APPENDIX G

SCHUYLER FLOOD RISK REDUCTION PLAN AND PARCEL LEVEL FLOOD RISK ASSESSMENT

JEO CONSULTING GROUP INC

(Revision 2)

May 2020

Flood Risk Reduction Plan and Parcel Level Flood Risk Assessment

Schuyler, Nebraska

JEO Project 170337.00

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1 PLAN PURPOSE AND BACKGROUND

The City of Schuyler participates in the Lower Platte North Natural Resources District (NRD) Multi-Jurisdictional Hazard Mitigation Plan (HMP). As part of this planning effort for the 2020 HMP update, additional funding was requested and allocated through the FEMA Pre-Disaster Mitigation Grant (PDM) program to provide the opportunity for participating communities to complete additional risk assessments for select floodprone properties within interested communities. The selected properties are intended to provide an example of flood risk types and risk characteristics in each community. Schuyler, located in Colfax County, cost-shared this funding with the NRD to conduct targeted risk assessments for floodprone areas of the community and the community's Extraterritorial Jurisdiction (ETJ) as shown on the effective Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM). An overview of Special Flood Hazard Area (SFHA) flood risk areas identified on the effective FIRM is shown in Figure 1. The SFHA is the land in the floodplain within a community subject to a one percent or greater chance of flooding in any given year. Based on parcel data analyzed for the City of Schuyler the value of improvements within the SFHA community-wide is approximately $66.5 million. This valuation is based on assessor data and includes primary structures and outbuildings only; it does not include business inventory values.

In March 2019, significant flooding was experienced on many river systems throughout Nebraska. Rare circumstances, including significant snowpack, deep frost, extended cold weather, untimely rain events, and rapid warming, created record flows in the Platte River, Lost Creek, and Shell Creek near Schuyler. For the City of Schuyler, this resulted in selected flood damage impacts to public and private infrastructure within the flood hazard areas of the community located along the Platte River and Lost Creek. For Shell Creek, a recently constructed levee system designed by the U.S. Army Corps of Engineers (USACE) minimized flooding impacts from Shell Creek for the portion of the City north of the railroad tracks and east of HWY 15. Flood risk for the Platte River and Lost Creek is located in the southern part of Schuyler. While the Platte River is included in the effective Flood Insurance Study (FIS), Lost Creek has not been studied in detail. During high water events on the Platte River, flows cross into the Lost Creek basin and essentially create a wide floodplain for the Platte River which includes Lost Creek. Therefore, it is assumed within the FIS that the primary driver of flood risk is the Platte River.

An overview of key current flood risk regions of the City of Schuyler within the Platte River floodplain is shown on Figure 2. Shell Creek flood risk areas were not included in this evaluation due to the flood risk reduction offered by the levee system; however, it should be noted that levee failure risk exists with any levee. These flood risk regions are based on sections of the SFHA with different risk characteristics and are also informed by observations from the March 2019 flooding. Red is based on the floodway on the effective FIRM, along with locations along Lost Creek most impacted during the March 2019 flooding event. While not necessarily limited to red areas, locations in the red may have also commonly experienced ice jam flooding impacts in the past. Areas in the orange are high risk areas within the SFHA that may not flood quite as frequently due to being outside the floodway and further away from Lost Creek. Locations in the yellow are further away from the Platte River and Lost Creek and are less likely to be impacted by direct overland flooding but may be at risk from backflow flooding through the storm drain system. It should also be noted that flooding risk observed during the March 2019 event did not line up well with the effective SFHA; these considerations have been reviewed by the City of Schuyler through a separate project and are discussed in Section 6 of this report, along with the Platte River Flow Evaluation technical memo provided in Appendix B.

In support of risk assessment objectives of the HMP update and considering the impacts of the March 2019 flood event, JEO has completed an in-depth review of selected properties for the purposes of identifying flood risk and flood insurance premium reduction strategies for individual properties at risk of flooding from the Platte River. These properties were selected to provide a sample of flood risk profiles considering flood risks from the Platte River. However, they do not represent all possible flood risks within Schuyler. This assessment also will support decision making by the City of Schuyler in conjunction with additional flood risk reduction planning actions that have previously been completed or are ongoing. These include but are not limited to the Schuyler Platte River Flow Evaluation and future floodplain mapping efforts (City of Schuyler and potentially NeDNR, ongoing); mitigation actions being completed by the City of Schuyler and Schuyler Department of Utilities including the Schuyler Electrical Transmission line berm project (ongoing) and development of a plan to install flap gates on key interior drainage outlets to prevent backflow of flooding into the storm drain system (ongoing). Further details regarding these other flood risk reduction actions that coordinate with the outcomes of this assessment and plan can be found in Section 6 of this report.

The overall purpose of this assessment and resulting plan is to identify and prioritize flood risk reduction alternatives on a property by property or regional basis for selected structures in the SFHA. The plan also identifies programmatic actions that can be taken by the community to reduce flood risks and flood insurance premium costs for all property owners with floodprone property based on the effective FIRM. Ultimately, this assessment and resulting mitigation actions can be used to both reduce flood damage impacts of future flood events and reduce flood insurance premium costs for both individual homeowners and the community in general. Findings of the assessment, in conjunction with other ongoing mitigation actions, can be used by Schuyler as a planning tool to prioritize flood risk reduction actions within the community. The results of the assessment and relative flooding risk information can also be used as a public engagement tool by the City to convey relative flood risk information to community residents.

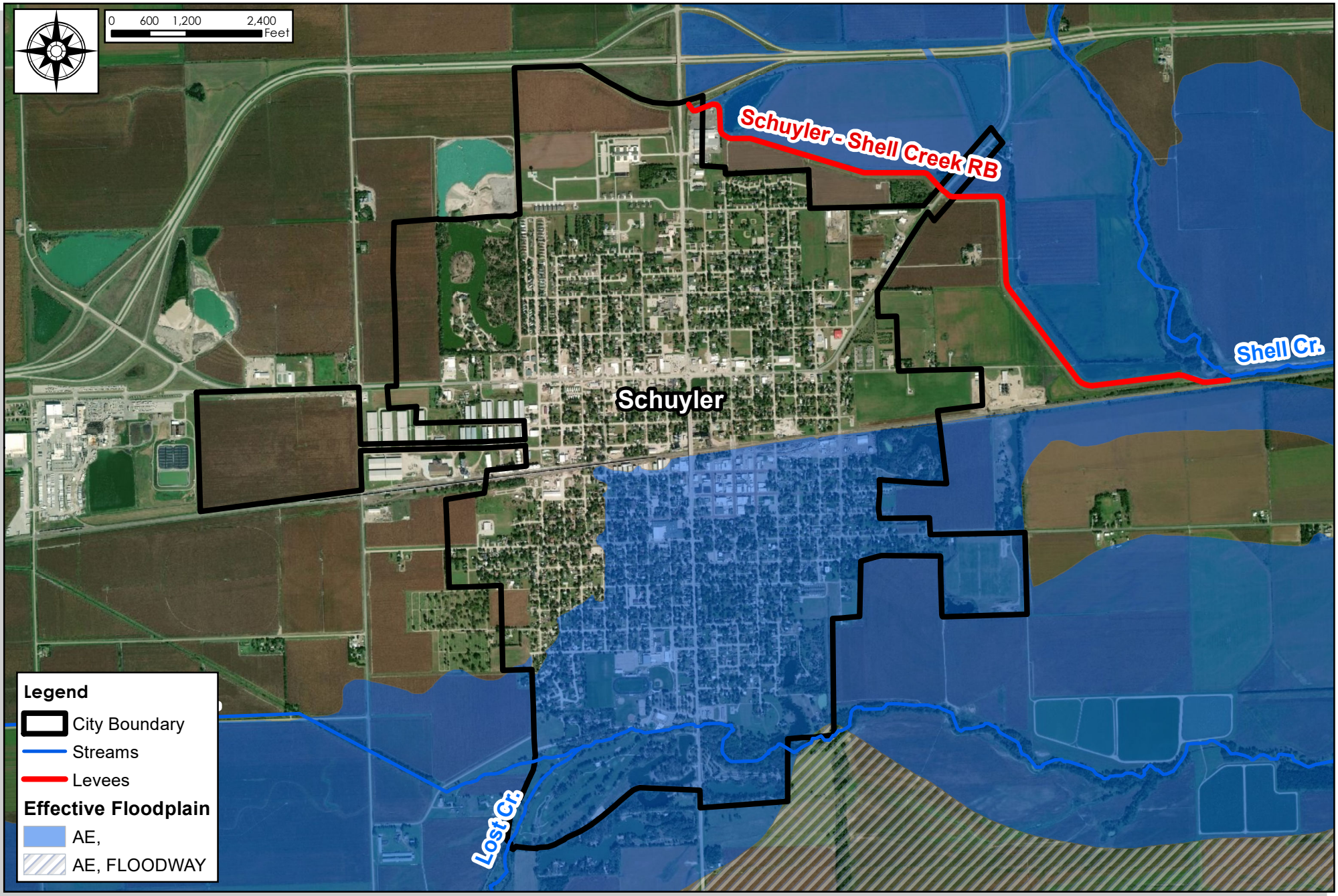

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Figure 1: Effective FIRM Overview

Schuyler, Nebraska

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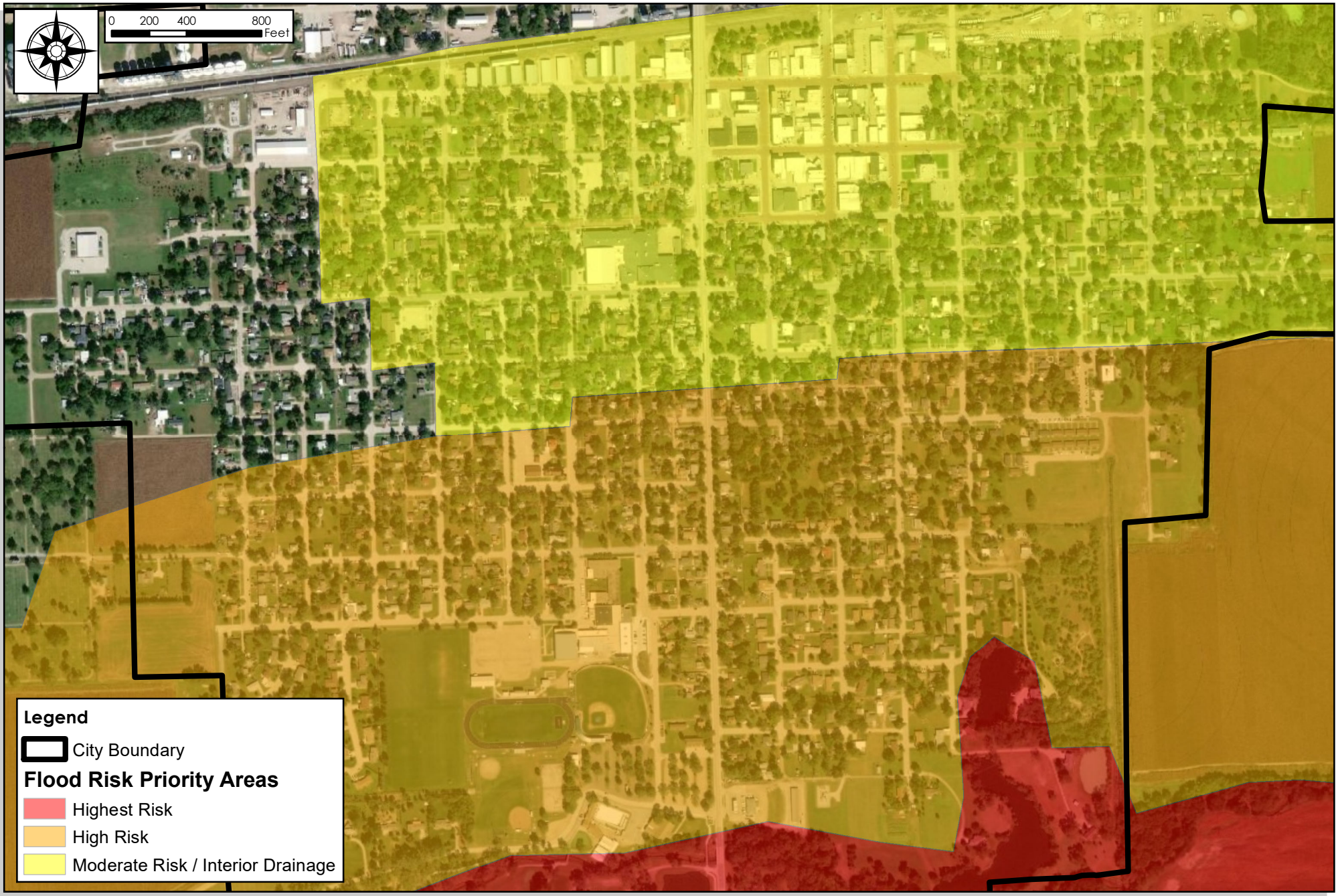

