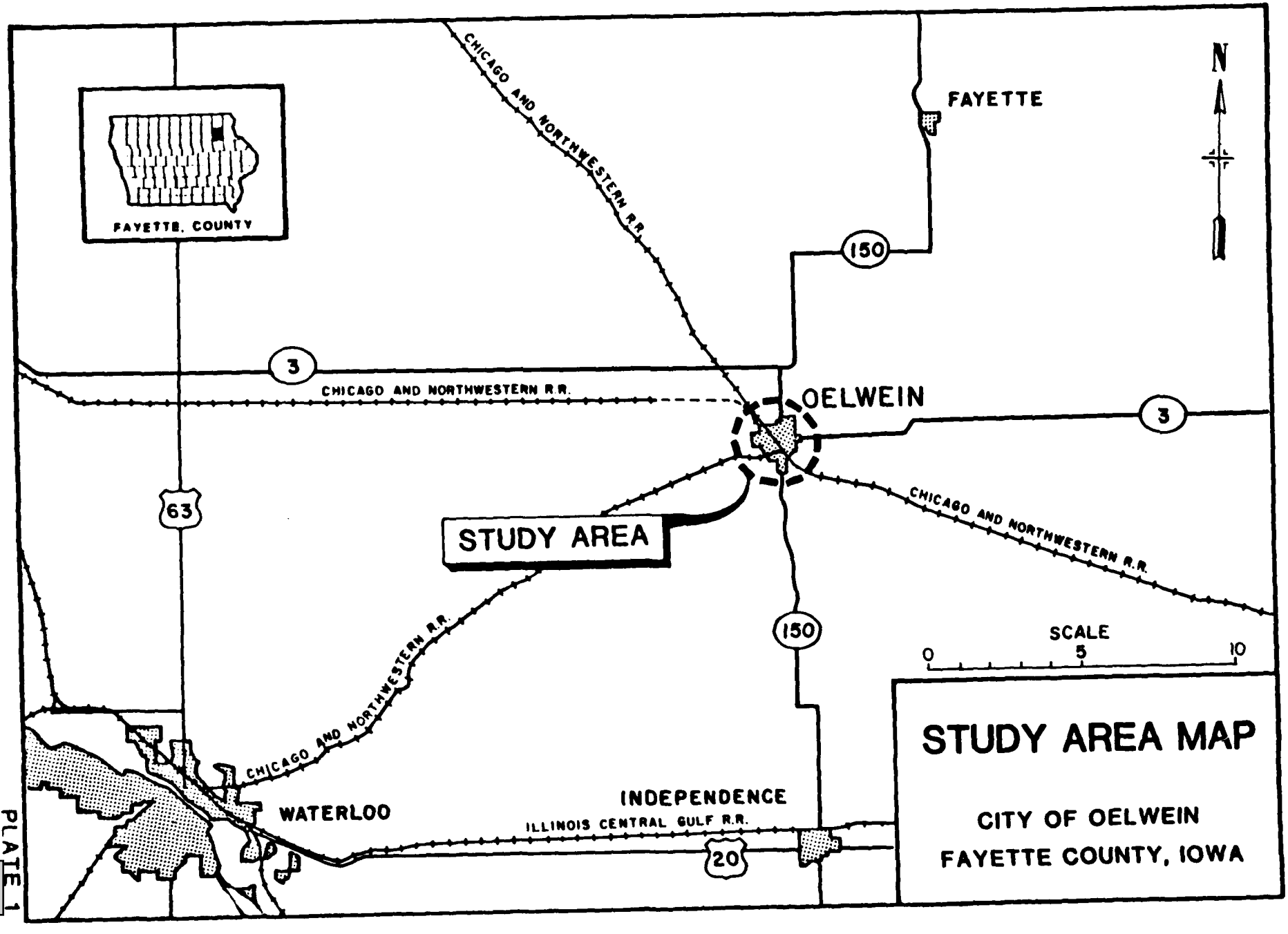

FAYETTE COUNTY
CHICAGO AND NORTHWESTERN R.R.
FAYETTE
N
150
3
CHICAGO AND NORTHWESTERN R.R.
OELWEIN
3
63
STUDY AREA
CHICAGO AND NORTHWESTERN R.R.
150
SCALE
0
5
10
CHICAGO AND NORTHWESTERN R.R.
WATERLOO
INDEPENDENCE
ILLINOIS CENTRAL GULF R.R.
20
STUDY AREA MAP
CITY OF OELWEIN
FAYETTE COUNTY, IOWA

PLATE 1

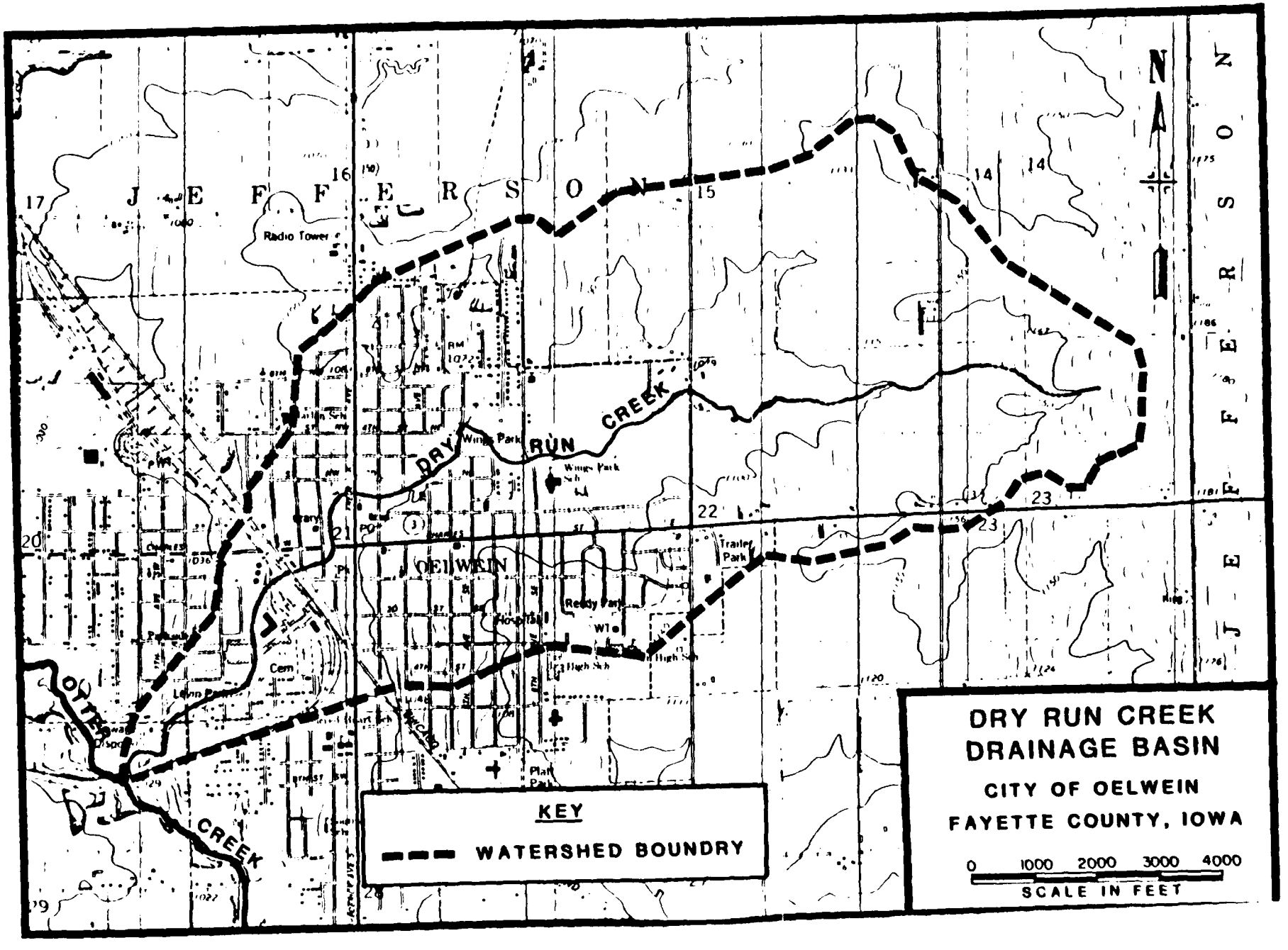
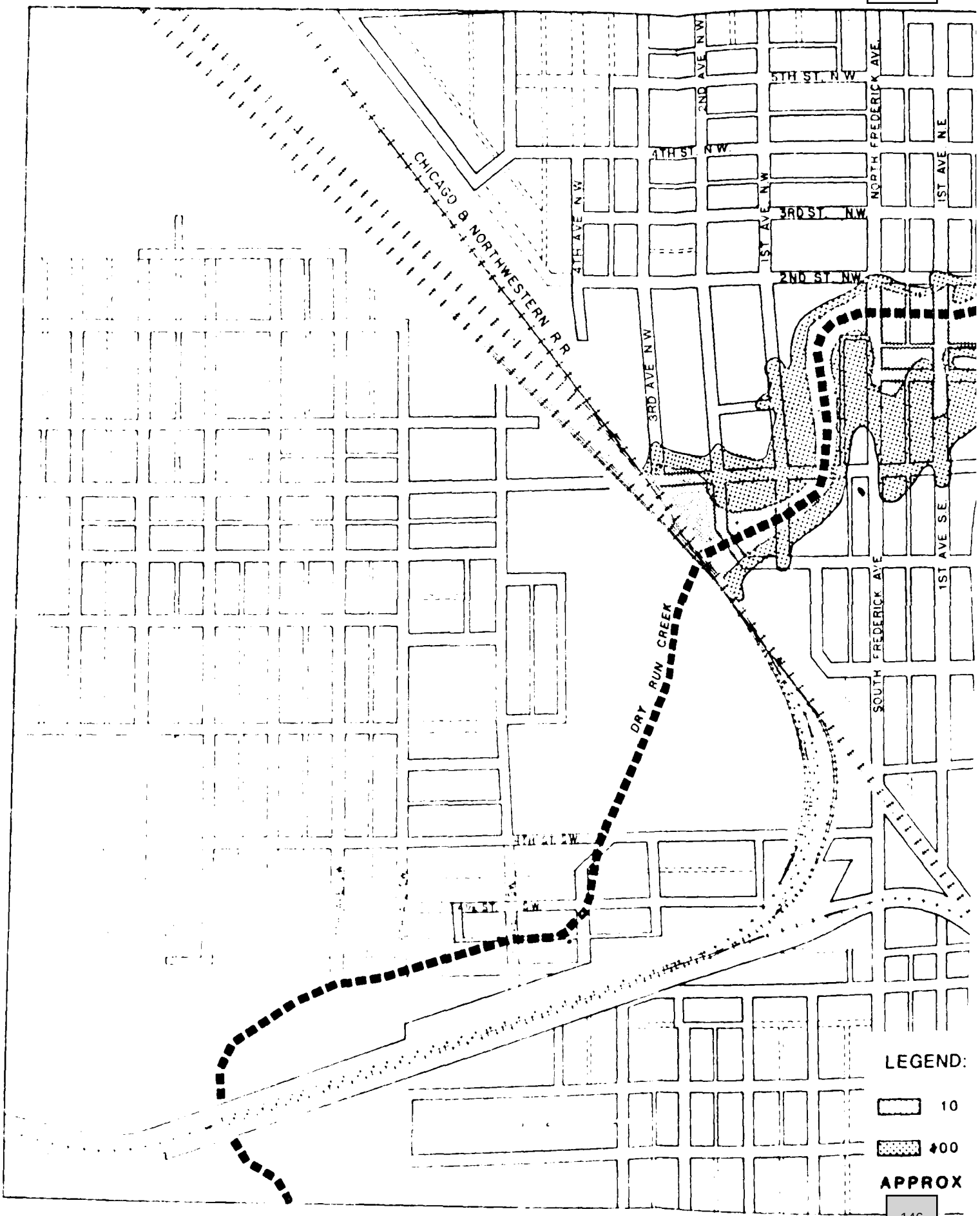
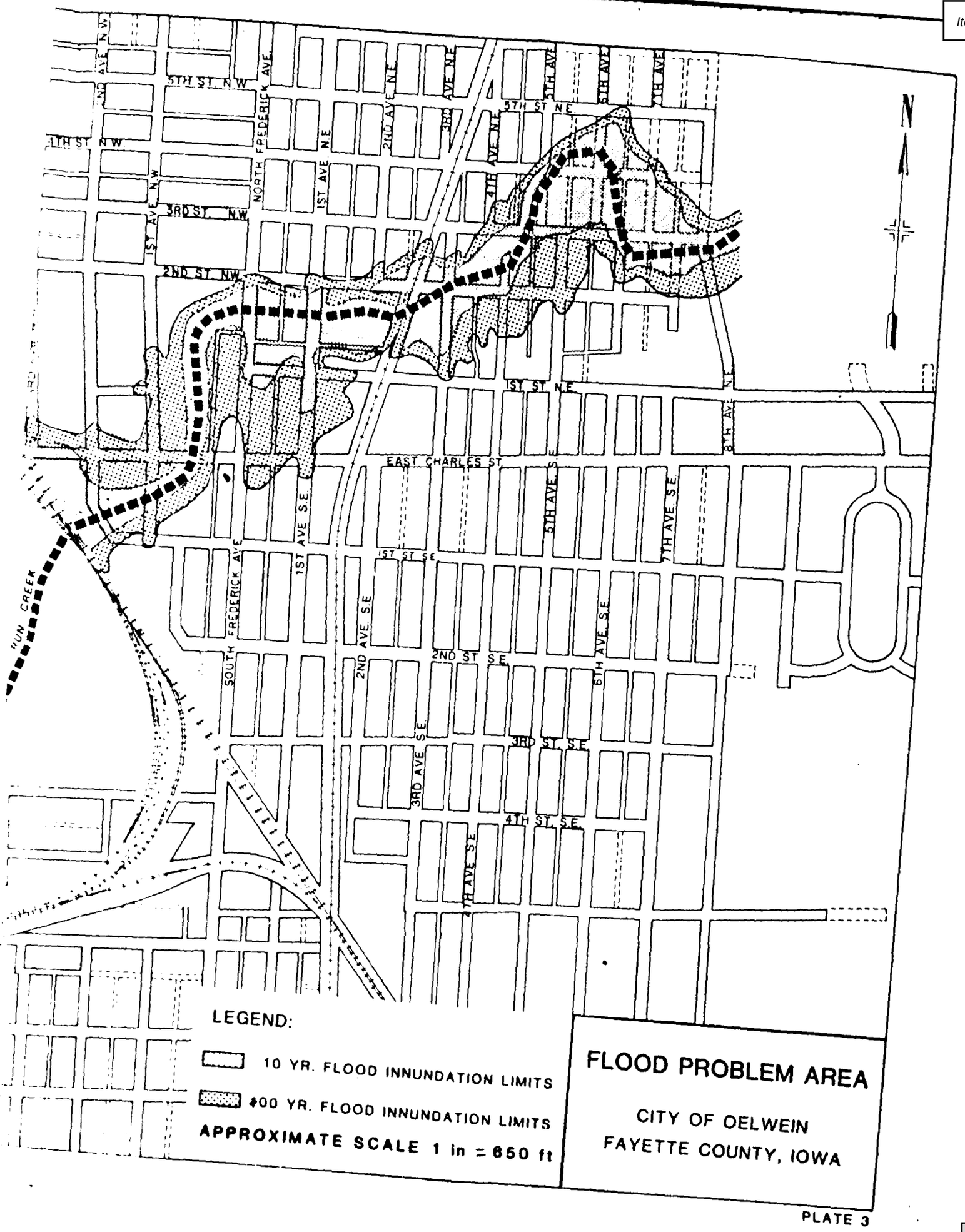
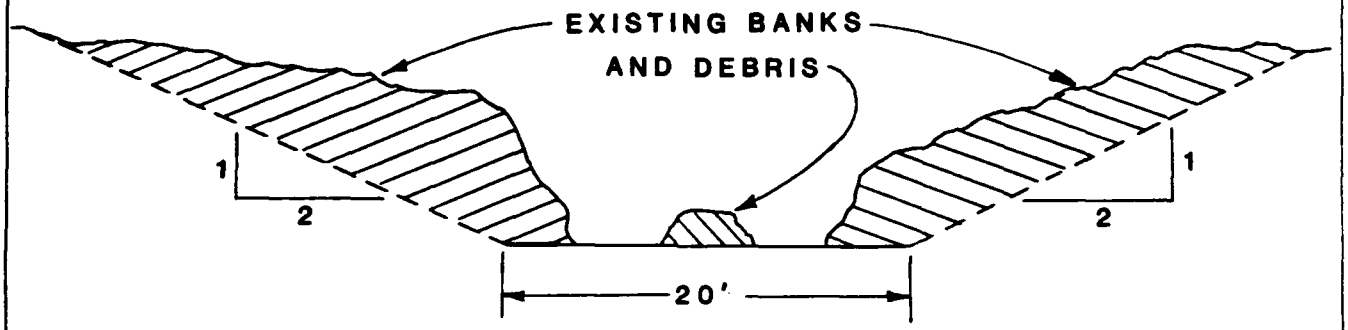