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Figure 2: Flood Risk Priority Areas

Schuyler, Nebraska

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2 FLOOD RISK ASSESSMENT

To identify and summarize the relative risk of flooding for properties within the SFHA of the Platte River, a flood risk assessment was developed for selected properties that represents a sample of flood risk profiles for the study area. The purpose of the flood risk assessment is to evaluate how deep flood water will be on the selected properties and the anticipated flood risk to the structures on the properties during certain flooding events. Because this assessment focuses on actions that will potentially both decrease flood risk and flood insurance premium costs, the effective FIRM floodplain boundaries and FIS flood elevations were used.

Key steps of the flood risk assessment included:

1. Property selection and field data collection to identify key property features. Properties were selected considering factors such as: variation in flood risk profiles/location in the floodplain and March 2019 flooding impacts.
2. Development of criteria to review and identify flood risk and potential flood damage factors for each property. These criteria are based on the effective FIRM and other known flood damage risks, such as flood impacts from the March 2019 flood event.
3. Development of a flood risk property score based on the flood risk and potential damage factors. This score will be used in conjunction with a mitigation action prioritization process to identify mitigation actions with the most flood risk reduction benefits for the selected properties.

The following sections outline in more detail the steps of the flood risk assessment process.

2.1 Property Selection and Field Data Collection

JEO utilized the effective FIRM and the City of Schuyler's observations from the flooding of March 2019 to identify key flood risk areas of interest. The objective was to identify areas of the community that have a variety of flood risk profiles based on the effective flood risk data and recent flooding experience. This resulted in the identification of 55 properties for further review. The selected properties are located in specific areas of the Platte River SFHA and share similar risk characteristics with nearby properties; while not all properties in these areas were evaluated in general the flood risk for structures in the vicinity of an evaluated property will be similar. An overview of the selected property locations can be seen in Figure 3.

For the selected properties, a field visit was conducted on August 28th, 2019. Observations were collected using Collector for ArcGIS regarding the current conditions on the property at the time of the field visit and building characteristics. Key data collected included property photos, approximate location of lowest adjacent grade (LAG) and highest adjacent grade (HAG), number of steps from the ground at the location of the steps (typically the HAG) to the first floor, foundation type, location of utilities, and general condition. The field data collection information was used in conjunction with flood risk data to determine the relative risk of flooding for each property, which was then used to inform mitigation action recommendations. Further details are provided in the following sections.

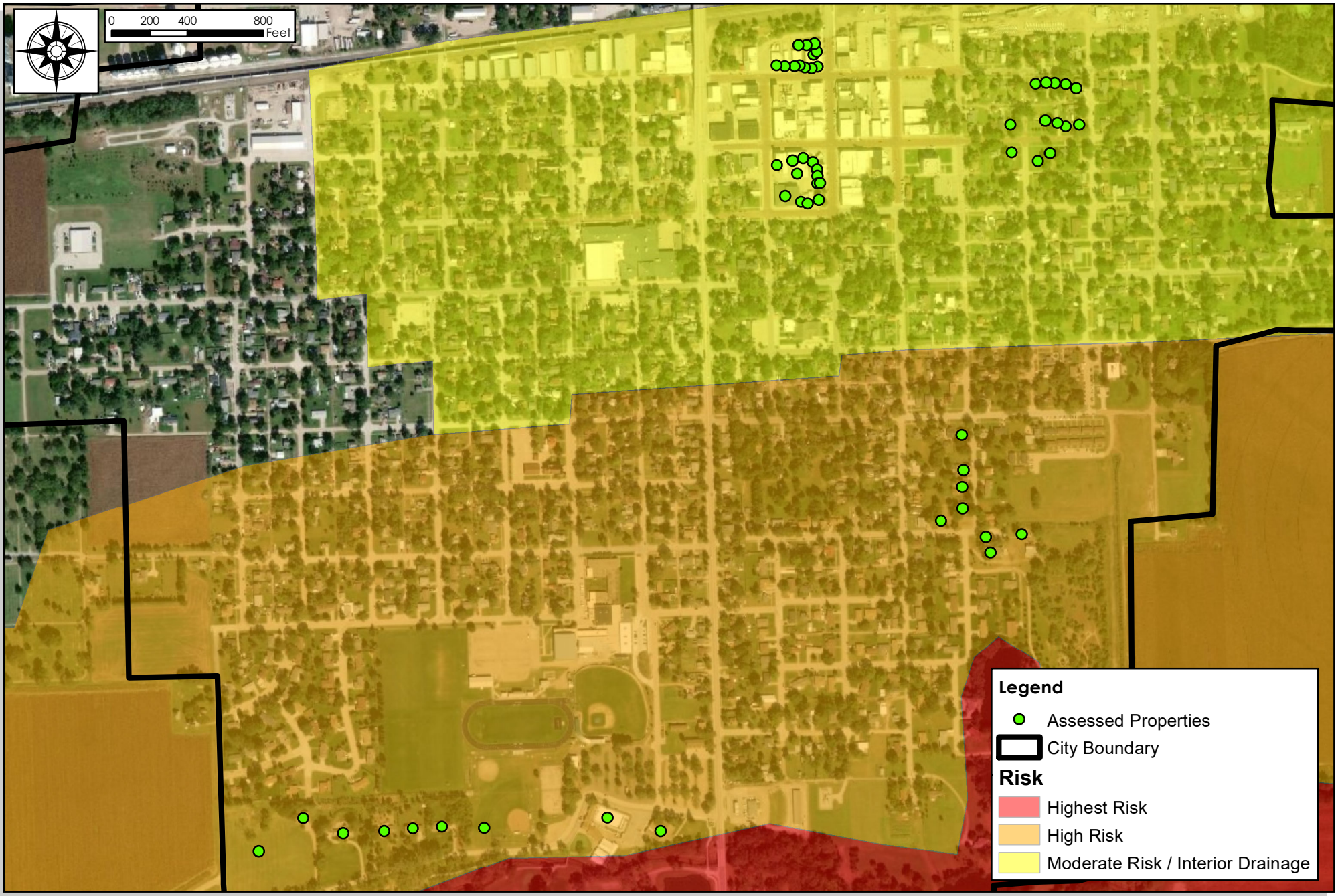

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Figure 3: Assessed Properties Overview

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2.2 Flood Risk Review Criteria

To assess the relative risk of flooding for structures on each property selected, the effective Colfax County, NE FIRM and Flood Insurance Study (FIS) dated 3/21/2019 were utilized to develop flood elevations for specified frequencies of flooding, including the 10-year (10% annual chance), 50-year (2% annual chance), and 100-year (1% annual chance). For the Platte River at Schuyler, flood elevations for each return period for the selected properties were derived from water surface rasters developed using the effective FIRM cross section GIS data set. The effective FIRM was utilized because it will be the baseline requirement for any short-term mitigation projects such as structure elevations or dry floodproofing that focus on both flood risk and flood insurance premium reduction. However, it should be noted that future flood studies for the Platte River may alter the flood risk elevation data. Since the evaluation was completed within GIS using best available data, if the flood risk component of this data is adjusted based on a new study the risk assessment can easily be updated using building elevations and other data used for the assessment.

2.3 Flood Risk Review Process and Results

To develop flood risk exposure results for the selected properties, best available LiDAR topography was used to develop building footprints for the primary structures (residential or non-residential structures) on each property. Building footprint boundaries were reviewed vs. aerial photographs and refined as needed. These building footprints along with field observations for each property were used to determine an estimated first floor elevation. This first-floor elevation was then compared to the flood elevations for the relevant flood frequencies developed from the effective FIRM to determine the depth of flooding for the structure for each return period, respectively. In general, if the building is flooded during a more frequent flood event such as the 10% annual chance flood, and/or has high flood depths for less frequent flooding such as the 1% annual chance flood, the greater the chance of recurring or significant flood damage impacts from future flooding.

In addition to flood depths for the primary structure based on the effective FIRM, additional flood depth considerations were also reviewed. These included visually estimated external utilities elevations, primarily HVAC equipment, based on photographs and site elevations. Also included were estimates of flood elevations from the March 2019 flood event. These estimates were based primarily on high water mark (HWM) observations collected by the U.S. Geological Survey (USGS) along with visual estimates of HWM available from field visit photographs. These flood elevations should be considered approximate due to the limited amount of data available. However, they do provide valuable insight into the scope of the 2019 flood within the context of best available published flood studies, with actual flood elevations being lower than the 1% annual chance flood elevation published in the effective FIS. Finally, using depth grids produced from the effective FIS water surface rasters and LiDAR along with parcel data, a data set showing the highest depth of flooding on all properties in the area of interest surrounding the selected properties in the Platte River SFHA was developed. For properties that were not selected for parcel assessment, this provides additional information regarding relative flood risk and frequency of flooding.

The results of the flood risk assessment and related observations regarding flood risk and the depth of flooding based on estimated first floor elevations for the assessed structures are provided in a summary table, which can be found in Appendix A.

2.4 Flood Risk Property Score

Using the results of the flood risk assessment for each property, a Flood Risk Property Score was developed. This was completed using selected criteria that describe the potential flooding impacts that could be experienced on each property. Heavier weighting (higher point values) was assigned to certain criteria such as flooding above the first floor of the building, critical facilities, and buildings that have been repetitively flooded or substantially damaged. A summary of the criteria used, and the point values assigned to each criterion can be found in the following Table 1.

Table 1: Flood Risk Property Score Criteria

Criteria	Property Flood Impacts	Base Points	% of possible total
1	Flooding above the first floor of a building	100	20.0%
2	Flooding of electrical and/or mechanical equipment	40	8.0%
3	Flood water is touching a portion of the building (likely crawlspace or unfinished basement being impacted)	40	8.0%
4	Property is completely surrounded by flood water (ingress/egress off of flooded property is not possible during flooding)	20	4.0%
5	Structure is completely surrounded by flood water (ingress/egress from building is not possible during flooding)	30	6.0%
6	Structure is completely surrounded by flood water AND is a Critical Facility	100	20.0%
7	Structure is completely surrounded by flood water AND is multi-family residential (additional people, vehicles)	50	10.0%
8	Flood water is touching a portion of the building AND has damage or substantial damage (subsidence, shifting, cracking) as a result of recent or cumulative flooding	100	20.0%
9	Flooding of exterior property improvements which are deemed functional necessities to reasonable use of single family or multi-family residential property (detached garage or shed)	20	4.0%
	Total Points Possible	500	100%

For each property, these criteria were reviewed, and points were assigned to generate the initial Flood Risk Property Score with a maximum initial score of 500. These scores were then supplemented by taking into account flood frequency factors as well as flood impact factors such as flow velocity, ice jam frequency, and interior drainage ponding risk. By incorporating these factors, the overall flood risk circumstances for each property can be differentiated. For example, a property in the floodway or flooded during the 10% annual chance flood has a much higher risk of being frequently flooded. Likewise, a property in the floodway has a higher risk of debris impacts due to higher flooding velocities and is more likely to be impacted by ice jam flooding due to proximity to the river channel. Using these factors, properties with otherwise similar flooding characteristics can be further prioritized based on relative risk of flooding impacts. A summary of the factors considered is provided in Table 2 and Table 3.

Table 2: Flooding Frequency Risk

Flooding Frequency Risk	Multiplier
Floodway	1
10% Annual Chance	1
2% Annual Chance	0.2
1% Annual Chance	0.1

Table 3: Flooding Impact Risk Factors

Factor	Description	Multiplier
Flow velocity risk	Higher flow velocities and debris impacts likely to be experienced closer to the river channel and riverward of the levee.	1.5
Ice jam flood risk area	Ice jam flooding risk and ice impact risk more likely to be experienced closer to the river channel and riverward of the levee.	1.5
Interior drainage ponding risk area	Potential impacts due to flooding backflow through the storm drain system	1.3

An overview of the Flood Risk Property Scores is provided in Figure 4. These results show which properties have the highest potential impacts based on flood depth, flooding frequency, and location within the floodplain. Background data supporting the Flood Risk Property Scores is also provided in Appendix A.

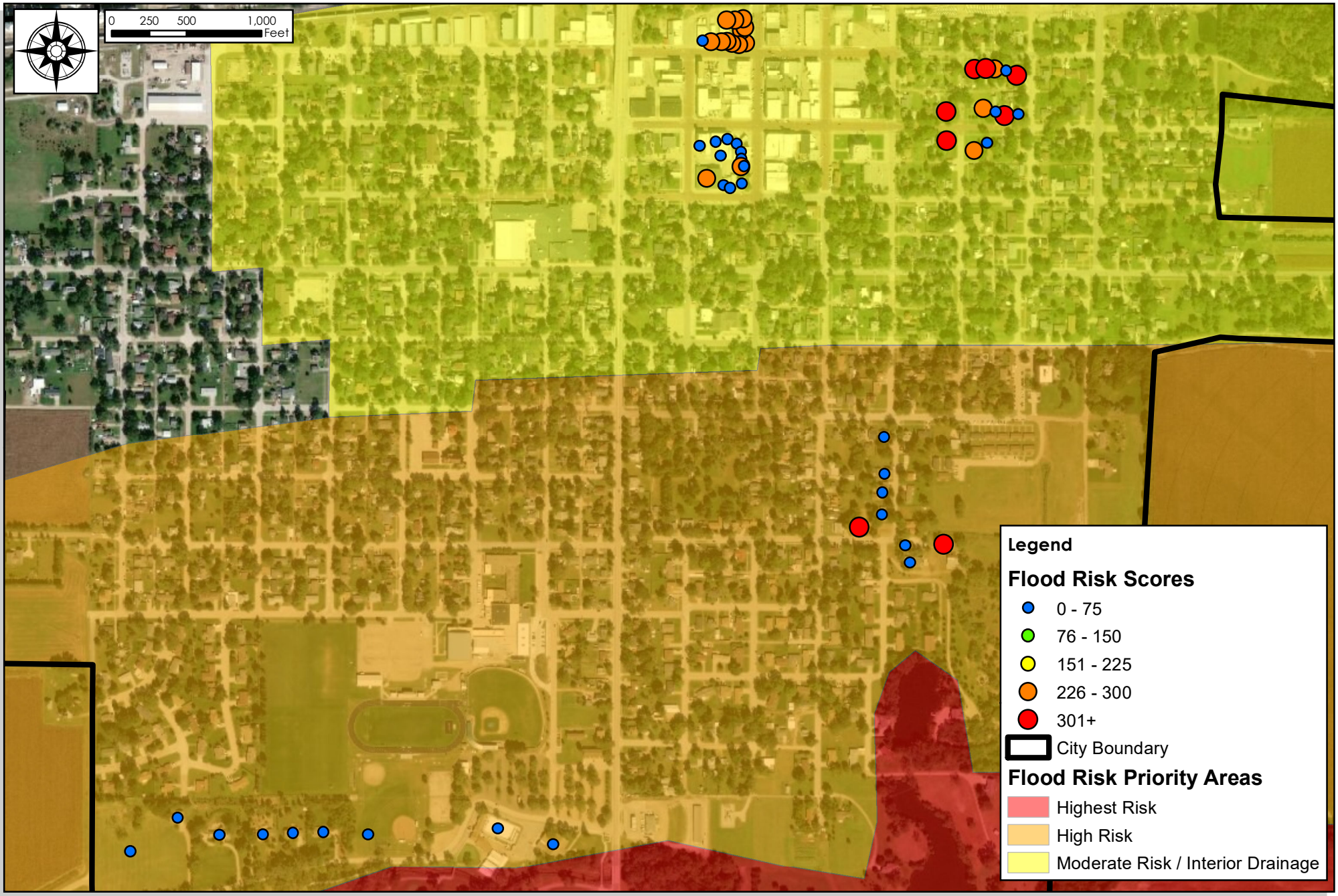

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Figure 4: Flood Risk Property Scores

Schuyler, Nebraska

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3 FLOOD RISK REDUCTION ACTION RECOMMENDATIONS

Flood risk reduction actions provide the opportunity for a community and property owners to achieve both flood damage and flood risk reduction as well as a potential decrease in flood insurance premium costs through actions that reduce the potential impacts of future flooding. To achieve this objective, thirteen potential nonstructural (building modification) flood risk reduction actions were identified, along with eight potential programmatic (policy or program implementation) actions. The overall objective of these potential actions is to both reduce real flood damage risk and reduce the costs of a key programmatic flood risk reduction action all property owners can take which is obtaining flood insurance. In addition to these nonstructural and programmatic actions, an evaluation of certain structural alternatives that coordinate with ongoing structural actions being taken by the community was also completed.

The following outlines the potential flood risk reduction actions reviewed for each property and the recommendations. Nonstructural actions are property specific, with a planning level feasibility evaluation completed for each individual property using field observations and flood risk data. Similar nearby properties will have similar flood risk profiles and will likely benefit from similar flood risk reduction actions. Programmatic flood risk reduction actions apply to all parts of the community. Structural actions will typically benefit specific community areas. Overall optimum flood risk reduction actions are likely a combination of one or more individual property actions plus programmatic or structural actions taken at the community or community region level.

3.1 Flood Risk Reduction Alternatives

3.1.1 Nonstructural

Nonstructural flood risk reduction actions represent building or property modifications that reduce the risk of flooding and flood damages for an individual property. Certain alternatives also offer the opportunity to reduce flood insurance premium costs for the applicable structures, in addition to the flood damage avoidance benefits. Potential flood risk reduction alternatives at the individual property or community level are outlined below. For each individual property alternative, a summary description of each action, flood risk reduction effectiveness, typical cost range, and potential funding sources are noted. Also noted is whether the action could potentially gather additional points for the community through possible participation in the National Flood Insurance Program's (NFIP's) Community Rating System (CRS) program, which provides flood insurance discounts community wide as a result of certain flood risk reduction actions taken by the community. For more information on the CRS program and flood insurance, see Section 5. For more information on ongoing related studies and potential funding sources, see sections 6 and 7, respectively.

An overview of potential actions is provided in the following Table 4.

Table 4: Potential Nonstructural Mitigation Actions

Alternative ID	Nonstructural Alternative	Description	Flood Risk Reduction Effectiveness	Funding	Relative cost range	Potential Flood Insurance Premium Cost Reduction Benefit	Potential CRS Benefits
1	Property Acquisition and Structure Demolition	Acquire property and demolish structures. If funded by FEMA grants, the property must remain open space.	Very High - removes structure from floodplain.	FEMA HMA, Local, Property Owner	Varies by property value and structure size. Typical cost in study area $50,000 - $175,000	Yes	Yes, Activity 420 and 520
2	Structure Demolition and Rebuild (Mitigation Reconstruction)	Demolish structure and re-build in compliance with local floodplain management requirements. This option is available for buildings that cannot be elevated for structural reasons.	High - reduces potential for flood damage, but structure remains in floodplain.	FEMA HMA, Local, Property Owner	Varies by property value and structure size. Typical cost in study area $50,000 - $175,000	Yes	Yes, Activity 530
3	Property Acquisition and Structure Relocation	Acquire property and move structures to a non-floodprone location. If funded by FEMA grants, the floodprone property must remain open space.	Very High - removes structure from floodplain.	FEMA HMA, Local, Property Owner	Varies by property value and structure size. Typical cost in study area $50,000 - $175,000	Yes	Yes, Activity 420 and 520
4	Property Acquisition, Demolition or Relocation, and Re-sale	Acquire property and demolish or move existing structures. This option is specifically locally funded, and provides an opportunity for the community to purchase the property for re-development in compliance with floodplain management requirements.	High - reduces potential for flood damage, but future development remains in floodplain.	Local	Varies by property value and structure size. Typical cost in study area $50,000 - $175,000	Yes	Yes, Activity 530
5	Structure Elevation	Elevation of the existing structure in place, potentially with a garage space and unfinished storage underneath that has flood vents installed. Requires abandonment of the existing basement, if applicable. Add vertical or lateral addition with safe room if possible; for structures with attached garages the garage space can be used for this. Should also include backflow prevention.	High - reduces potential for flood damage, but structure remains in floodplain.	FEMA HMA, Local, FHA 203(k) loan, Property Owner	Varies by structure size. Typical cost in study area $50,000 - $75,000	Yes	Yes, Activity 530
6	Abandon Basement and Fill	Typically involves adding flood vents. Should also include backflow prevention. Add vertical or lateral addition with safe room if possible.	Moderate - reduces potential for flood damage, but structure remains in floodplain.	FEMA HMA, Local, FHA 203(k) loan, Property Owner	Varies by structure size. Typical cost in study area $20,000 - $30,000	Yes	Yes, Activity 530
7	Dry Floodproofing of Structures	Retrofitting to make a structure watertight. Typically requires construction of a perimeter wall or sealant for existng walls combined with door closures. Also requires a plan for implementation of closures.Generally used only for non-residential; flood insurance benefits can only be obtained for this property type. Should also include backflow prevention.	Moderate - reduces potential for flood damage, but structure remains in floodplain.	FEMA HMA, Local, Property Owner	Varies by structure size. Typical cost in study area $10,000 - $30,000	Yes	Yes, Activity 530
8	Wet Floodproofing of Structures	Add flood vents to re-constructed or existing enclosed space below the first floor. Ideally combined with elevation or basement fill, but can be considered as a retrofitting technique for non-filled unfinished basements (helps prevent structural damage during flooding). Add backflow prevention.	Moderate - reduces potential for flood damage, but structure remains in floodplain.	FEMA HMA, Local, FHA 203(k) loan, Property Owner	Varies by structure size. Typical cost in study area $5,000 - $10,000. Included in the costs of a typical elevation project.	Yes	Yes, Activity 530
9	Levee/Floodwall Protection for Multiple Structures	Construction of a levee or floodwall for groups of structures. Generally applicable only to relatively small groups of structures requiring flood risk reduction.	Moderate - reduces potential for flood damage, but structure remains in floodplain. Failure or overtopping of the levee or floodwall can result in catastrophic damage.	FEMA HMA, Local, Property Owner	Not applicable to study area.	Yes, but requires levee certification	Yes, Activity 530
10	Utility Elevation/Backflow prevention	Elevate utilities and install backflow prevention devices on sanitary sewer services.	Low - reduces severity of damage/utility down time but structure remains at risk.	FEMA HMA, Local, FHA 203(k) loan, Property Owner	Varies by individual property requirements. Typical cost in study area $5,000 - $10,000.	Yes	Yes, Activity 530
11	Partial Dry Floodproofing	Partial dry floodproofing retrofit to reduce risk from higher frequency flooding.	Moderate to Low, depending on elevation of risk reduction action - reduces potential for flood damage, but structure remains in floodplain.	Local, Property Owner	Varies by structure size. Typical cost in study area $10,000 - $30,000	No	Yes, Activity 530
12	Partial Wet Floodproofing	Partial wet floodproofing retrofit to reduce risk from higher frequency flooding.	Moderate to Low, depending on elevation of risk reduction action - reduces potential for flood damage, but structure remains in floodplain.	Local, Property Owner	Varies by structure size. Typical cost in study area $5,000 - $10,000. Included in the costs of a typical elevation project.	No	Yes, Activity 530
13	Levee/Wall/Berm for a Single Structure	Construction of a levee or floodwall for a single structure. Generally considered a last option if other alternatives are not feasible.	Moderate - reduces potential for flood damage, but structure remains in floodplain. Failure or overtopping of the levee or floodwall can result in catastrophic damage.	FEMA HMA, Local, Property Owner	Not applicable to study area.	Yes, but requires levee certification	Yes, Activity 530