JEFFERSON
JEFFERSON
N
Radio Tower
DRY RUN CREEK
OELWEIN
Trailer Park
Reddy Park
Wings Park
Cem
Plat Park
OTTER CREEK
KEY
WATERSHED BOUNDRY
DRY RUN CREEK
DRAINAGE BASIN
CITY OF OELWEIN
FAYETTE COUNTY, IOWA
0 1000 2000 3000 4000
SCALE IN FEET

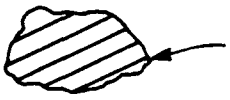
PLATE 2


CHICAGO & NORTHWESTERN R.R.
DRY RUN CREEK
5TH ST. NW
4TH ST. NW
3RD ST. NW
2ND ST. NW
2ND AVE NW
4TH AVE NW
3RD AVE NW
1ST AVE NW
NORTH FREDERICK AVE.
1ST AVE NE
1ST AVE SE
SOUTH FREDERICK AVE
LEGEND:
10
100
APPROX


5TH ST. N.W.
4TH ST. N.W.
3RD ST. N.W.
2ND ST. NW
1ST ST. N.E.
EAST CHARLES ST.
1ST ST. S.E.
2ND ST. S.E.
3RD ST. S.E.
4TH ST. S.E.
NORTH FREDERICK AVE.
SOUTH FREDERICK AVE.
1ST AVE N.E.
2ND AVE N.E.
3RD AVE N.E.
4TH AVE N.E.
5TH AVE N.E.
7TH AVE N.E.
1ST AVE S.E.
2ND AVE S.E.
3RD AVE S.E.
4TH AVE S.E.
5TH AVE S.E.
6TH AVE S.E.
7TH AVE S.E.
8TH AVE N.E.
RUN CREEK
N
LEGEND:
10 YR. FLOOD INNUNDATION LIMITS
400 YR. FLOOD INNUNDATION LIMITS
APPROXIMATE SCALE 1 in = 650 ft
FLOOD PROBLEM AREA
CITY OF OELWEIN
FAYETTE COUNTY, IOWA
PLATE 3