3.1.2 Programmatic

Programmatic flood risk reduction actions represent planning or policy actions that reduce the risk of flooding and flood damages community wide. Typically, these actions promote awareness of flooding risk, potential mitigation actions for property owners, flood preparedness and flood warning planning, and floodplain management planning and policy. Implementation of these planning actions may also involve a combination of nonstructural and structural flood mitigation project construction. Most of these actions, if implemented, would provide additional CRS point credit to the City, resulting in potential flood insurance discounts for property owners community wide. For more information on the CRS program and flood insurance, see Section 5.

An overview of potential actions is provided in the following Table 5.

3.1.3 Structural

Structural flood risk reduction actions physically alter the path of flooding for the purposes of reducing impacts. Structural actions are sometimes more expensive than nonstructural or programmatic actions and tend to benefit a more limited area while not reducing all risks of flooding. Specific structural actions, such as dams and levees, may also increase flooding consequences in the event of failure, causing more catastrophic impacts if failure occurs. However, in certain circumstances structural improvements are very beneficial and provide widespread flood risk reduction. These improvements can be coupled with nonstructural and/or programmatic actions as part of a comprehensive flood risk reduction effort for a community.

For Schuyler, based on the experience of the flooding in March 2019, the City is strategically identifying structural actions that can be taken to reduce the risk of flooding impacts to areas that were impacted in March 2019. These actions include mitigation actions being completed by the City of Schuyler and Schuyler Department of Utilities including the Schuyler Electrical Transmission line berm project (ongoing) and development of a plan to install flap gates on key interior drainage outlets to prevent backflow of flooding into the storm drain system (ongoing). Further details regarding these structural flood risk reduction actions that coordinate with the outcomes of this assessment and plan can be found in Section 6 of this report.

3.2 Flood Risk Reduction Recommendations

Each individual property in the group of properties selected for review was assessed for potential mitigation action, considering the nonstructural mitigation actions identified in Table 4 as well as the flood risk factors reviewed as part of development of the flood risk assessment. For each property, potential recommendations were considered along with relative effectiveness to develop a summary of potential actions for each property. An overview of the summary is provided in Table 6. Highly effective, recommended actions are green; recommended actions are yellow, and actions that are not recommended are red. Certain actions are also identified as needing further evaluation (blue); typically, this is due to lack of data regarding the property relative to the action evaluated. Typically, further evaluation in these cases would require more in-depth property data such as field survey or structure inspection. It should also be emphasized that the recommendations are planning level and generally will require further evaluation as a next step; for example, elevation of a structure as a recommendation will require additional information on structural condition to confirm that elevation is possible. If this is not possible, an alternative flood risk reduction action should be considered.

For each property, a primary recommendation was identified based on the review of the flood risk and potential mitigation actions. This primary recommendation was carried through to the next step of

evaluation as part of the development of flood mitigation priority scores. An overview of the primary mitigation action recommendations for each evaluated property is provided in Figure 5. For most residential properties, utility elevation/backflow prevention is the recommended primary nonstructral alternative; for most non-residential properties, dry floodproofing and utility elevation is the recommended primary nonstructural alternative. Dry floodproofing options include temporary barriers such as closures on doors and windows for the downtown buildings. For these options, it is important to consider several factors including but not limited to warning time vs. time for installation; depth of flooding, and velocity of flooding. Depths of flooding for downtown commercial buildings are generally low and approximately 2-3 feet. These are also low velocity flooding areas. Because of this, multiple options may be available that are not available for locations closer to the Platte River and Lost Creek that may experience higher depths of flooding and/or flooding velocity. For final selection and design of specific alternatives, it is recommended that the community and property owners consult the following resources:

- National Flood Barrier Testing and Certification Program:
  - https://nationalfloodbarrier.org/
- National Nonstructural Floodproofing Committee Guidance:
  - https://www.usace.army.mil/Missions/Civil-Works/Project-Planning/nnc/
- FEMA P-936 – Floodproofing Non-Residential Buildings:
  - https://www.fema.gov/media-library/assets/documents/34270

It was also was noted that through existing planned or potential structural flood risk reduction projects coupled with the findings of the Platte River Flow Evaluation (provided in Appendix B) that flood risk for most selected properties will be reduced through these actions. Most properties in the evaluation area will be benefited by installation of backflow prevention on existing storm drain outlets attached to the storm drain network. Specific properties will also benefit from flood risk reduction through installation of an electrical transmission corridor berm (ongoing) as well as a possible southwest flood risk reduction berm built near the region of the Oak Ballroom. More information on these ongoing structural projects and alternatives is shown on Figure 5 and is also provided in Section 6. Further details on potential southwest berm alternatives including alternative concept alignments and costs are provided in Appendix C; the recommended Alternative 3 is shown on Figure 5. This alternative provides flood risk reduction for the Oak Ballroom and nearby structures while taking advantage of existing high ground north of Higgins Drive for the remainder of the alignment. It should be noted that the alignments and costs presented are highly conceptual and subject to change through more detailed design investigation. It should also be noted that the berm alternatives noted are not intended to be accredited levees and therefore provide physical flood risk reduction but do not carry a flood insurance premium reduction benefit. This benefit could potentially be obtained by designing these alternatives to be accredited levees on the FIRM in accordance with the relevant Code of Federal Regulations (CFR) sections of 44 CFR 65.10.

Table 5: Potential Programmatic Actions

Alternative ID	Programmatic Alternative	Description	Potential CRS Benefits
1	Audible Flood Warning System	An audible flood warning system for the most floodprone areas of the community. Implementation can be coordinated with development of a Flood Preparedness and Response Plan.	Yes, Activity 610
2	Public Education	Promote flood risk awareness through the City's website as well as other outreach efforts. These actions can be incorporated into other floodplan management/flood preparedness planning efforts.	Yes, Activity 320 and 330
3	Flood Insurance	Flood insurance as a mitigation action is the easiest way to reduce risk, especially while additional actions are in development. Promotion of flood insurance as a mitigation action will result in more Increased Cost of Compliance (ICC) coverage, which can be used to support the cost of mitigation if flood damage occurs again.	Yes, Activity 370
4	CRS Program Participation - Floodplain Management Plan	The City of Schuyler currently does not participate in the NFIP's Community Rating Sytem (CRS). If the City joins this program, points could be obtained with a community wide floodplain management plan. This plan can incorporate existing planning tools such as the Hazard Mitigation Plan along with planning team coordination to develop a comprehensive floodplain management plan.	Yes, Activity 510
5	Flood Preparedness and Response Plan	The purpose of this plan is to develop a community wide response plan in the event of another significant flood. The planning process helps the community identify key contacts, and determine the best approach to respond to flooding, including prioritizing preparedness actions taken before and during the flood.	Yes, Activity 610
6	Flood Study Updates	The effective flood study for Schuyler uses older analysis techniques, and would also benefit from incorporation of flood data obtained as a result of the March 2019 flood. This action would continue development of revised flood studies for use as part of other programmatic actions and to promote risk informed decision making.	Yes, Activity 410
7	Floodplain Management Policy Revisions - Planning and Zoning/Comprehensive Planning	This activity involves a comprehensive review of floodplain management requirements and potential adoption of higher standards. This also involves integration of floodplain management into the comprehensive plan. This can be incorporated with a floodplain management planning effort, if applicable.	Yes, Activity 430
8	Natural Resource Protection/Recreation	This activity involves identifying and maintaining open space to support the natural and beneficial functions of the floodplain. This can involve both open space preservation as well as comprehensive planning to coordinate this effort with natural floodplain functions.	Yes, Activity 420 and 510

Table 6: Potential Mitigation Actions

Property ID	Property Acquisition and Structure Demolition	Structure Demolition and Rebuild (Mitigation Reconstruction)	Property Acquisition and Structure Relocation	Property Acquisition, Demolition or Relocation, and Re-sale	Structure Elevation	Abandon Basement and Fill	Dry Floodproofing of Structures	Wet Floodproofing of Structures	Levee/Floodwall Protection for Multiple Structures	Utility Elevation/Backflow prevention	Partial Dry Floodproofing	Partial Wet Floodproofing	Levee/Wall/Berm for a Single Structure
1													
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Alternative Key
Highly Effective, Recommended
Effective
Not Recommended
Further Evaluation Needed
N/A (incomplete data)

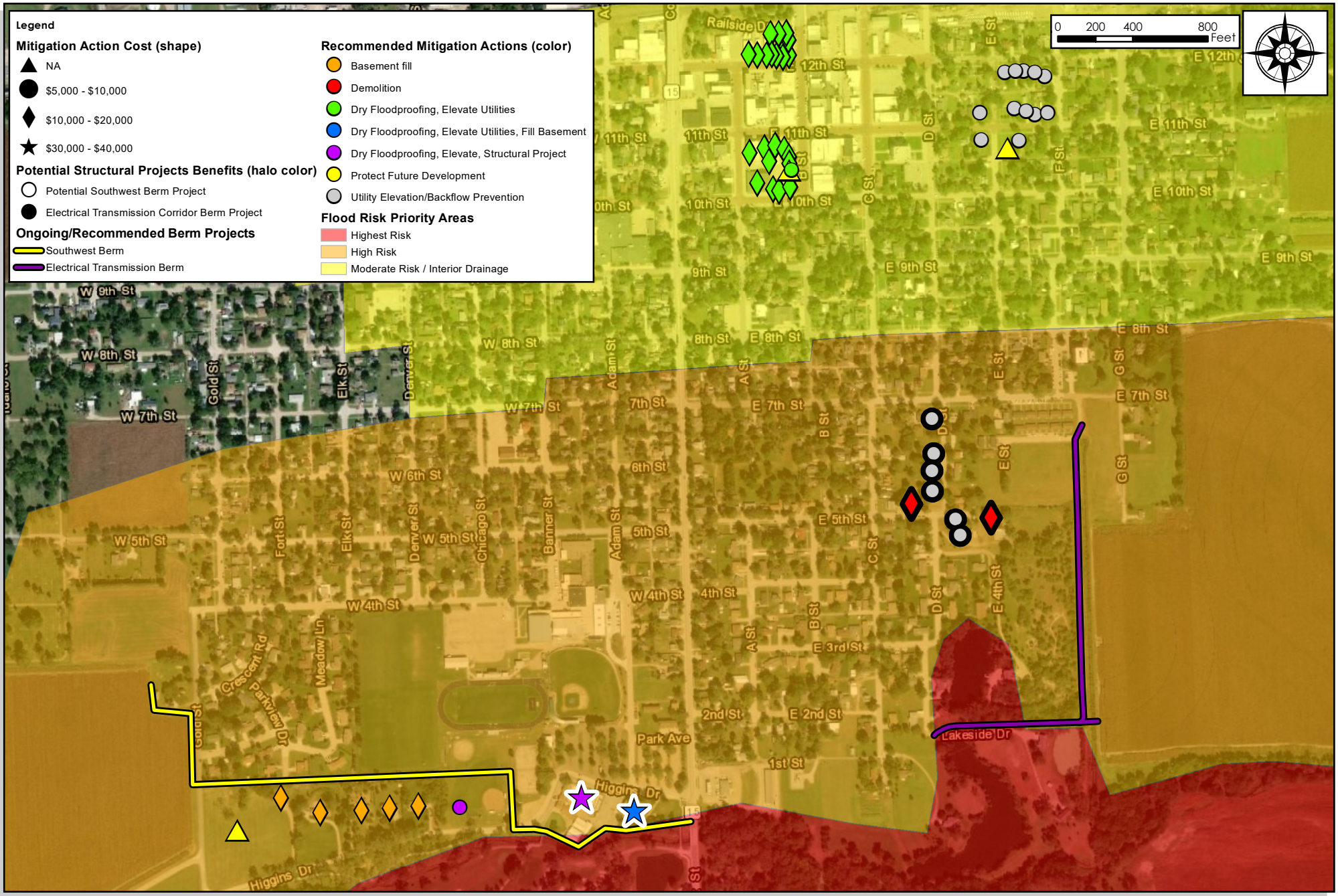

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Figure 5: Primary Mitigation Action Recommendations

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4 FLOOD MITIGATION PRIORITY SCORES

Flood mitigation priority scores are used to further prioritize flood risk reduction actions by determining how these actions provide additional benefits such as impact beyond minimum flood risk reduction objectives.

4.1 Scoring Approach

A scoring system similar to the flood risk property scores was developed to determine Flood Mitigation Priority Scores. However, in contrast to the Flood Risk Property Scores, the priority scores are used to determine which properties are highest priority to take mitigation action on based on specific property and mitigation action characteristics. Factors considered include but are not limited to benefits to repetitively flooded properties and proximity to other mitigation projects. This information can then be used to further differentiate projects. For example, if a property is repetitive loss, a mitigation action has higher priority than a similar action for a non-repetitive loss property. An overview of the factors considered, and point values assigned is provided in Table 7.

For any individual property, the maximum risk assessment score for flood mitigation priority scoring is 500 points. A multiplier is determined based on the number of points assigned divided by 500; this is then multiplied by the Flood Risk Property Score to get the final Flood Mitigation Property Score. A higher multiplier indicates that the factors considered result in the property being a higher priority for mitigation action. When combined with the Flood Risk Property Score, the higher a resulting Flood Mitigation Property Score the higher priority the property is overall to mitigate.

4.2 Scoring Results

Results of the scoring are provided on the following Figures 6 and 7. The final Flood Mitigation Property Scores on Figure 7 indicate the overall combination of the Flood Risk Property Score, recommended mitigation action, and Flood Mitigation Priority Score and can be used to set relative priority for mitigation action decision purposes. The higher the score, the higher priority the property is to mitigate considering the flood risk and effectiveness of the recommended flood risk reduction action. The final score for each property is heavily driven by relative flood risk and potential for flooding impacts, with additional considerations accounted for as noted using the Flood Mitigation Priority Score multiplier.

Table 7: Flood Mitigation Priority Scoring

Factor	Points	Criteria	Applicable Mitigation Actions
Life and human safety	80	Project involves the permanent removal of habitable structure from flood hazard area.	Property Acquisition and Structure Demolition Property Acquisition and Structure Relocation Property Acquisition, Demolition/Relocation, and Re-sale
Relative cost effectiveness	80	Very cost effective - Mitigation action meets automatic BC threshold for HMA grants and will provide significant risk reduction for a cost lower than the cost to acquire the property.	Property Acquisition and Structure Demolition Property Acquisition and Structure Relocation Property Acquisition, Demolition/Relocation, and Re-sale Structure Elevation Dry Floodproofing of Structures Wet Floodproofing of Structures
	40	Moderately cost effective - Mitigation action is effective at reducing risk and flood insurance costs but does not meet the automatic BC threshold for HMA grants or will not provide significant risk reduction for a cost lower than the cost to acquire the property.	
	0	Undetermined or not cost effective	
Proximity to other mitigation projects	65	Project is located adjacent to other previously implemented or planned mitigation projects	Property Acquisition and Structure Demolition Property Acquisition and Structure Relocation Property Acquisition, Demolition/Relocation, and Re-sale Structure Elevation
Property recently added to floodplain with prior floodplain map revision	50	Property was not located in a mapped floodplain at the time of purchase by current owner	Any
Repetitive loss structure	50	Severe Repetitive Loss Structure	Any
	50	Repetitive Loss Structure	
	0	N/A	
Property adjacent to publicly owned land	25	Property touches publicly owned land	Property Acquisition and Structure Demolition Property Acquisition and Structure Relocation Property Acquisition, Demolition/Relocation, and Re-sale
Natural Resource protection benefits/recreation access	50	Property has or is adjacent to naturally beneficial areas, or provides recreation access.	Property Acquisition and Structure Demolition Property Acquisition and Structure Relocation Property Acquisition, Demolition/Relocation, and Re-sale
Historic preservation and cultural asset protection	20	Property includes historic structure(s) or is in proximity to areas of historic or cultural significance	Any
Other	80	High	Any
	40	Medium	
	0	Low	

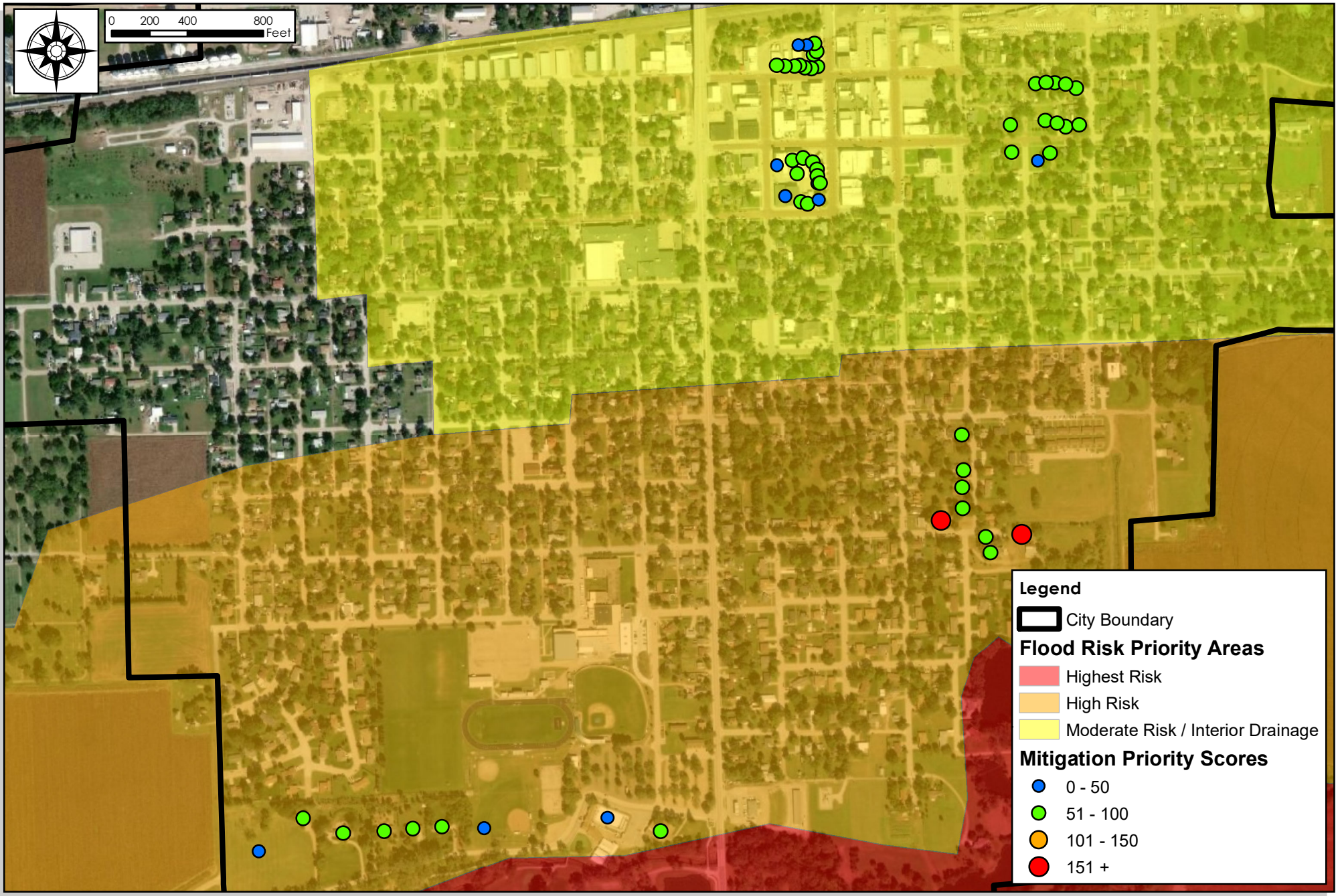

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Figure 6: Flood Mitigation Priority Scores