CHANNEL MODIFICATION



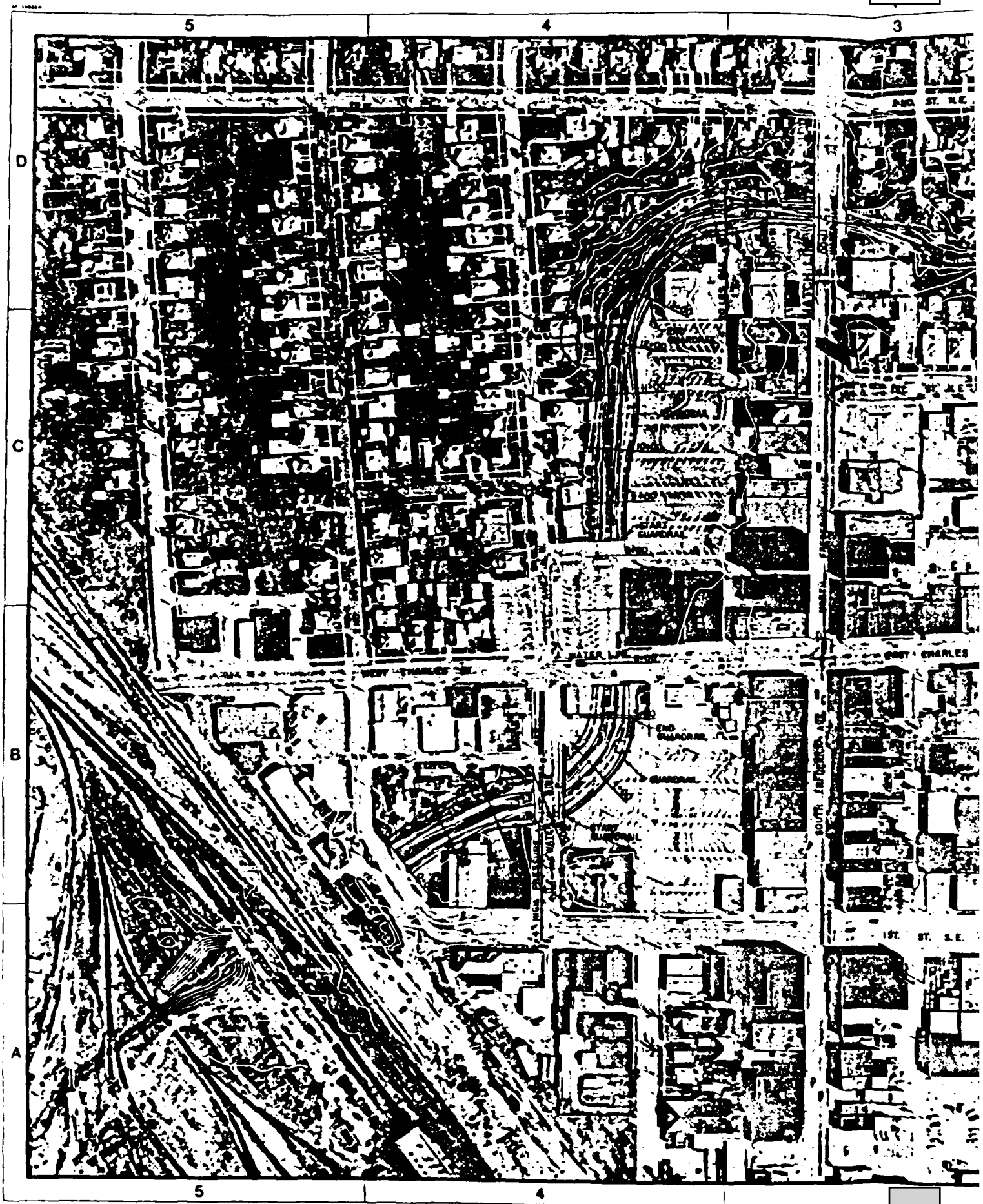


PROPOSED CHANNEL MODIFICATION PROJECT

CITY OF OELWEIN

FAYETTE COUNTY, IOWA

PLATE 4


5
4
3
D
C
B
A
WEST CHARLES ST.
EAST CHARLES
END GUARDRAIL
GUARDRAIL
1ST. ST. S.E.
5
4

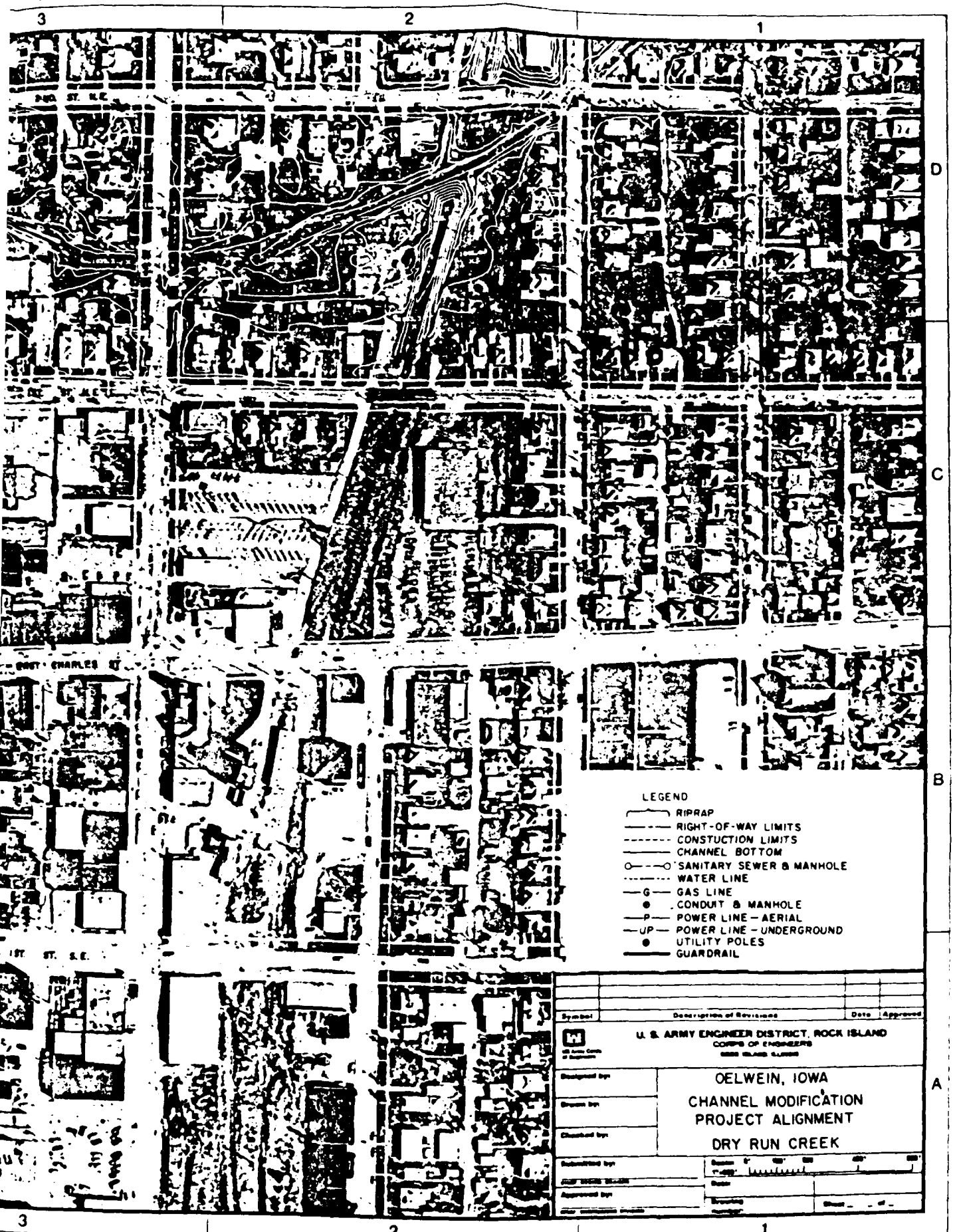
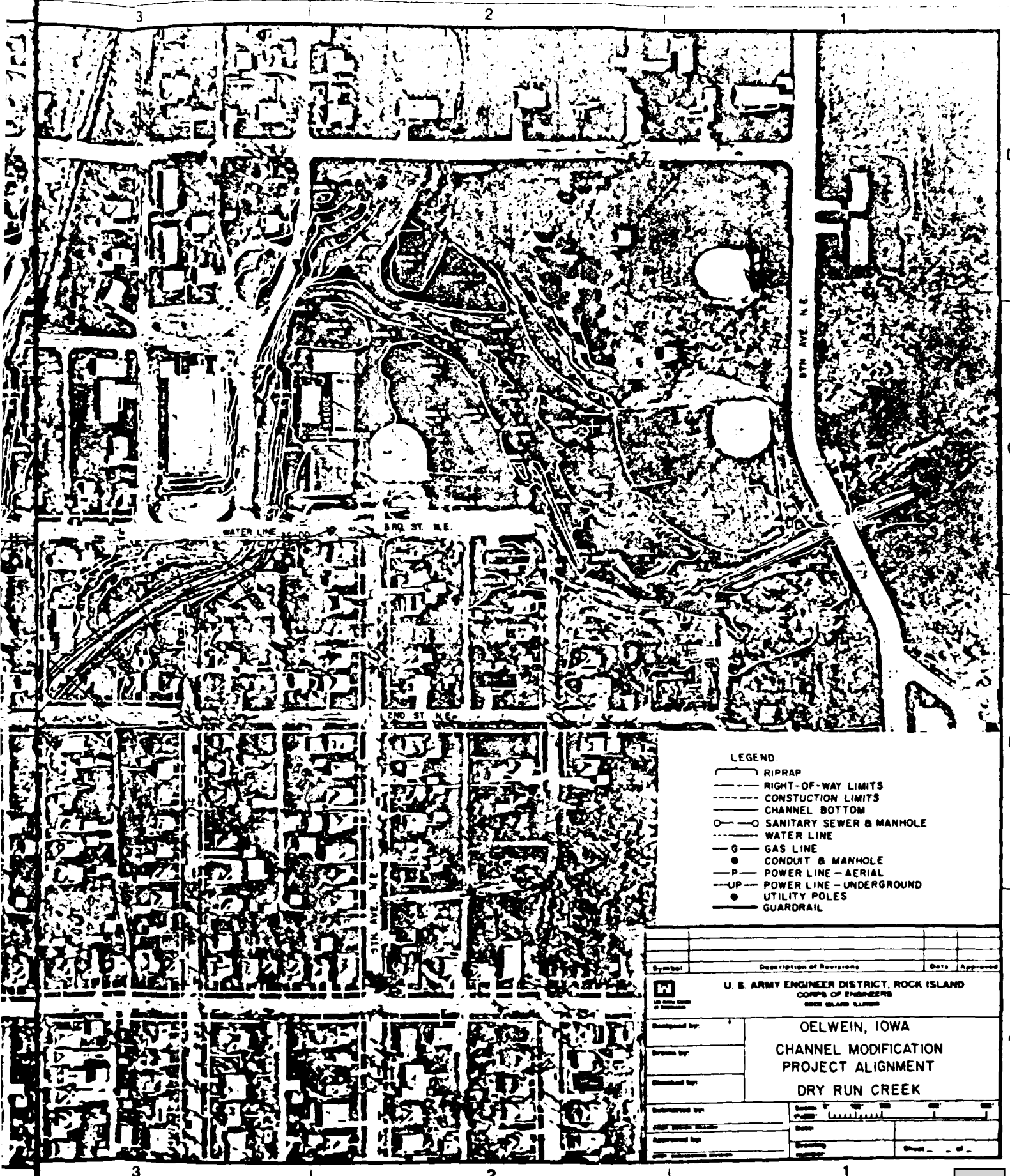

3
2
1
D
C
B
A
EAST CHARLES ST
1ST ST. S.E.
LEGEND
RIPRAP
RIGHT-OF-WAY LIMITS
CONSTUCTION LIMITS
CHANNEL BOTTOM
SANITARY SEWER & MANHOLE
WATER LINE
GAS LINE
CONDUIT & MANHOLE
POWER LINE – AERIAL
POWER LINE – UNDERGROUND
UTILITY POLES
GUARDRAIL
Symbol
Description of Revisions
Date
Approved
U. S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
Designed by
Drawn by
Checked by
Submitted by
Approved by
OELWEIN, IOWA
CHANNEL MODIFICATION
PROJECT ALIGNMENT
DRY RUN CREEK
Scale
Date
Drawing
Sheet
3
2
1

PLATE 5


5
4
3
D
C
B
A
NORTH FREDERICK AVE.
1ST AVE NE
RIPRAP
MATCH LINE
MATCH LINE
5
4
3


3
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A
8TH AVE. N.E.
3RD ST. N.E.
2ND ST. N.E.
WATER LINE
LEGEND
RIPRAP
RIGHT-OF-WAY LIMITS
CONSTUCTION LIMITS
CHANNEL BOTTOM
SANITARY SEWER & MANHOLE
WATER LINE
GAS LINE
CONDUIT & MANHOLE
POWER LINE - AERIAL
POWER LINE - UNDERGROUND
UTILITY POLES
GUARDRAIL
Symbol
Description of Revisions
Date
Approved
U. S. ARMY ENGINEER DISTRICT, ROCK ISLAND
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
Designed by
Drawn by
Checked by
Submitted by
Approved by
OELWEIN, IOWA
CHANNEL MODIFICATION
PROJECT ALIGNMENT
DRY RUN CREEK
Scale
Date
Drawing
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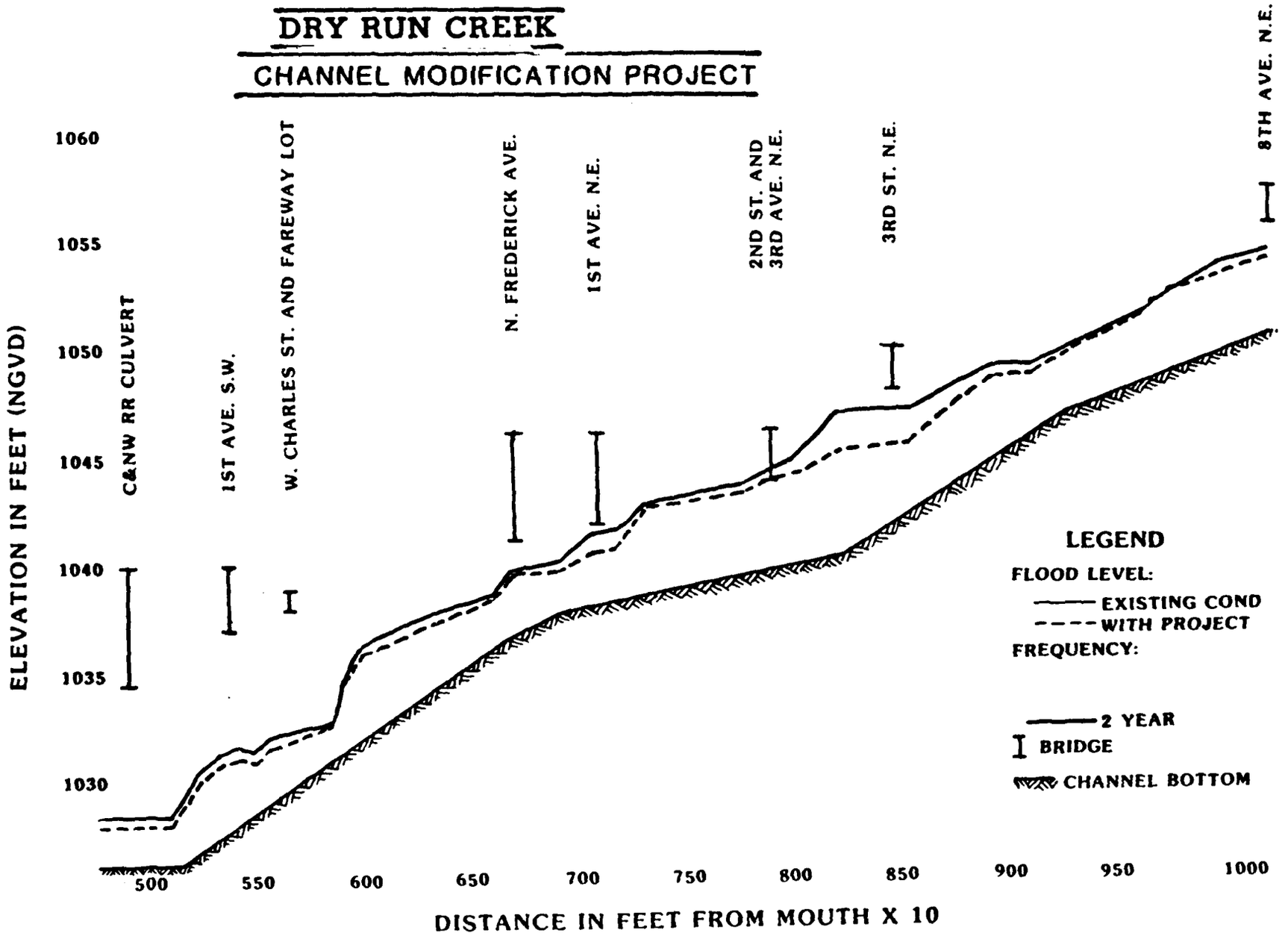
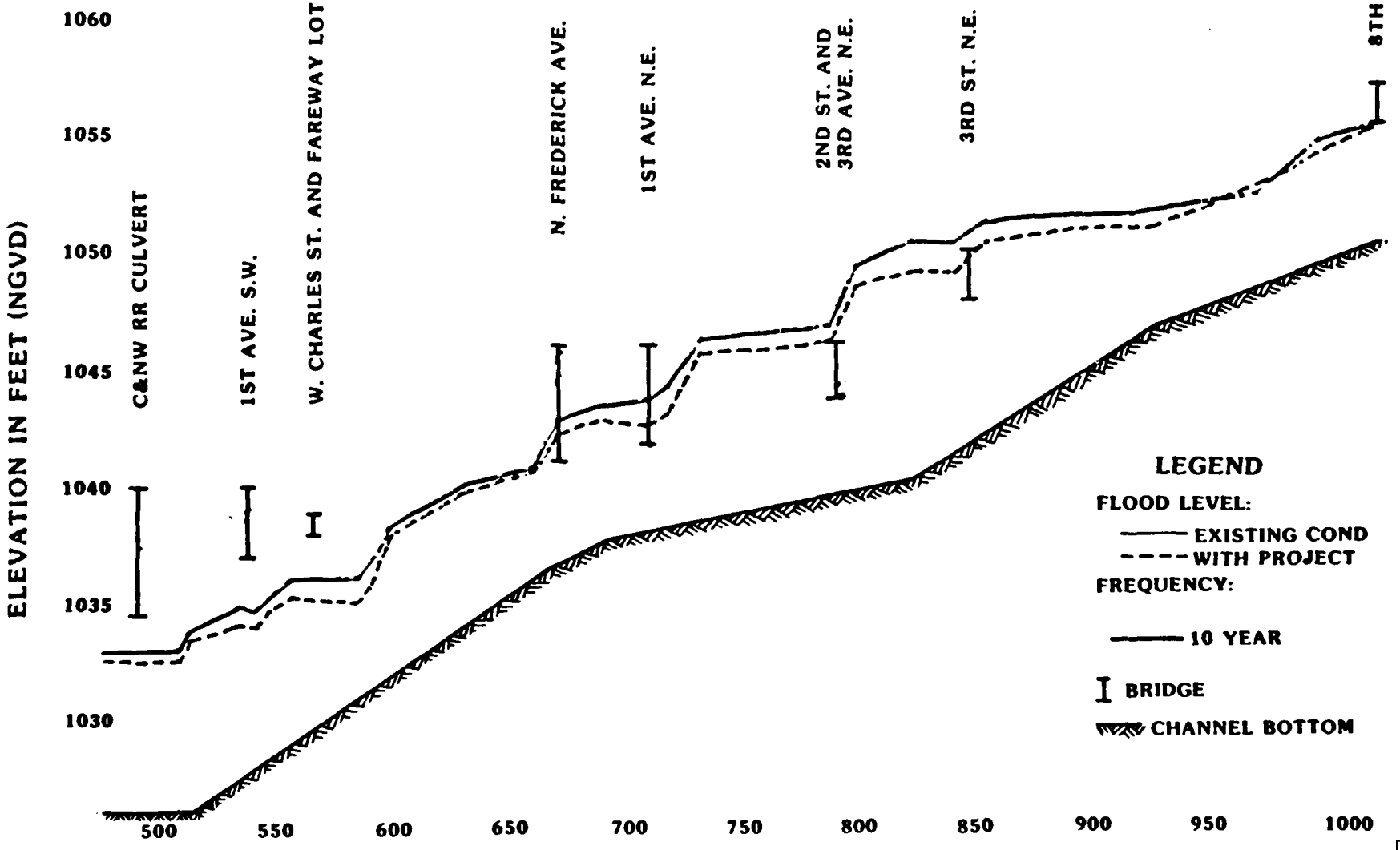
PLATE

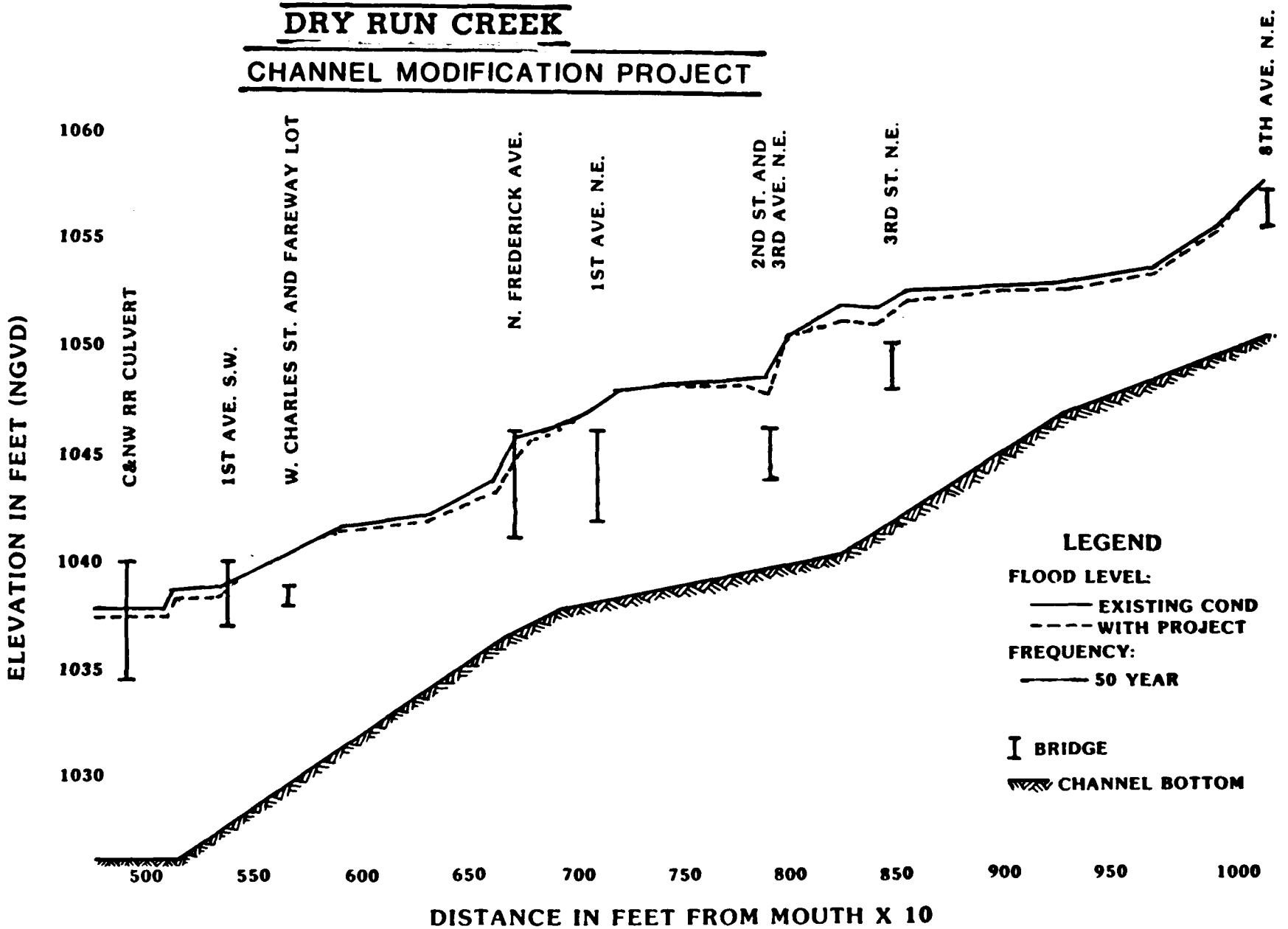

DRY RUN CREEK
CHANNEL MODIFICATION PROJECT
ELEVATION IN FEET (NGVD)
1060
1055
1050
1045
1040
1035
1030
C&NW RR CULVERT
1ST AVE. S.W.
W. CHARLES ST. AND FAREWAY LOT
N. FREDERICK AVE.
1ST AVE. N.E.
2ND ST. AND 3RD AVE. N.E.
3RD ST. N.E.
8TH AVE. N.E.
LEGEND
FLOOD LEVEL:
EXISTING COND
WITH PROJECT
FREQUENCY:
2 YEAR
BRIDGE
CHANNEL BOTTOM
500
550
600
650
700
750
800
850
900
950
1000
DISTANCE IN FEET FROM MOUTH X 10

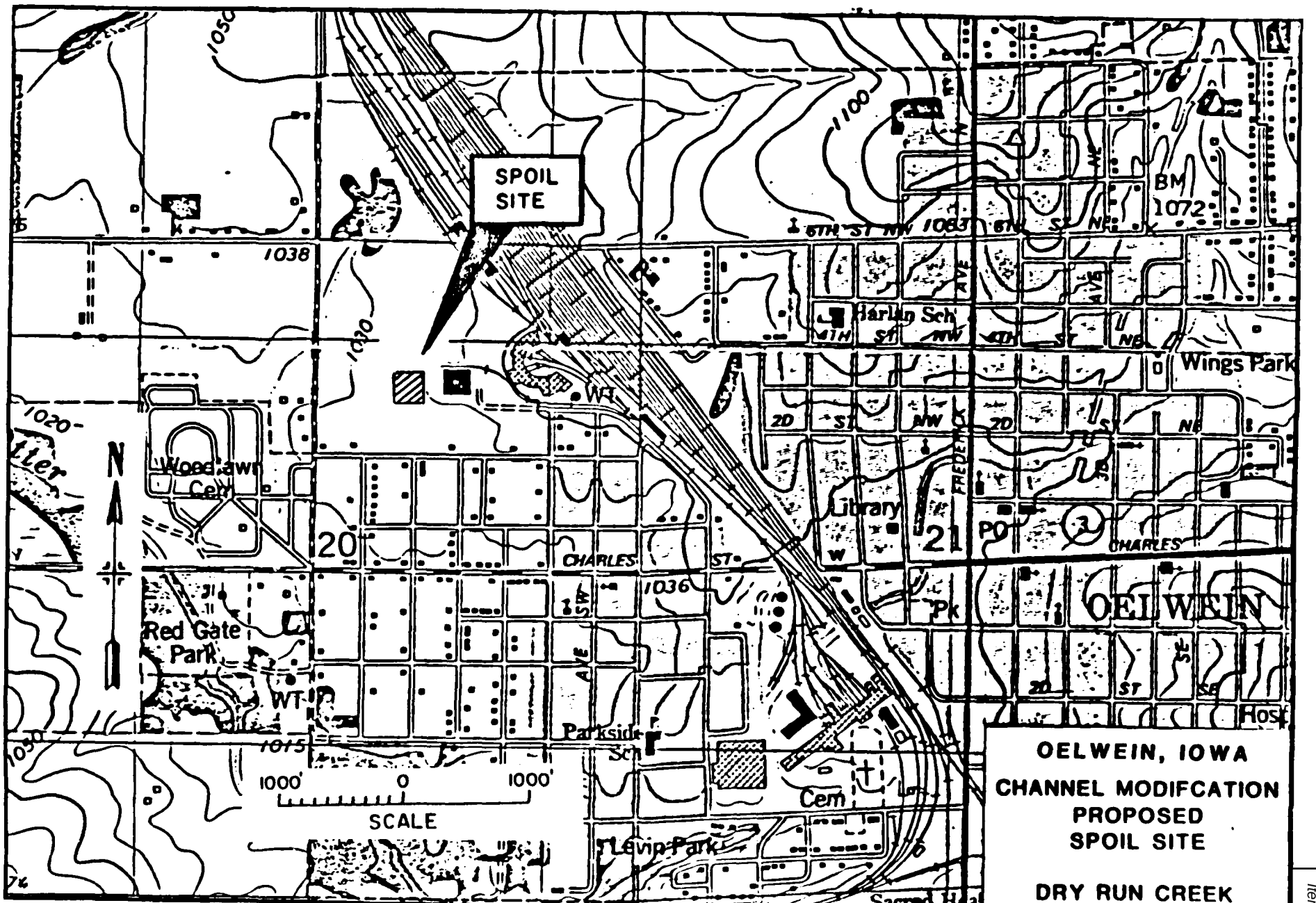
PLAT

DRY RUN CREEK

CHANNEL MODIFICATION PROJECT




DRY RUN CREEK
CHANNEL MODIFICATION PROJECT
ELEVATION IN FEET (NGVD)
1060
1055
1050
1045
1040
1035
1030
C&NW RR CULVERT
1ST AVE. S.W.
W. CHARLES ST. AND FAREWAY LOT
N. FREDERICK AVE.
1ST AVE. N.E.
2ND ST. AND 3RD AVE. N.E.
3RD ST. N.E.
8TH AVE. N.E.
500
550
600
650
700
750
800
850
900
950
1000
DISTANCE IN FEET FROM MOUTH X 10
LEGEND
FLOOD LEVEL:
EXISTING COND
WITH PROJECT
FREQUENCY:
50 YEAR
BRIDGE
CHANNEL BOTTOM



OELWEIN, IOWA

CHANNEL MODIFCATION

PROPOSED

SPOIL SITE

DRY RUN CREEK

PLATE 10

Oelwein Flood Mitigation Scoping Study

City Council

May 13th, 2024

Marie Amundson, PE

Today's Presentation

- **Background: Historical Flooding in Oelwein**
- Scope of Work for this Study
- Modeling: Proposed Mitigation Alternatives
- Recommended Option #1: Regional Pond 3b Revised
- Recommended Option #2: 1st Ave SW Bridge Removal
- Recommended Option #3: Charles St Parking Lot Removal
- Recommended Option #4: Property Acquisition
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- Funding
- Next Steps

MSA

Historical Flooding in Oelwein

- Riverine flooding from Dry Run Creek
- Drainage Area Upstream of RR Culvert: 2.9 sq miles