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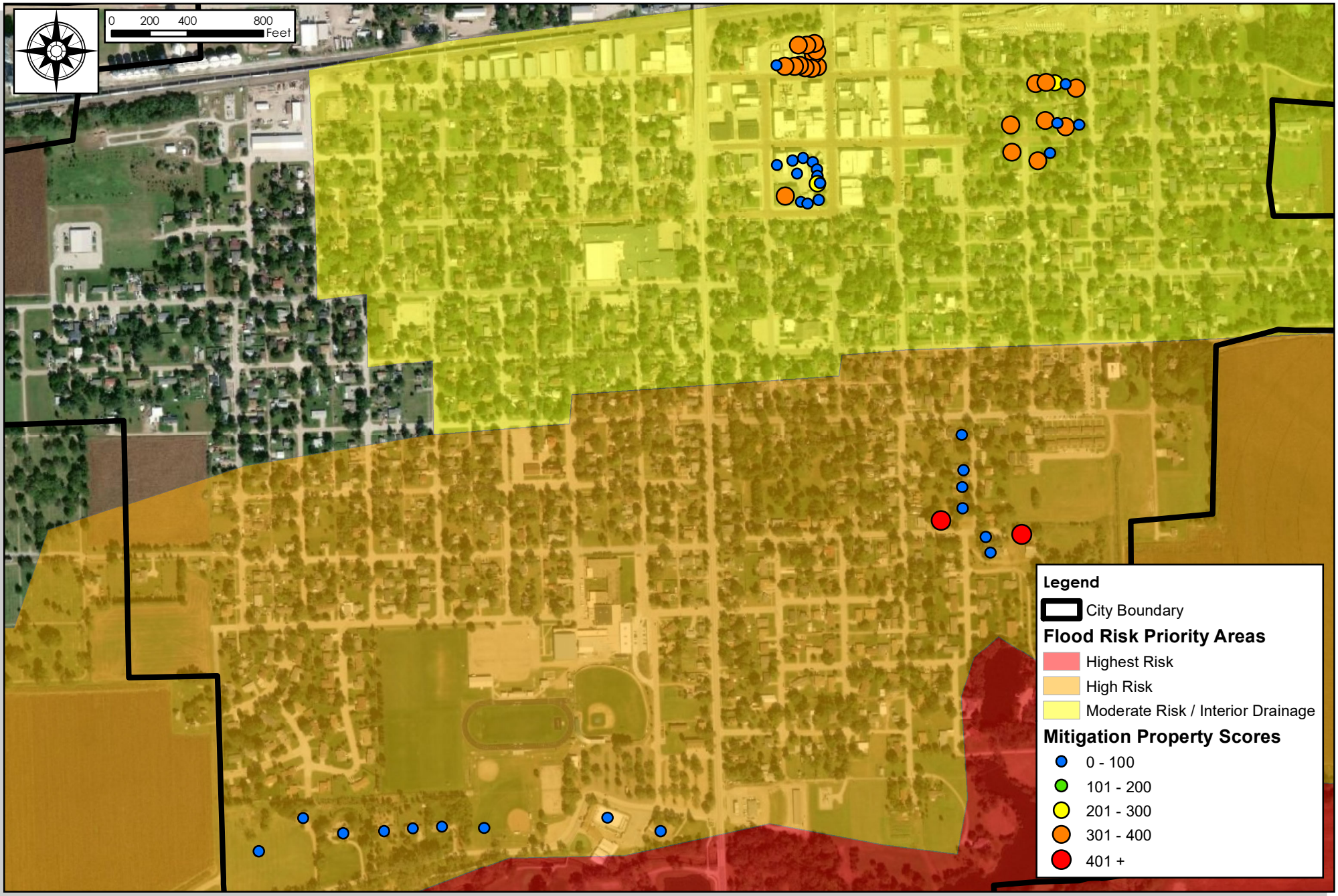

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Figure 7: Flood Mitigation Property Scores

Schuyler, Nebraska

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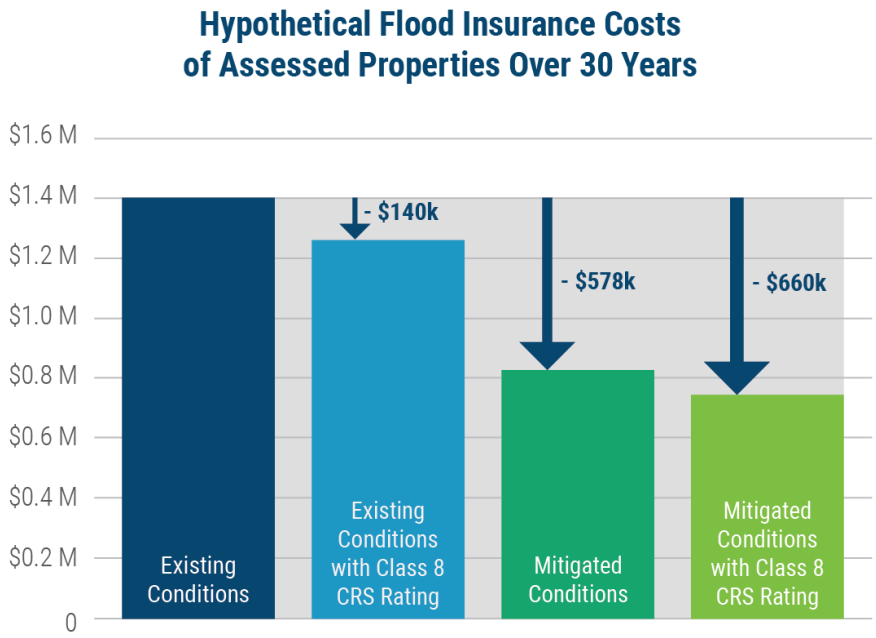
5 FLOOD INSURANCE AND THE COMMUNITY RATING SYSTEM (CRS)

Flood insurance is an essential mitigation action and it is recommended that all property owners within flood risk areas in the community obtain flood insurance whether required as part of a mortgage loan or not. While flood insurance is legally required for properties with a federally backed mortgage, it is available to all property owners in Schuyler as a result of the community's participation in the National Flood Insurance Program. By covering a property through both structure and contents coverage, property owners can both have protection from the financial consequences of flooding and be covered by the Increased Cost of Compliance (ICC) provision of flood insurance policies, which will provide funding for certain flood risk reduction projects in the event the covered structure is substantially damaged (damage exceeding 50% of the pre-damage market value) in a future flood. As of July 31, 2019 (best publicly available data) total flood insurance policies and coverage in Schuyler is 352 policies and approximately $37.1 million in coverage, respectively. An unknown number of properties were likely not covered by flood insurance during the March 2019 flood and may remain without flood insurance coverage. The buildings on these properties are vulnerable to both future damages and the potential for significant losses due to the lack of flood insurance coverage, unless flood risk is mitigated through nonstructural or structural mitigation action.

Based on current conditions of the floodprone properties evaluated for this assessment, JEO completed a planning level evaluation of current flood insurance costs to those properties compared with what the cost will be once mitigated according to the primary mitigation action recommendation. This assessment is approximate as it depends on a number of assumptions including the level of coverage for structure and contents. For the purposes of this evaluation, it was assumed that the existing properties are generally rated as Pre-FIRM, which means they were either constructed before 3/5/1990 or before being identified in the floodplain as shown on the effective FIRM dated 4/5/2016. Pre-FIRM rating is currently a subsidized rating option, meaning it costs less than the actuarial, or elevation-based rate. For properties that have a floor lower than the base flood elevation, actuarial (elevation based) rating will result in a much higher rate than the Pre-FIRM rate. For proposed conditions, it was assumed the primary structure on the property is either elevated one foot above the base flood elevation or floodproofed to two feet above the base flood elevation. Based on these assumptions and using actuarial rates, the benefits of mitigation for just the assessed properties is approximately $15,000 - $20,000 per year in lower premiums which is approximately $450,000 - $600,000 dollars in premium savings over a 30-year period, as shown in Figure 8. Assuming flood mitigation through elevation or floodproofing is completed for all floodprone properties in the SFHA within the community, this would result in a potential premium savings of over $10 million over a 30 year period assuming a savings of approximately $350.00/property/year and considering 975 applicable properties. It is worth noting that the significance of the premium difference is impacted by the subsidized rating structure of Pre-FIRM policy rates; these rates are anticipated to transition to full actuarial risk (elevation based) rates in the future, which will result in a more significant benefit for elevation projects that both reduce flood damage risk and flood insurance premium rates.

Figure 8: Hypothetical Flood Insurance Costs Over 30-Years – Assessed Properties



Currently the NFIP is moving towards a new rating structure called Risk Rating 2.0, which is anticipated to be implemented on October 1, 2021. While full details have not been released, this flood insurance rating structure is anticipated to take into account distance from the flooding source along with depth and frequency of flooding. Likely this could result in higher flood insurance rates for the highest risk properties, such as the properties in the floodway/highest flood risk priority areas of Schuyler. Under Risk Rating 2.0, it is anticipated that mitigation actions such as elevation of structures, wet floodproofing, and elevating utilities will be credited with flood insurance cost reductions, similar to the current rating structure. The overall rating structure is anticipated to put a focus on reducing flood damage risk to properties that are in the highest risk areas such as high velocity or high flood depth regions of the floodplain. By taking mitigation action now, property owners can avoid potentially significant future flood insurance cost increases.

As previously noted, the community could consider participating in the NFIP's CRS program. Through this program, the community would receive flood insurance discounts for floodplain management related activities and policies the community implements. Based on a review of potential activities and scoring, Schuyler would likely enter the program as a Class 8 and receives a 10% flood insurance discount for all property owners in the community. Based on current levels of coverage and written premium this would result in an annual savings to property owners of approximately $19,200 just for the community participating in the CRS program. This annual savings could translate to $575,000 or more in savings over a 30-year period.

6 RELATED STUDIES AND FLOOD RISK REDUCTION PROJECTS

In addition to performing routine floodplain management through participation in the NFIP and potential additional activities through the NFIP's CRS program, the City of Schuyler continues to pursue multiple floodplain management and flood risk reduction actions that collectively will reduce the risk of flooding and potential damages from flooding for Schuyler property owners. A summary of these historical and ongoing actions is provided in Table 8. An overview of these projects for the areas covered by this parcel level mitigation action assessment is also shown on Figure 9.

As part of these efforts, the City has been evaluating flood risk for the community overall through technical assessment of revised hydrologic and hydraulic modeling for the Platte River. Initially, this effort was started due to recent hydrologic evaluation updates completed by USACE (December 2018 Platte River Hydrology analysis). However, due to the March 2019 flooding, these observations were also considered. A HEC-RAS 2D flood model was developed to match the observed flood heights of the March 2019 flooding. Along with this, hydraulic models with higher flow rates were also developed and represent an assessment of the sensitivity of flood risk to changes in peak flow rate. The City is considering how to utilize this information and the pursuit of a potential flood map change, as open water peak flooding appears to produce less flood risk than currently represented on the effective FIRM. It is important to note, however, that further assessment of ice effects with future modeling efforts will be necessary. This flood risk modeling may also be utilized to develop further identification and prioritization of flood risk reduction alternatives for the community. Details are provided in the Schuyler Platte River Flow evaluation, provided in Appendix B, as well as Figure 10.