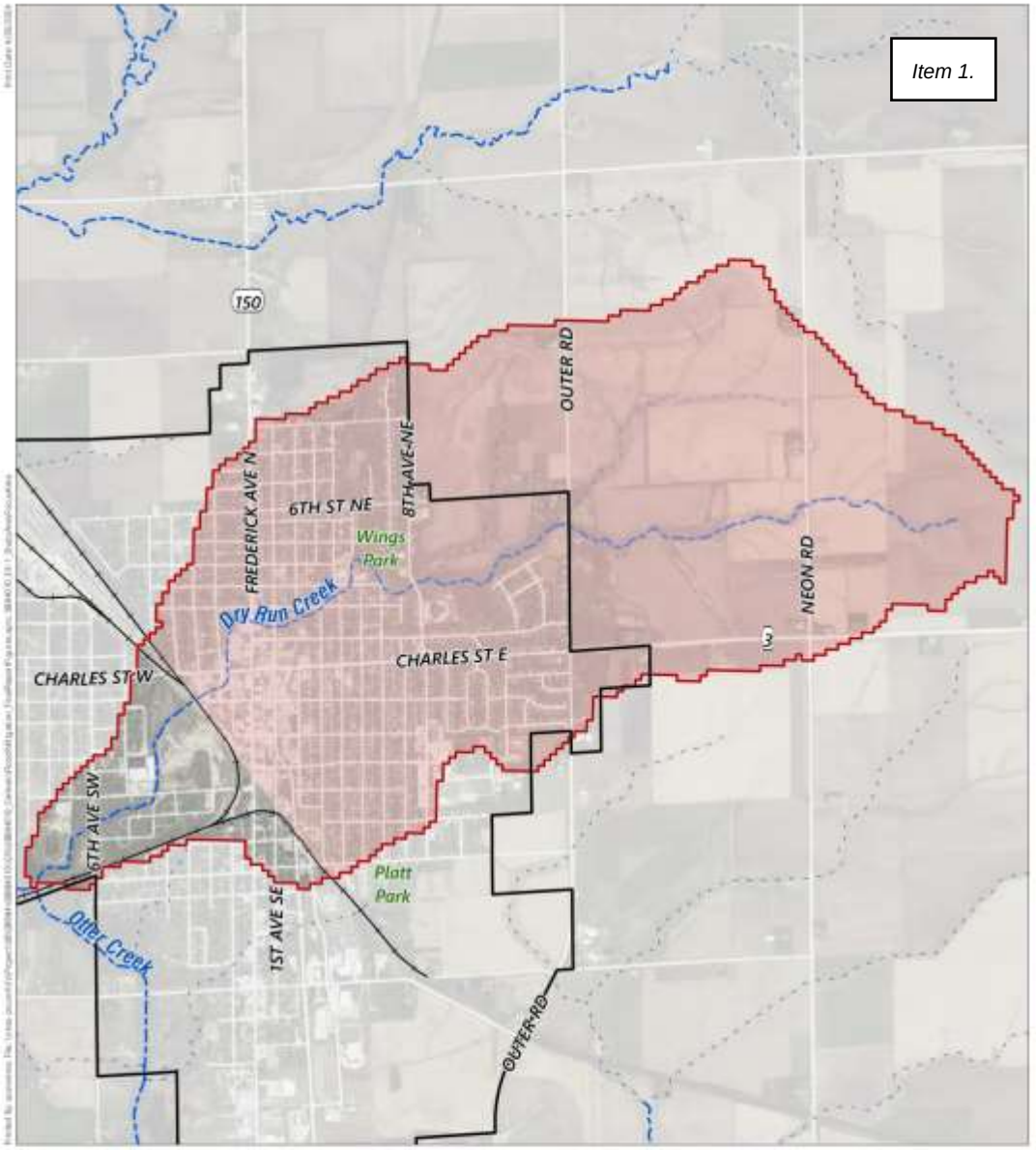
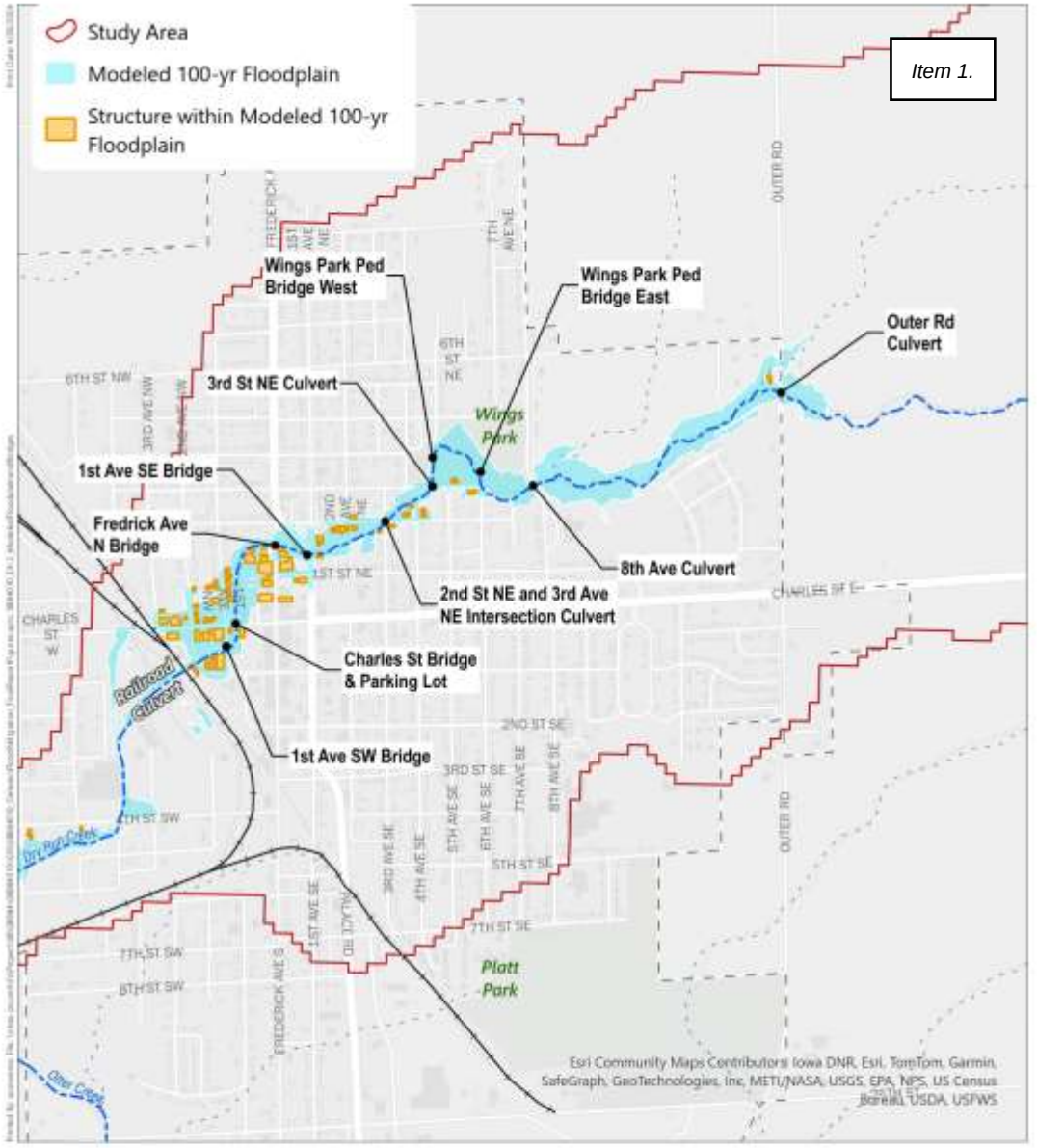


Figure 1-1
Flood Mitigation Planning

Historical Flooding in Oelwein

- Many structures within the 100-yr floodplain, including the Fire Department
- Creek restricted by bridges and Railroad Culvert
- Charles Street Viaduct acts as secondary overland flow path



Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Floodplain Extents: FEMA (2021/05/17)

0 0.13 0.25 Miles

Modeled 100-yr Floodplain and Existing Bridges & Culverts

Fig -2
Flood Mitigation ng

Historical Flooding in Oelwein

- Dry Run Creek overtops the banks and regularly floods the downtown areas
- Largest daily total

Date	Daily Total Precipitation (in)
July 23, 2010	9.93
September 7, 1989	7.19
June 15, 1925	6.5
August 31, 1981	6.38
June 10, 2020	5.48
July 19, 1963	4.63
July 26, 1940	4.55
August 21, 1966	4.44
May 16, 1999	4.38
September 8, 1941	4.25

Flooding along Charles Street, June 2020. Photo from the Oelwein Daily Register.

Historical Flooding in Oelwein

Prior Studies for Flood Reduction in Oelwein:

- **1981 Storm Sewer Study:** Recommended detention upstream of 8th Ave NE, surface water interception, and soil stabilization.
- **1982 Flood Study Report:** Recommended channel improvements, tile outlet terraces, and floodwater detention upstream of 8th Ave NE.
- **1983 Initial Appraisal:** Recommended more detailed study of flood reduction methods.
- **1987 Army Corp of Engineers Flood Control Project:** Recommended widening the channel but indicated that flooding would still occur in the 2-yr storm.
- **2021 Iowa CTP Real Time Technical Assistance:** Recommended bridge removal, upstream detention basins, widening the channel, and flood walls

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MSA

Scope of Work for this Study

Use the 2021 Study as a starting point:

1. **Update Floodplain Mapping:** Update the Federal Emergency Management Agency (FEMA) regulatory floodplain model for Dry Run Creek to add additional detail to support flood reduction alternative analyses
2. **Mitigation Alternatives:** Conceptualize and model flood mitigation alternatives
3. **Recommendations:** Identify preferred mitigation alternatives
4. **Benefit/Cost Analysis:** Estimate the benefits using the FEMA BCA toolkit, and estimate design & construction costs for each alternative
5. **Funding:** Review funding options to complete mitigation project(s)

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MSA

Modeling: Proposed Mitigation Alternatives

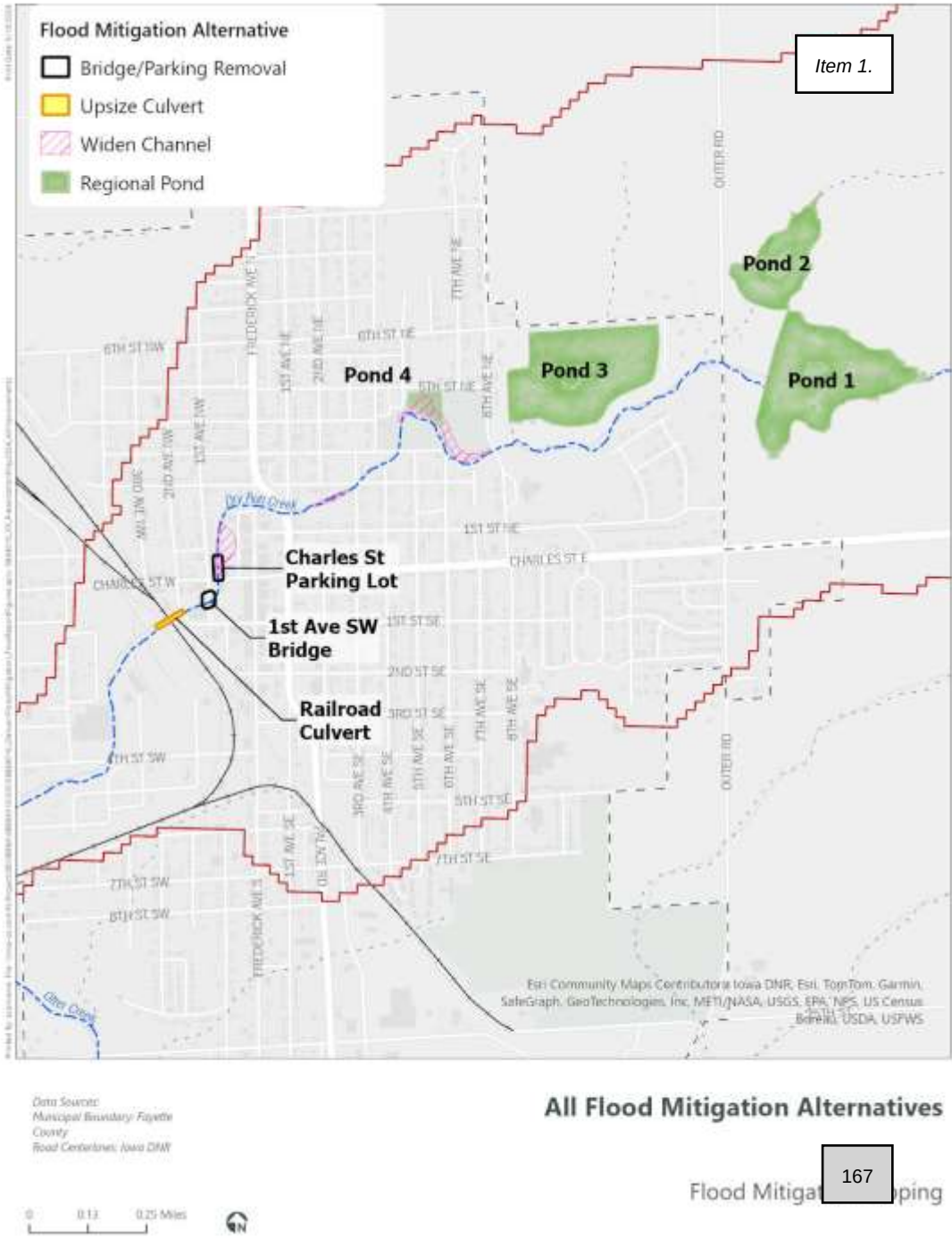
- New 10-, 50-, 100- and 500-yr floodplain maps for existing conditions
- Mitigation alternatives added to the model to estimate flood reduction

- **Water Surface Elevation (WSEL):** The height of flood waters of various magnitudes and frequencies in a floodplain
- **Discharge:** The amount of water that passes a

Modeling: Proposed Mitigation Alternatives

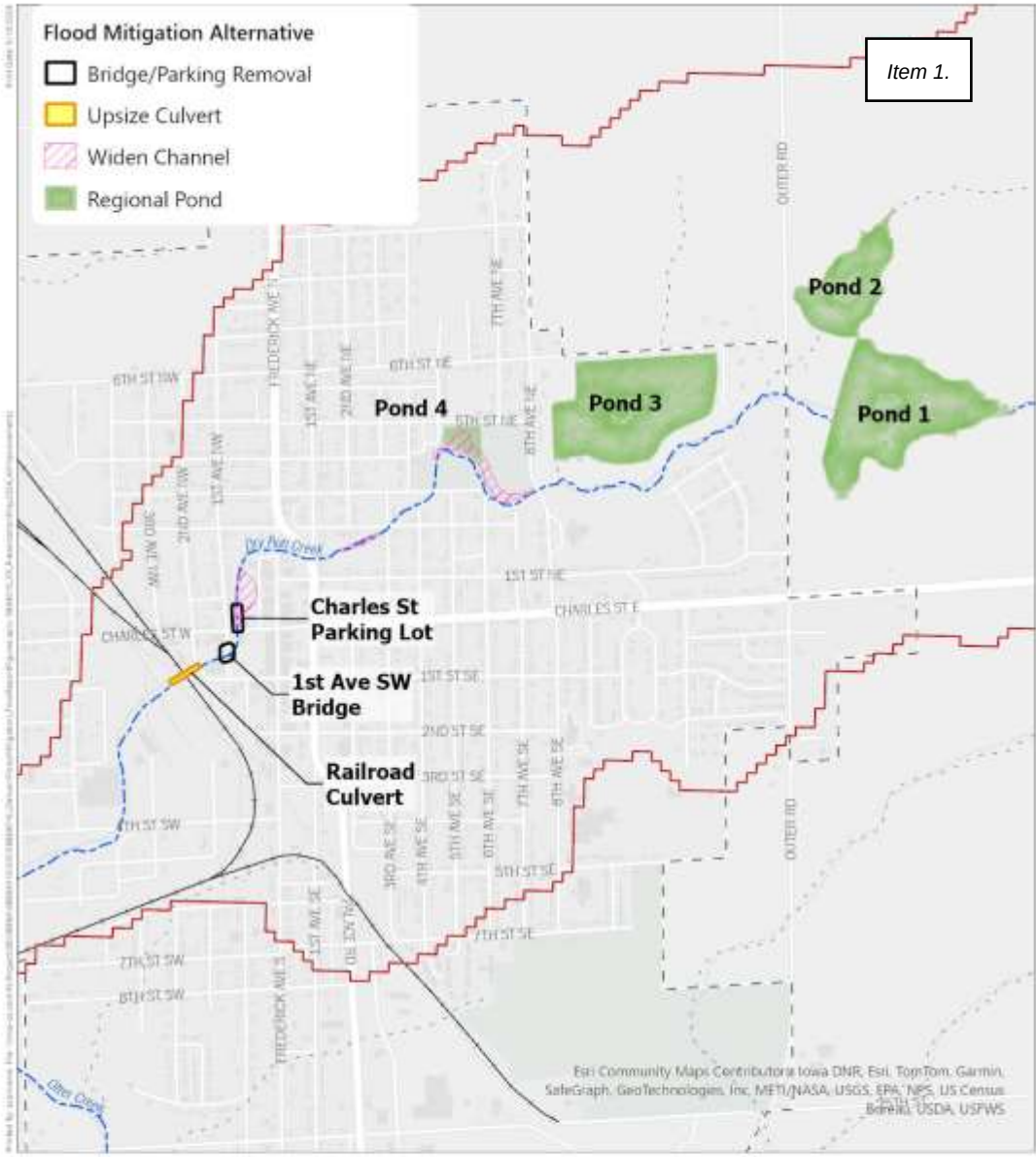
Considerations when Reviewing Alternatives

- **Cost Effective**
- Do not negatively impact other properties. Do not "shift the problem elsewhere"
- Storage solutions designed to 100-yr event
- No floodwalls
- Upsizing culvert under RR would be



Modeling: Proposed Mitigation

Modeled Alternative	# of Structures Removed from the Modeled 100-yr Floodplain
Modeled Existing Conditions	(69 Total)
Pond 1	64
Pond 2	1
Pond 3a	8
Pond 3b	66
Pond 4	1
Pond 1+2	67
Pond 1 + 3a	67
Pond 2 + 3a	11
Pond 1 + 2 + 3a	67
Pond 1 + 2 + 3b	67
Remove 1st Ave SW Bridge	6
Remove Charles St Parking Lot	0
Remove portion of RR Culvert	0
RR Upsize	10
Widen Channel	1

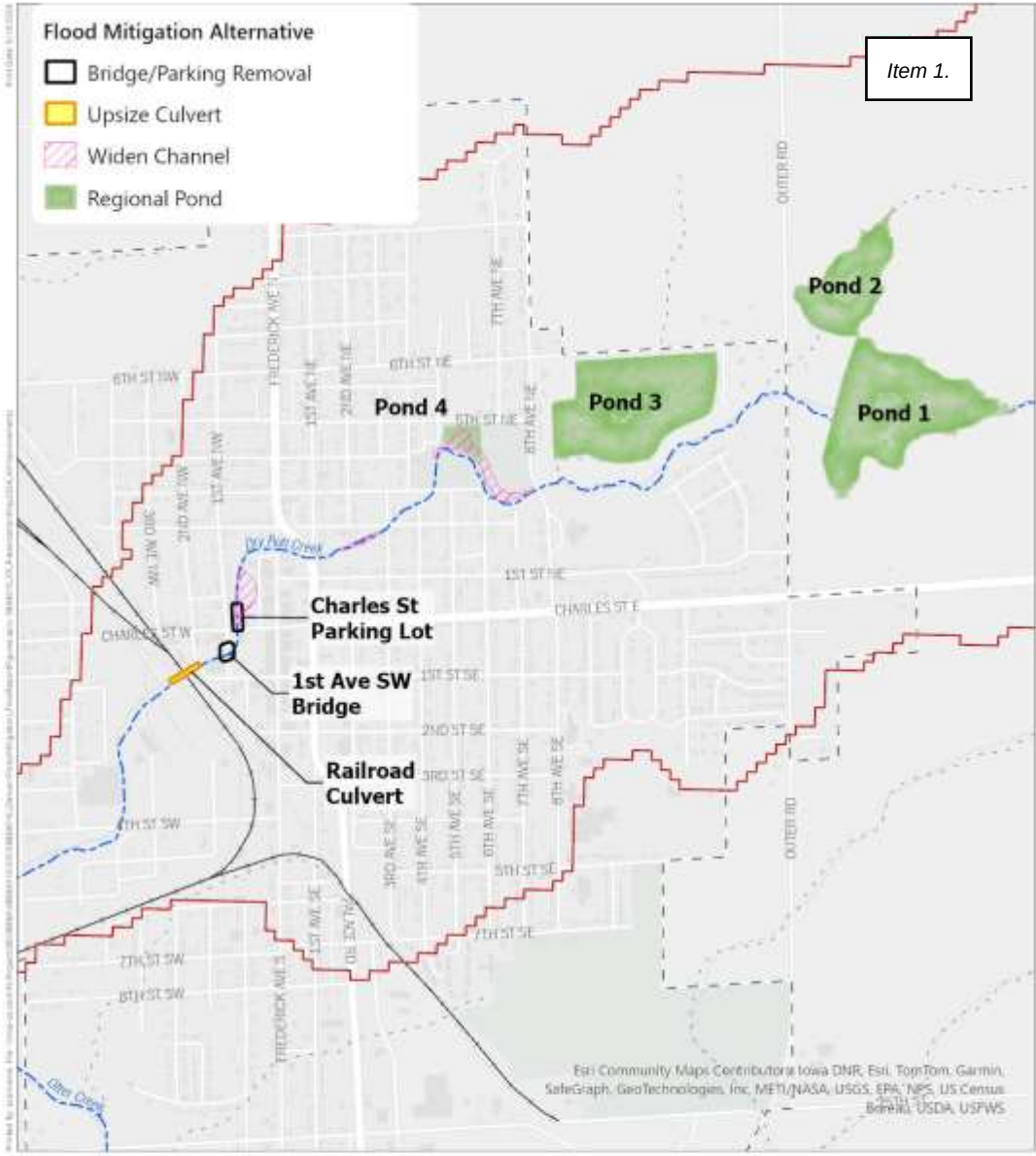


All Flood Mitigation Alternatives

Flood Mitigat ping

Modeling: Proposed Mitigation Alternatives

Modeled Alternative	# of Structures Removed from the Modeled 100-yr Floodplain
Modeled Existing Conditions	(69 Total)
Pond 1	64
Pond 2	1
Pond 3a	8
Pond 3b	66
Pond 4	1
Pond 1+2	67
Pond 1 + 3a	67
Pond 2 + 3a	11
Pond 1 + 2 + 3a	67
Pond 1 + 2 + 3b	67
Remove 1st Ave SW Bridge	6
Remove Charles St Parking Lot	0
Remove portion of RR Culvert	0
RR Upsize	10
Widen Channel	1



All Flood Mitigation Alternatives

Property Acquisition. Not modeled within HEC-RAS but permanently removes a structure from the floodplain

Today's Presentation

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MSA

Recommended Option #1: Regional Pond 3b Revised

- Within City Limits
- Diverts Dry Run Creek into pond
- Maintain low-flow through channel
- Only stores water during large rain events
- Berm to protect homes to the south
- Requires property acquisition
- Attempt to keep all fill onsite
- *Ecosystem Services*: Converts agricultural

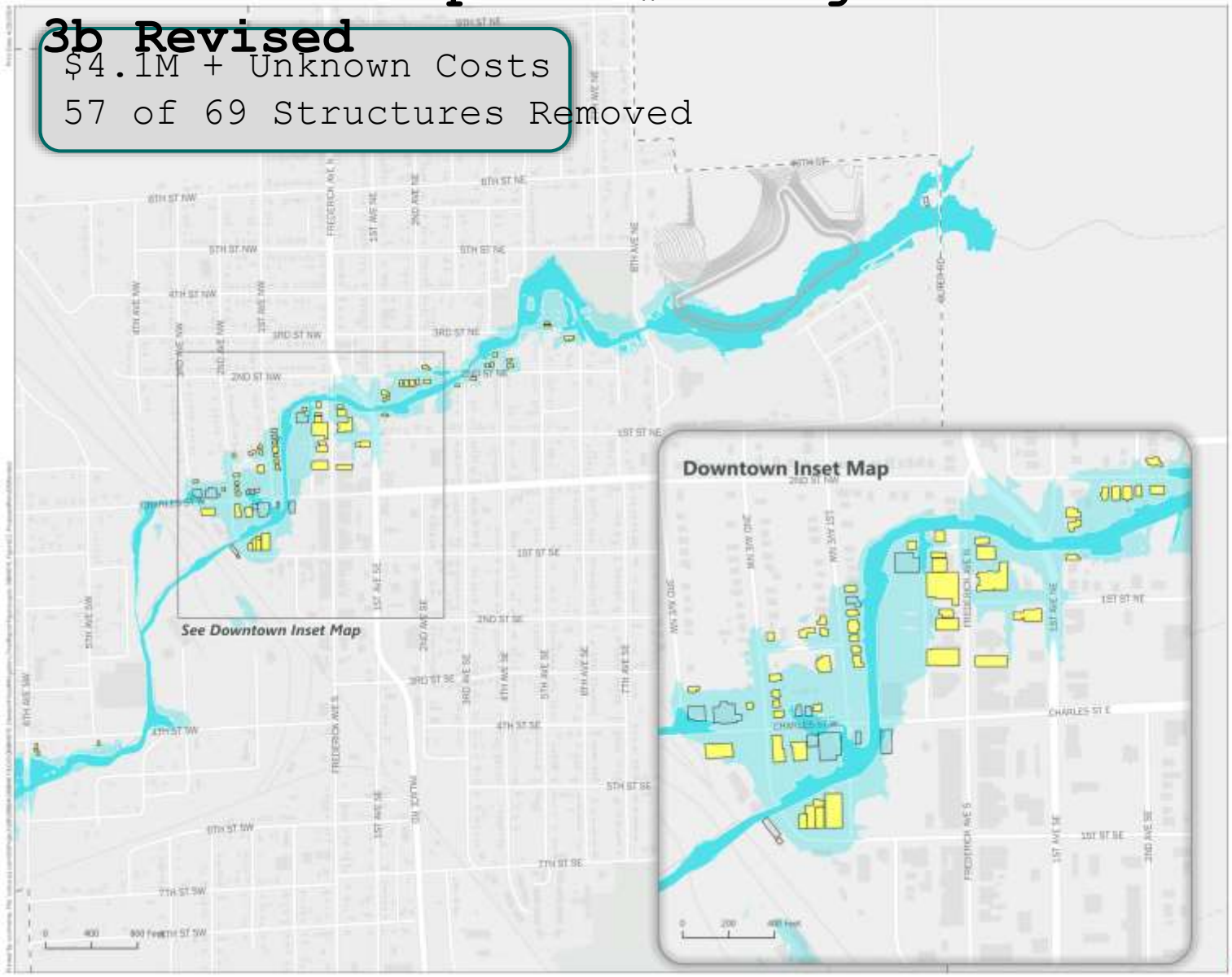
Proposed Pond 3b Revised Concept

EX-3

Flood Mitigat ping

Recommended Option #1: Regional Pond 3b Revised

$4.1M + Unknown Costs
57 of 69 Structures Removed



Proposed Pond 3b Revised Floodplain

Figure 22
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA

- Oelwein
- Existing 100-yr Floodplain
- With Pond 3b as a Dam, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (57)

Preliminary Concept Pond

- 10-ft Contour
- 2-ft Contour

In this alternative, Pond 3b Revised would be classified as a Dam.