Table 8: Related Plans and Studies

Action	Timeline	Objective	Outcome
Platte River Corridor Evaluation	Ongoing	Based on a combination of new flood data developed through hydrologic analysis by USACE and observations of flood risk from the March 2019 flood, the City has undertaken an initial evaluation of updated flood risk modeling. The objective is to improve the accurace of flood risk assessments for the City of Schuyler and determine if a floodplain mapping revision effort is appropriate.	Additional flood modeling, prioritization, and development of flood risk reduction actions for the City of Schuyler. An overarching goal of this effort is to ensure that further identificaiton and prioritization of structural and nonstructural mitigation actions is informed by best available flood risk modeling. It is also a goal of this effort that any revised flood modeling ultimately be taken into account on the effective FIRM for Schuyler.
Local Drainage Evaluation	Ongoing	Evaluate installation of backflow prevention on the storm drain system and other capital projects for the storm drainage system at Schuyler that will reduce risk of flooding impacts during a major flooding event.	Identification and prioritization of potential improvements to the strom drain system and resulting reduction of flooding risks.
Electrical Transmission Corridor Berm	Ongoing	Design of improvements and enhancements to exisiting high ground southeast of Schuyler for the purposes of reducing peak flow flood risks.	Construction of berm improvements that will reduce peak flow flooding risks to southeast Schuyler.

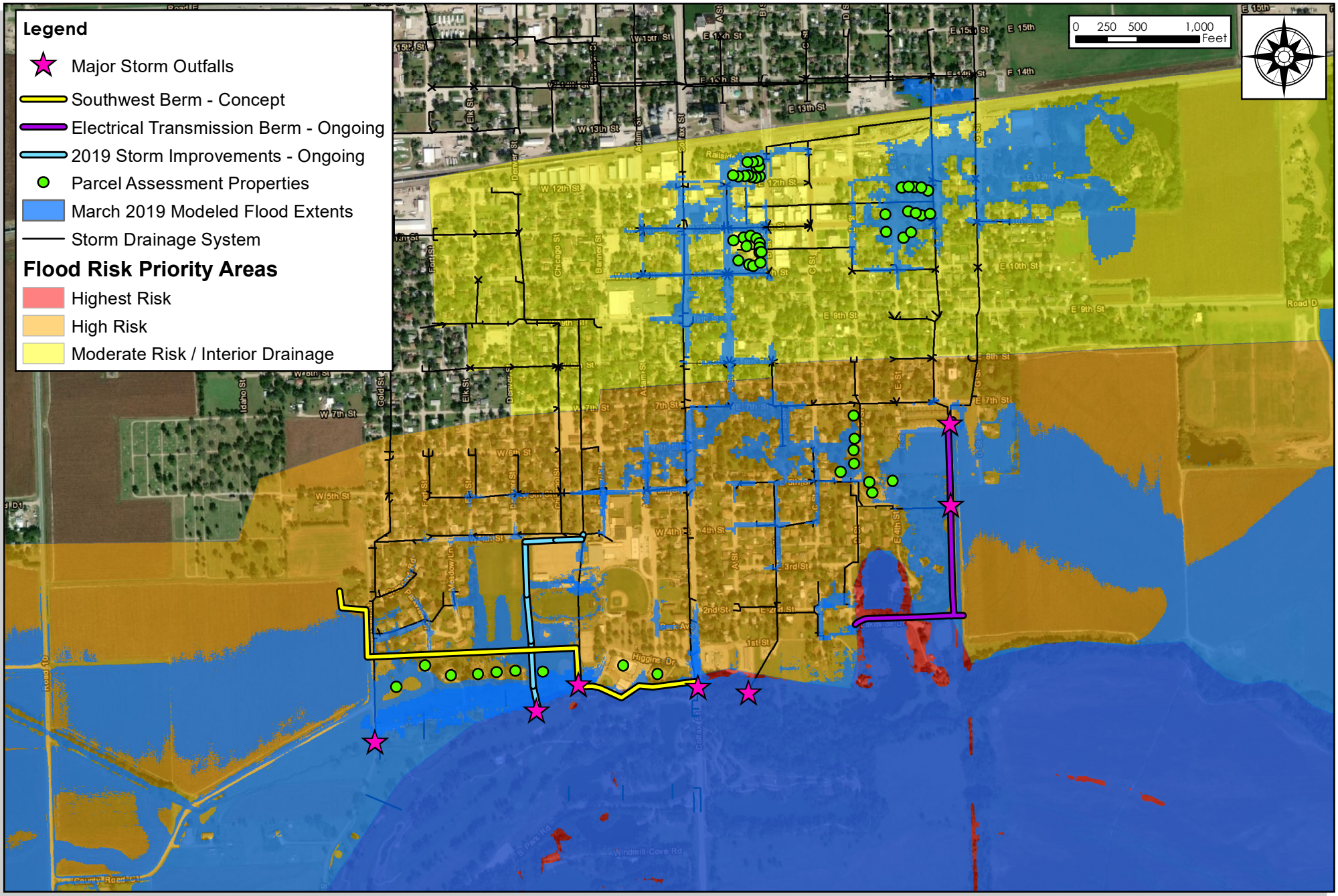


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Figure 9: Related Plans and Studies

Schuyler, Nebraska

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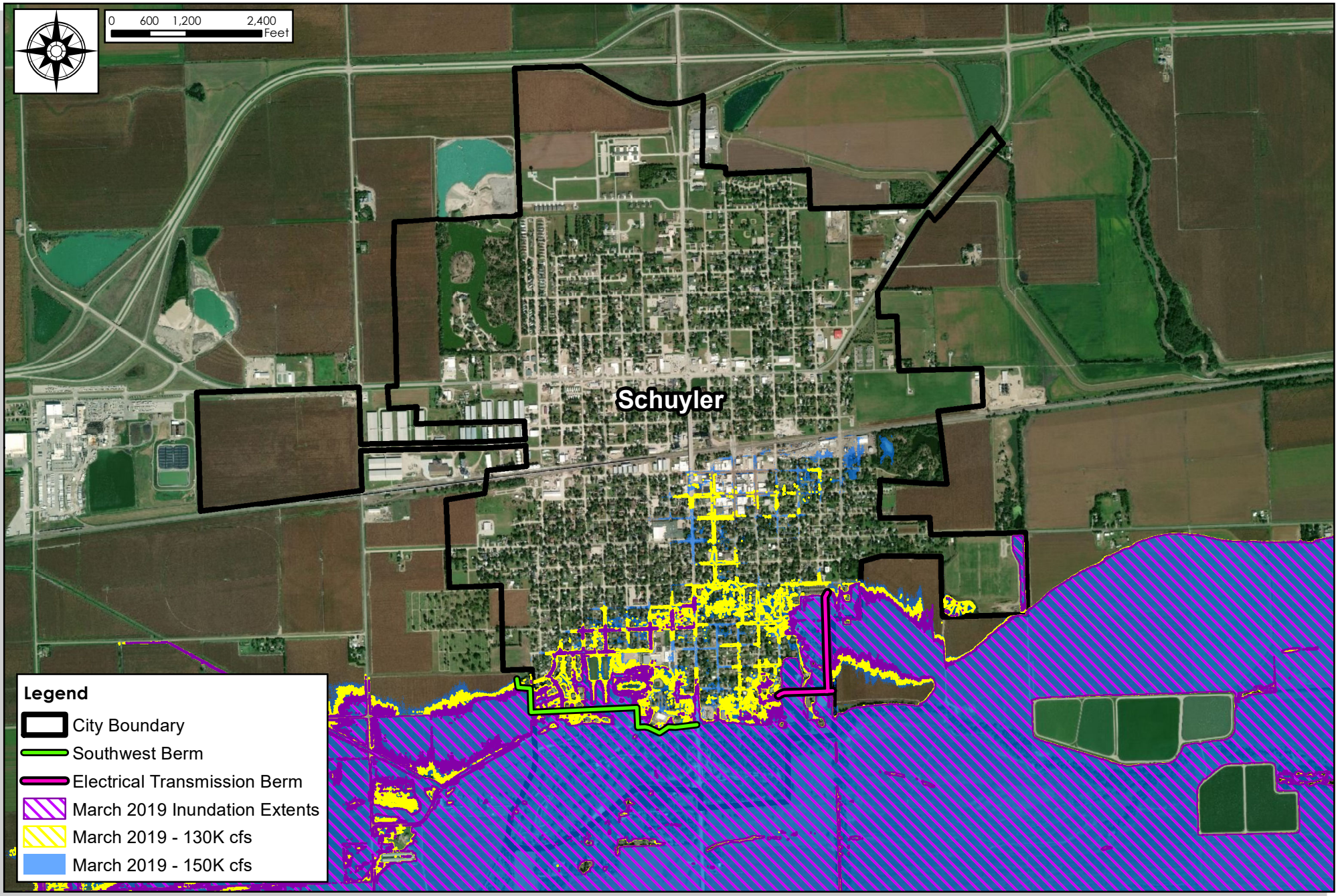

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Figure 10: Flooding Extents Scenarios and Flood Risk Reduction Berm Locations

Schuyler, Nebraska

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7 RECOMMENDED FLOOD RISK REDUCTION ACTIONS PRIORITY

Based on the findings of the parcel assessment and a review of recent and ongoing flood risk reduction mitigation actions to date, recommendations have been developed to promote flood risk reduction action by property owners within Schuyler. The recommendations are reflected in the flood mitigation property scores shown on Figure 7 as well as the content of Tables 4, 5, and 6. A summary of these recommendations in priority order are:

1. Continue pursuit of a flood risk reduction mitigation action program through CDBG and other potentially applicable funding sources. Mitigation actions should be focused on the highest risk areas.
    a. First priority should be placed on structures in the highest and high risk Flood Risk Priority Areas, which generally includes the floodway and areas with the most overland flooding impacts experienced during the March 2019 flood. Key locations include the structural and nonstructural mitigation actions focused around the ongoing Electrical Transmission corridor berm project and the possible berm project/nonstructural actions (Southwest Berm) in the Oak Ballroom area.
    b. Second priority should be placed on drainage improvements that will reduce the risk of backflow flooding to through the storm drain system to downtown areas as well as other capital improvements that will reduce flood risk associated with the storm drainage outfall locations. Prioritized recommendations are expected to result from the ongoing storm drainage evaluation.
    c. The City should also consider acquisition and removal or acquisition and re-development for low value structures within the assessment area.
2. The City should continue participating on the NFIP's community rating system and consider evaluation of alternatives to increase public education regarding flooding and promotion of flood insurance. The City should also consider joining the NFIP's CRS program. Along with these efforts the City should evaluate ongoing or potential activities that will result in a CRS class improvement and associated flood insurance cost reductions for community property owners.
3. The City should consider incorporating all ongoing flood risk reduction efforts into a comprehensive long-term flood risk mitigation and recovery plan. Doing this will allow for consistent and prioritized coordination of outcomes of all activities over the long term, resulting in the optimum flood risk reduction action implementation process for the City. Completing this plan will also likely improve the City's CRS class, should the City seek to join the CRS program. Additionally, Economic Development Administration (EDA) funds can potentially be used for development and implementation of this plan.
4. The City should consider development of a Flood Preparedness and Response Plan, to include the potential for development of a more robust flood warning system and flood warning procedures.

8 FUNDING

Given the significant costs to potentially implement large scale flood risk reduction mitigation actions such as those presented in these recommendations, the City should seek additional funding support beyond the general budget. Several potential funding options are summarized below, generally in order of complexity and effort needed to procure funding.