Data Sources
Municipal Boundary: Fayette County
Floodplain Extents: MSA
Basemap: Esri Community Maps Contributors, Iowa DNR, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri Community Maps Contributors, Iowa DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

MSA

Today's Presentation

- Background: Historical Flooding in Oelwein
- Scope of Work for this Study
- Modeling: Proposed Mitigation Alternatives
- Recommended Option #1: Regional Pond 3b Revised
- **Recommended Option #2: 1st Ave SW Bridge Removal**
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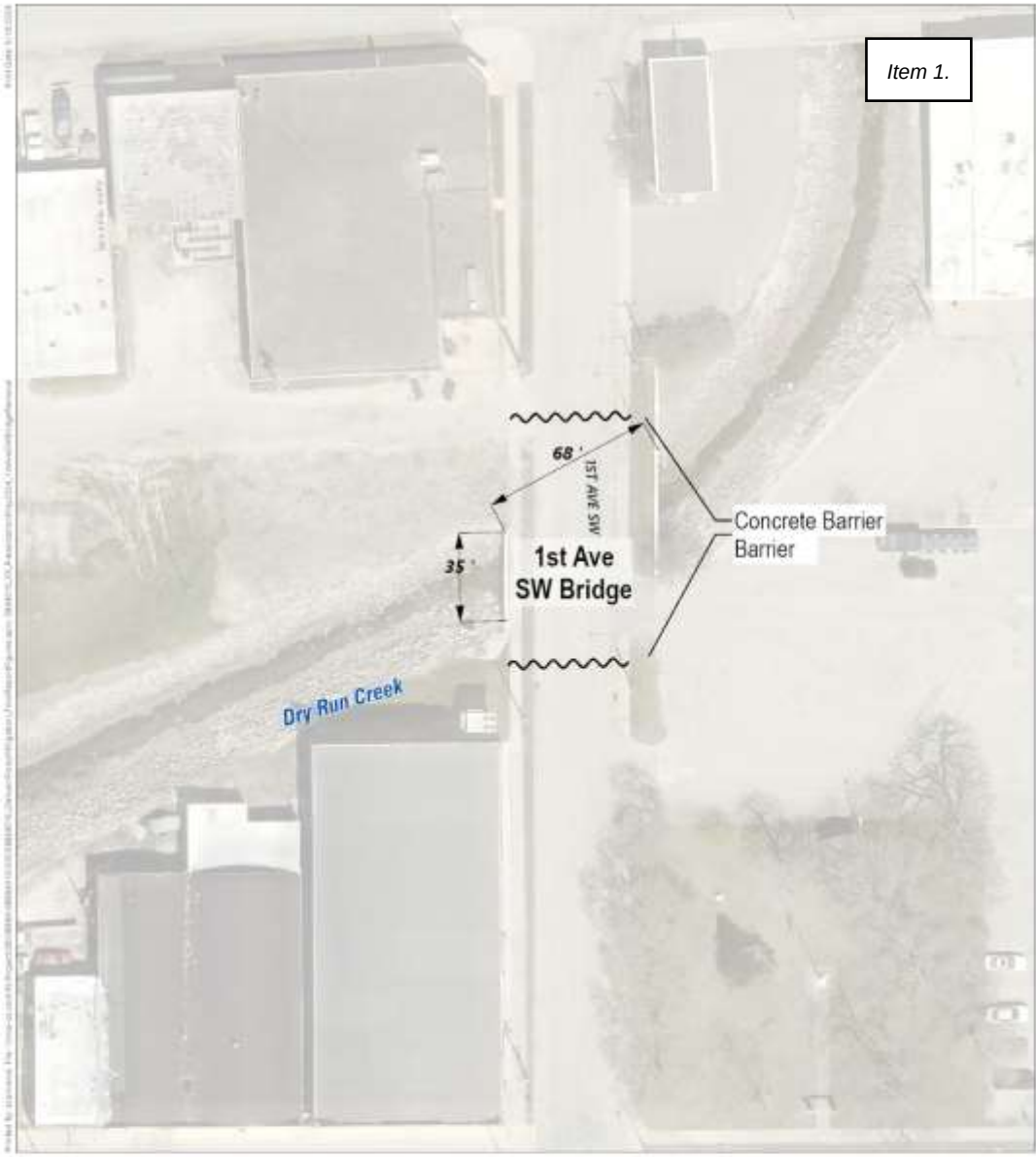
MSA

Recommended Option #2: 1st Ave SW Bridge Removal

- One-time up-front cost
- Other transportation options for residents to get downtown
- Bridge is in poor condition
- Install concrete barriers to block access

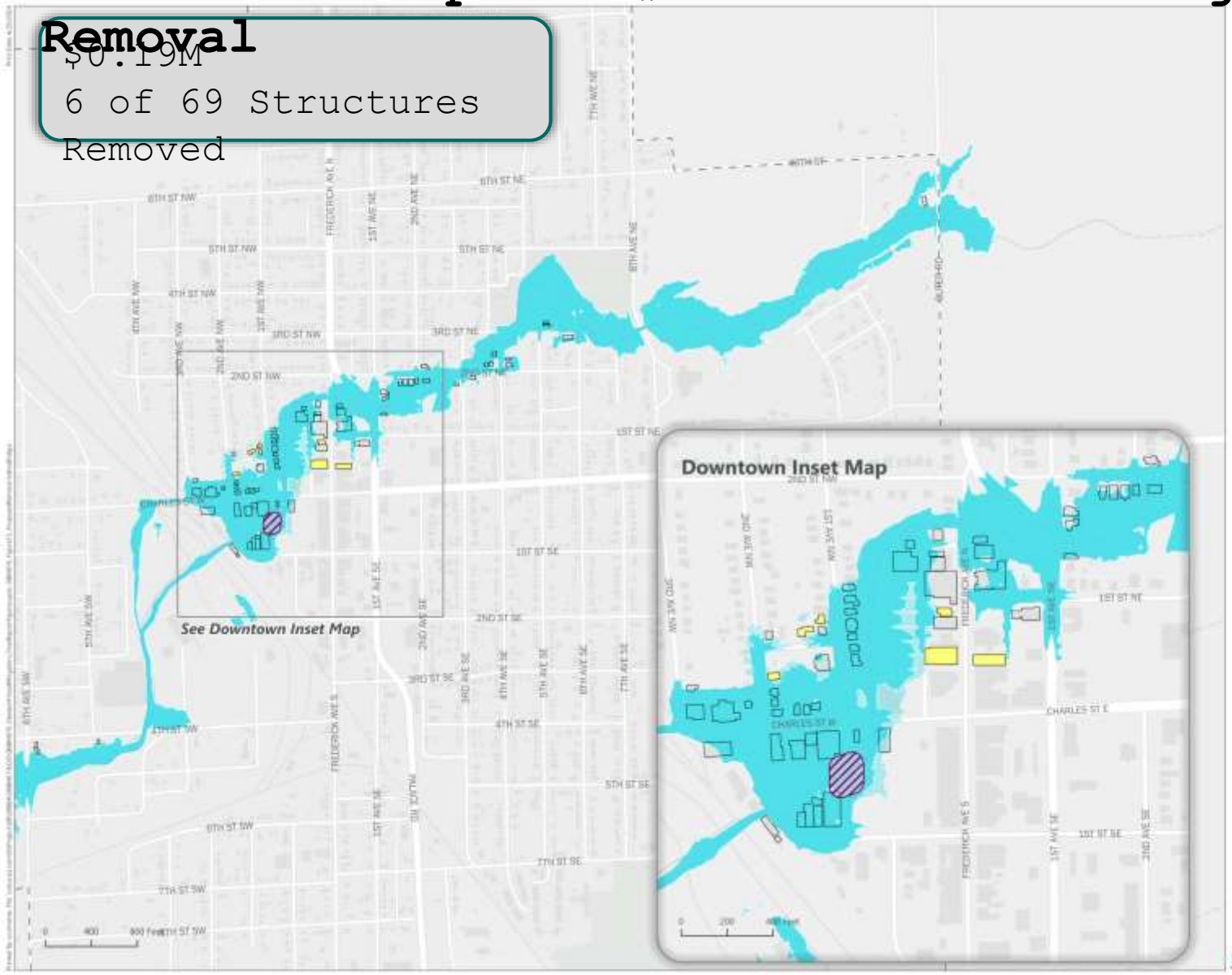


Remove 1st Ave SW Bridge

Flood Mitigat ping

Recommended Option #2: 1st Ave SW Bridge Removal

$0.19M
6 of 69 Structures Removed



Today's Presentation

- Background: Historical Flooding in Oelwein
- Scope of Work for this Study
- Modeling: Proposed Mitigation Alternatives
- Recommended Option #1: Regional Pond 3b Revised
- Recommended Option #2: 1st Ave SW Bridge Removal
- **Recommended Option #3: Charles St Parking Lot Removal**
- Recommended Option #4: Property Acquisition
- Benefit Cost Analysis: FEMA's BCA Toolkit
- Funding
- Next Steps

MSA

Recommended Option #3: Remove Charles St Parking Lot

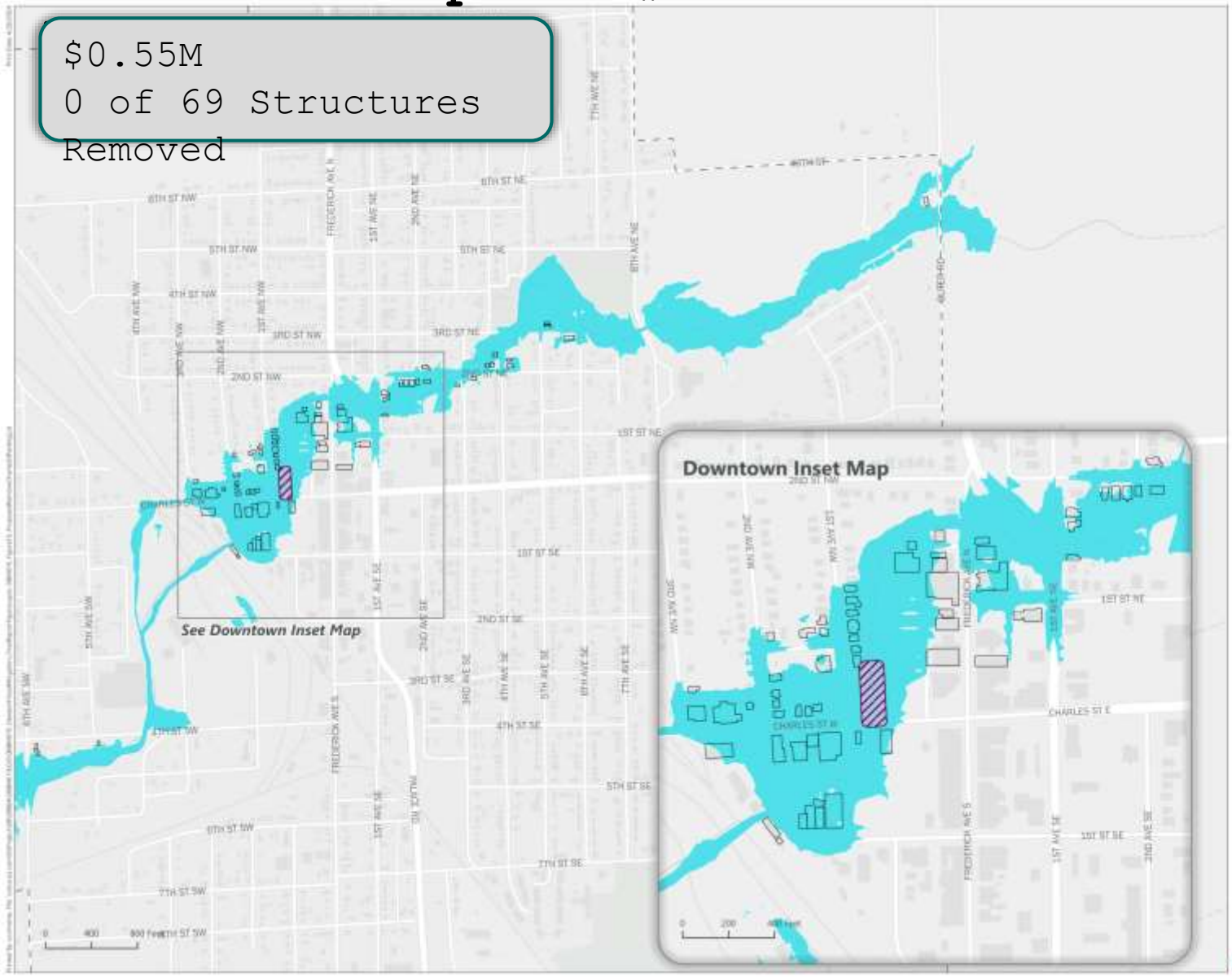
- One-time up-front cost
- Other parking lots available downtown
- Will require funds to maintain if not removed
- Install a concrete barrier to block access
- Does not provide flood mitigation benefits on its own, but could be coupled with conversion of adjacent lands to urban open space for Ecosystem

Remove Charles St Parking Lot

Flood Mitigat ping

Recommended Option #3: Remove Charles St

$0.55M
0 of 69 Structures Removed



Proposed Remove Charles St Parking Floodplain

Figure 16
Flood Mitigation Scoping

City of Oelwein
Fayette County, IA

- Oelwein
- Existing 100-yr Floodplain
- Remove Charles St Parking Lot, 100-yr Floodplain
- Building within Existing 100-yr Floodplain (69)
- Building Removed from 100-yr Floodplain (0)
- Remove Charles St Parking Lot
- Stream

MSA

Today's Presentation

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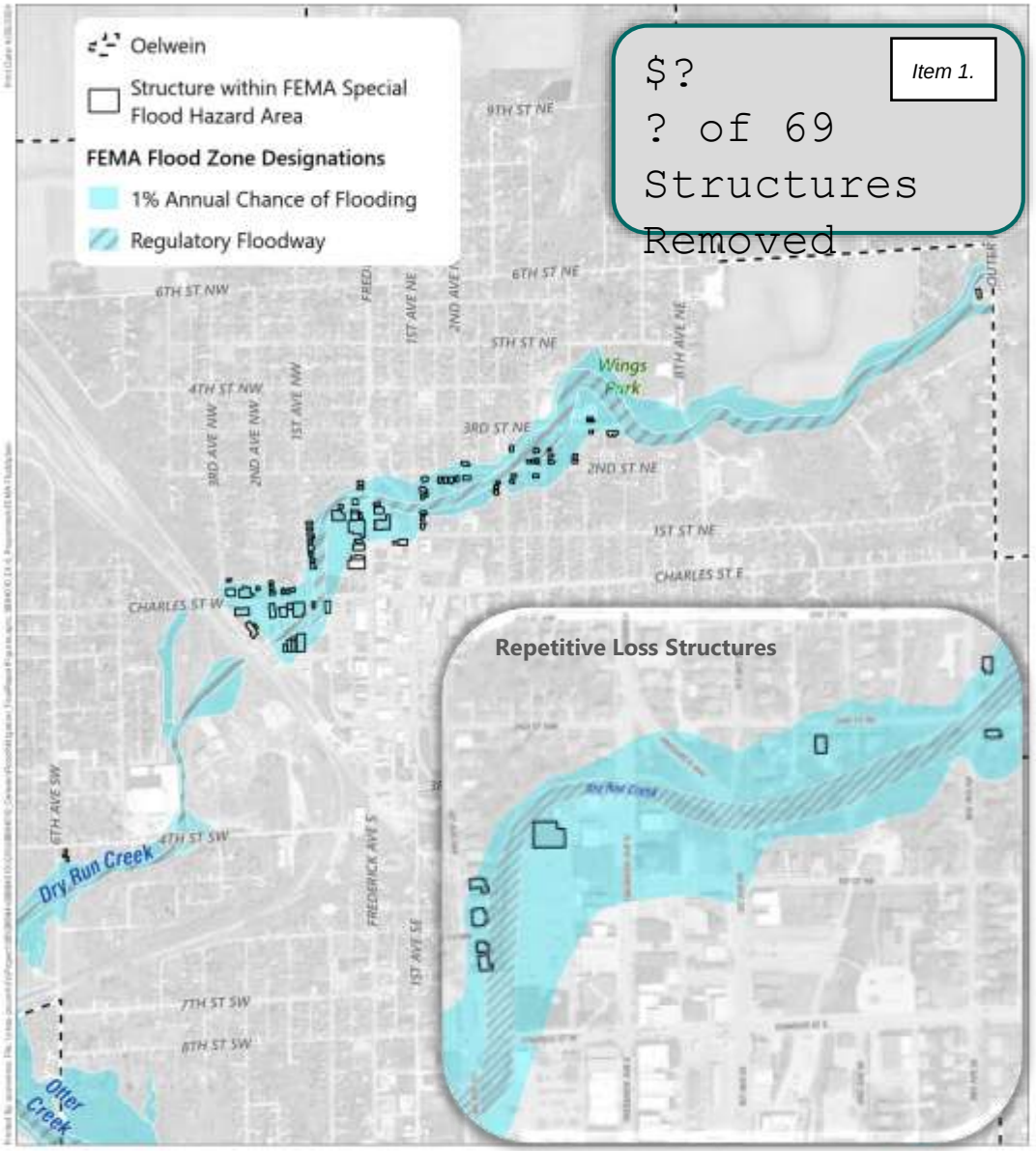
MSA

Recommended Option #4: Property Acquisition

- One-time up-front cost
- Property acquisition is easiest for structures located within the FEMA mapped floodplain
- Property owners volunteer to participate in the program
- Homes valued for less than 360K can use Pre-Calculated Benefits Based of 360K
- Repetitive Loss Structures are the



Data Sources:
Municipal Boundary: Fayette County
Road Centerlines: Iowa DNR
Floodplain Extents: FEMA (2021/05/17)
Aerial: Fayette County

0 0.1 0.2 Miles

Structures within FEMA Special Flood Hazard Area

Fig -6
Flood Mitigation ng

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- **Benefit Cost Analysis: FEMA's BCA Toolkit**
- Funding
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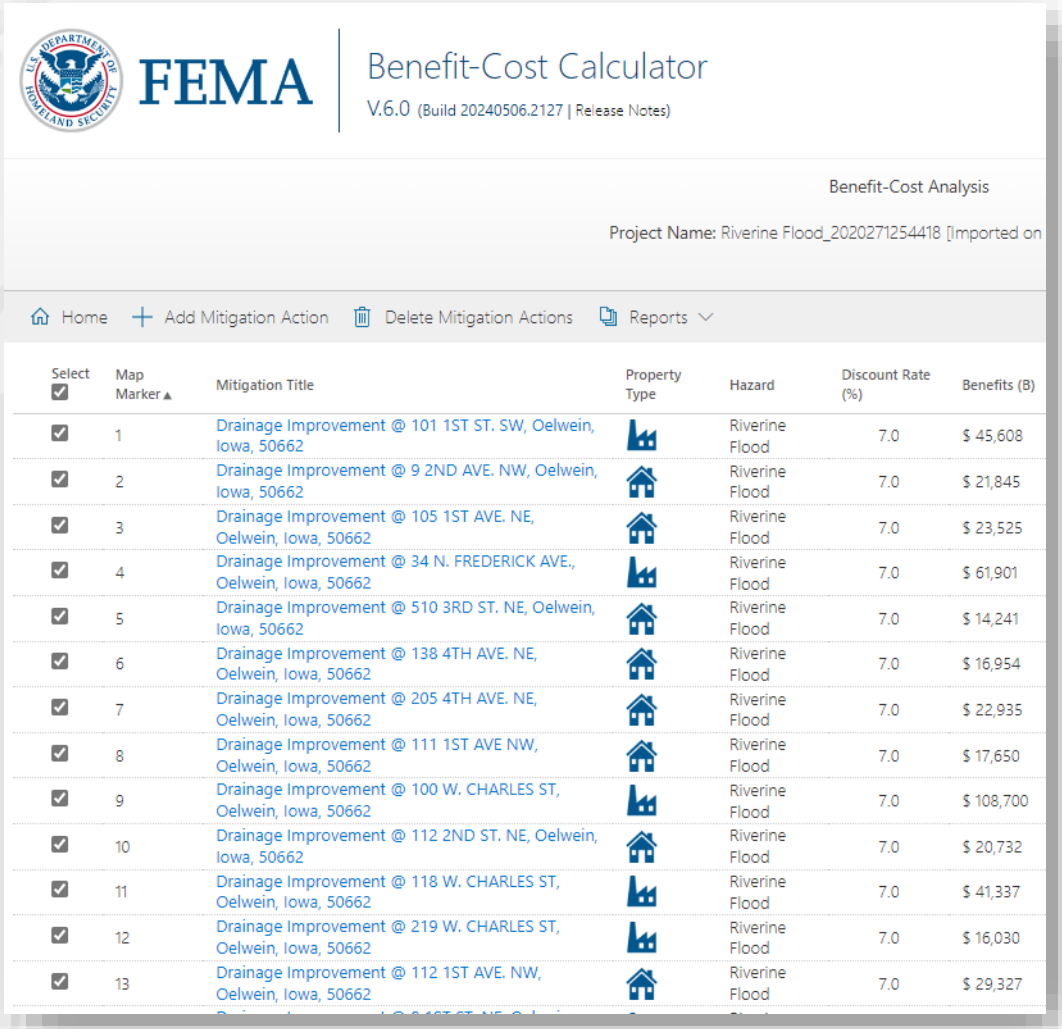
MSA

Benefit Cost Analysis: FEMA's BCA Toolkit

Benefit Cost Analysis (BCA) toolkit estimates the monetary benefits of flood risk reduction

- **Standard benefits** account for reduced risk to buildings, contents within the building, displacement costs and ecosystem services*
- **Social benefits** account for the improvement metal health and productivity for residents who are less impacted by flooding
- **Ecosystem services**



Select	Map Marker	Mitigation Title	Property Type	Hazard	Discount Rate (%)	Benefits (B)
☑	1	Drainage Improvement @ 101 1ST ST. SW, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 45,608
☑	2	Drainage Improvement @ 9 2ND AVE. NW, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 21,845
☑	3	Drainage Improvement @ 105 1ST AVE. NE, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 23,525
☑	4	Drainage Improvement @ 34 N. FREDERICK AVE., Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 61,901
☑	5	Drainage Improvement @ 510 3RD ST. NE, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 14,241
☑	6	Drainage Improvement @ 138 4TH AVE. NE, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 16,954
☑	7	Drainage Improvement @ 205 4TH AVE. NE, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 22,935
☑	8	Drainage Improvement @ 111 1ST AVE NW, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 17,650
☑	9	Drainage Improvement @ 100 W. CHARLES ST, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 108,700
☑	10	Drainage Improvement @ 112 2ND ST. NE, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 20,732
☑	11	Drainage Improvement @ 118 W. CHARLES ST, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 41,337
☑	12	Drainage Improvement @ 219 W. CHARLES ST, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 16,030
☑	13	Drainage Improvement @ 112 1ST AVE. NW, Oelwein, Iowa, 50662		Riverine Flood	7.0	$ 29,327

Benefit Cost Analysis: FEMA's BCA Toolkit

Alternative	Regional Pond 3b Revised		Remove 1st Ave SW Bridge			Remove Charles St Parking over Creek			Residential Property Acquisition within FEMA Special Flood Hazard Area (52 Structures @ 360K)	
Assumed Project Lifespan	*30-yr*		*100-yr*			*100-yr*			*100-yr*	
Structure/Social Benefit*	$2.710 M		$1.125 M			$0.000 M			$18.720 M	
Ecosystem Service	17 ac, Rural Open Space	46 ac, Rural Open Space	*None. Unless the project creates urban open space*			*None. Unless the project creates urban open space*			*None. Unless the project creates urban open space*	
Ecosystem Services Benefit*	$2.243 M	$6.069 M								
Total Benefits*	**$4.953 M**	**$8.779 M**	**$1.125 M**			**$0.000 M**			**$18.720 M**	
One-Time Cost Description**	Construction Costs (see Table 5)	Property Acquisition, Hauling Costs, Permitting, Stream Mitigation Fee	Bridge Removal	Guard Rail	Contingency (20%)	Parking Lot Removal	Guard Rail	Contingency (20%)	Property Acquisition (based on tax assessment)	Demolition (15K per Structure)
Individual One Time Cost	$3.845 M	Unknown	$0.150 M	$10,000	$32,000	$0.450 M	$5,000	$91,000	$3.178 M	$0.780 M
Total One Time Cost	$3.845M + Unknown Costs		$0.192 M			$0.546 M			$3.958 M	
Maintenance Costs***	$0.255 M		*none*			*none*			*none*	
Total Cost	**$4.100 M + Unknown Costs**		**$0.192 M**			**$0.546 M**			**$3.958 M**	

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- Next Steps

MSA

Funding

- **FEMA's Hazard Mitigation Grants**
  - Building Resilient Infrastructure and Communities (BRIC)
  - Flood Mitigation Assistance (FMA) Grant
  - Safeguarding Tomorrow Revolving Loan Fund (STRLF)
  - Flood Mitigation Assistance Swift Current (Swift C
- **Environmental Protection Agency (EPA)**
  - Community Change Grant
- **Iowa Department of Natural Resources (IDNR)**
  - Resource Enhancement and Protection (REAP)
- **Bridge Removal Funding, Iowa DOT**
  - Poorly rated bridges may be eligible for funding t removed

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MSA

Next Steps

- **Select preferred alternative(s)**
  - Regional Pond 3b
  - Combination of other alternati
    - Remove 1st Ave SW Bridge
    - Remove Charles St Parking L
    - Property Acquisition
    - Create urban open space (for Ecosystem Services Benefits
- **Apply for funding and start project design**
- **Model alternative with updated FEMA model and BCA Toolkit**