8.1 Lower Platte North NRD

Historically, the LPNRD has assisted communities within the NRD with flood risk reduction improvements as well as flood risk reduction planning. A typical cost share has ranged from 25-50% of project costs and may or may not include cost share assistance for engineering studies and design related to the projects. The NRD's ability to cost share on any specific project may vary based on other NRD project priorities and available funding year to year. Because of this, it is recommended that the City initiate discussions with the LPNRD regarding cost share opportunities and feasibility as soon as possible if the City wishes to pursue one or more potential projects.

8.2 Community Development Block Grants (CDBG)

Under the CDBG Program, DED has several funding categories to address housing, downtown revitalization, water and wastewater, public works, planning, and economic development. One such category is Emergent Threat (EM). The purpose of the EM Category is to assist communities with situations that pose a serious and immediate threat to public health, safety, or welfare. Priority is given to those projects that are meeting the emergent threat criteria. All activities proposed in applications for CDBG funding in the EM Category must meet the national objective of benefitting low-and moderate- income persons (through the subcategories LMI Area Benefit and LMI Limited Clientele), aid in the prevention or elimination of slums or blight in either an area (SBA) or spot basis (SBS), and/or through urgent need (UN). The City's low- and moderate-income (LMI) percentage is 55.90% (American Community Survey 5-Year Estimate 2011-2015), therefore, the City will need to apply for this funding using the CDBG National Objective of preventing or eliminating of slum and blight or urgent need. Respondent to the current threats associated with disaster declarations throughout the state, this category also allows for the State and communities to respond to and address emergent issues and needs as they are identified. Given a disaster is transitory in nature and future events likely, application must identify the cause of the situation, such as: flooding, tornado, fire, or other natural or man-made disaster.

On December 4, 2019, Governor Ricketts issued a news release announcing that the U.S Department of Housing and Urban Development (HUD) awarded the State of Nebraska $108.9 million to aid Nebraska in its long-term disaster recovery efforts. The rules, policies, and application guidelines governing this supplemental allocation of CDBG funds are expected to be released in Spring 2020. Schuyler should consider this funding source for flood risk reduction improvements, once available.

8.3 Economic Development Administration (EDA)

EDA funding can be utilized to help communities recover from disasters such as the March 2019 flooding. The highest potential for funding through this program is for actions that will promote economic development and job creation. Potentially eligible activities relevant to the City of Schuyler include restoration or enhancement of damaged infrastructure; disaster resilience, mitigation, and recovery

planning; and industry diversification/economic re-development. The City could consider EDA funding for a number of potential planning and recovery actions.

8.4 FEMA Hazard Mitigation Assistance (HMA)

FEMA Hazard Mitigation Assistance funding opportunities include Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation Assistance (PDM), and Hazard Mitigation Grant Program (HMGP) opportunities. FMA and PDM are annual grant funding opportunities that are nationally competitive, while HMGP funding is associated with post-disaster circumstances and therefore is variable, although funding is state specific. FMA is administered by NeDNR and PDM and HMGP are administered by NEMA While project eligibility and approval criteria are similar across each grant program, certain programs carry additional stipulations. For example, FMA will not fund levee improvements. Obtaining funding through these programs requires a detailed application process and must meet cost-benefit requirements.

For a summary of potential grants and eligibility by project, see Table 9 below. Shaded entries indicate the potential for the noted funding source to be used for the specified mitigation action.

Table 9: Funding Alternatives Summary

	Potential Funding Sources				
	LPNRD	**FEMA HMA**	**CDBG - EM**	**EDA**	**Local**
Priority 1 - Structural Projects Resulting from Drainage Evaluation, Electrical Transmission Berm, and possible Southwest Berm					
Priority 2 - Public Outreach and Joining CRS					
Priority 3 - Long Term Flood Mitigation and Recovery Plan					
Priority 4 - Flood Preparedness and Response Plan					

[1] FEMA HMA funding may be more difficult to attain for a Flood Preparedness Plan based on recent attempts to fund similar plans around the state.

APPENDIX A – PARCEL LEVEL FLOOD RISK AND MINIMUM REQUIRED ELEVATION INCREASE DATA

Appendix A: Parcel Level Flood Risk and Minimum Required Elevation Increase Data

								Positive Depth = flooding risk				
Property ID	**Foundation (Field observations)**	**Estimated Lowest Adacent Grade (LAG)**	**Estimated Highest Adacent Grade (LAG)**	**10% Annual Chance Flood Elevation**	**2% Annual Chance Flood Elevation**	**1% Annual Chance Flood Elevation**	**Estimated First Floor Elevation**	**10% Annual Chance Flood Depth at First Floor**	**2% Annual Chance Flood Depth at First Floor**	**1% Annual Chance Flood Depth at First Floor**	**Minimum Recommended Elevation Increase of First Floor (New Lowest Floor)**	**Required Lowest Floor Elevation Based on 1% Annual Chance Flood Elevation**
1	Basement	1346.95	1347.70	1349.95	1351.36	1352.05	1348.70	1.25	2.66	3.35	4.35	1353.05
2	Basement	1346.43	1347.16	1349.88	1351.28	1351.99	1348.66	1.22	2.62	3.32	4.32	1352.99
3	Basement	1346.70	1347.52	1349.90	1351.31	1352.02	1349.02	0.88	2.29	3.00	4.00	1353.02
4	Crawl Space	1347.48	1348.18	1349.74	1351.15	1351.80	1349.18	0.56	1.97	2.62	3.62	1352.80
5	Basement	1347.62	1348.30	1349.81	1351.21	1351.90	1351.30	-1.49	-0.09	0.60	1.60	1352.90
6	Basement	1347.02	1347.75	1349.81	1351.22	1351.90	1348.92	0.89	2.30	2.98	3.98	1352.90
7	Basement	1347.06	1347.59	1349.74	1351.15	1351.79	1350.09	-0.35	1.06	1.70	2.70	1352.79
8	Crawl Space	1346.95	1347.55	1349.93	1351.34	1352.04	1349.55	0.38	1.79	2.48	3.48	1353.04
9	Basement	1347.22	1348.19	1349.88	1351.29	1351.99	1350.69	-0.81	0.60	1.30	2.30	1352.99
10	Basement	1347.72	1348.36	1350.05	1351.45	1352.13	1349.86	0.19	1.59	2.27	3.27	1353.13
11	Slab on Grade	1347.47	1348.20	1350.03	1351.43	1352.12	1349.20	0.83	2.23	2.92	3.92	1353.12
12	Open Lot	1347.53	1348.12	1349.91	1351.31	1352.02	NA	NA	NA	NA	4.90	1353.02
13	Basement	1347.53	1348.12	1349.91	1351.31	1352.02	1351.62	-1.71	-0.31	0.40	1.40	1353.02
14	Basement	1349.70	1350.43	1350.66	1352.02	1352.68	1350.43	0.23	1.59	2.25	3.25	1353.68
15	Slab on Grade	1349.70	1350.43	1350.66	1352.02	1352.68	1350.43	0.23	1.59	2.25	3.25	1353.68
16	Slab on Grade	1349.70	1350.43	1350.66	1352.02	1352.68	1350.43	0.23	1.59	2.25	3.25	1353.68
17	Slab on Grade	1349.70	1350.43	1350.66	1352.02	1352.68	1350.43	0.23	1.59	2.25	3.25	1353.68
18	Slab on Grade	1349.70	1350.43	1350.66	1352.02	1352.68	1350.43	0.23	1.59	2.25	3.25	1353.68
19	Slab on Grade	1349.70	1350.43	1350.66	1352.02	1352.68	1350.43	0.23	1.59	2.25	3.25	1353.68
20	Slab on Grade	1349.70	1350.43	1350.66	1352.02	1352.68	1350.43	0.23	1.59	2.25	3.25	1353.68
21	Basement	1349.70	1350.43	1350.66	1352.02	1352.68	1350.43	0.23	1.59	2.25	3.25	1353.68
22	Basement	1349.70	1350.43	1350.66	1352.02	1352.68	1350.43	0.23	1.59	2.25	3.25	1353.68
23	Slab on Grade	1349.70	1350.43	1350.66	1352.02	1352.68	1350.43	0.23	1.59	2.25	3.25	1353.68
24	Slab on Grade	1349.69	1350.27	1350.69	1352.05	1352.70	1350.27	0.42	1.78	2.43	3.43	1353.70
25	Slab on Grade	1349.51	1350.38	1350.73	1352.08	1352.74	1350.88	-0.15	1.20	1.86	2.86	1353.74
26	Slab on Grade	1349.87	1351.03	1350.65	1351.98	1352.75	1351.03	-0.38	0.95	1.73	2.73	1353.75
27	Slab on Grade	1349.87	1351.03	1350.65	1351.98	1352.75	1351.03	-0.38	0.95	1.73	2.73	1353.75
28	Slab on Grade	1349.87	1351.03	1350.65	1351.98	1352.75	1351.03	-0.38	0.95	1.73	2.73	1353.75
29	Slab on Grade	1349.87	1351.03	1350.65	1351.98	1352.75	1351.69	-1.04	0.29	1.06	2.06	1353.75
30	Crawl Space	1349.87	1351.03	1350.65	1351.98	1352.75	1351.69	-1.04	0.29	1.06	2.06	1353.75
31	Slab on Grade	1349.87	1351.03	1350.65	1351.98	1352.75	1351.03	-0.38	0.95	1.73	2.73	1353.75
32	Slab on Grade	1349.87	1351.03	1350.65	1351.98	1352.75	1351.03	-0.38	0.95	1.73	2.73	1353.75
33	Slab on Grade	1350.02	1350.39	1350.65	1351.97	1352.77	1350.39	0.26	1.58	2.38	3.38	1353.77
34	Slab on Grade	1350.16	1351.08	1350.57	1351.91	1352.69	1351.58	-1.01	0.33	1.12	2.12	1353.69
35	Slab on Grade	1350.16	1351.08	1350.57	1351.91	1352.69	1351.08	-0.51	0.83	1.62	2.62	1353.69
36	Basement	1351.00	1351.45	1350.53	1351.87	1352.65	1357.45	-6.92	-5.58	-4.80	-3.80	1353.65
37	Parking Lot	1350.07	1350.68	1350.53	1351.88	1352.65	NA	NA	NA	NA	2.97	1353.65
38	Slab on Grade	1350.07	1350.68	1350.53	1351.88	1352.65	1351.27	-0.74	0.61	1.38	2.38	1353.65
39	Crawl Space	1348.74	1350.88	1350.15	1351.50	1352.29	1351.38	-1.23	0.12	0.91	1.91	1353.29
40	Basement	1349.05	1350.21	1350.19	1351.54	1352.30	1350.87	-0.68	0.67	1.43	2.43	1353.30
41	Basement	1349.37	1350.86	1350.20	1351.55	1352.30	1352.61	-2.41	-1.06	-0.31	0.69	1353.30
42	Basement	1349.96	1350.91	1350.21	1351.56	1352.29	1352.41	-2.20	-0.85	-0.12	0.88	1353.29
43	No Observation	1349.37	1349.94	1350.27	1351.62	1352.35	1349.94	0.33	1.68	2.41	3.41	1353.35
44	Basement	1349.17	1350.70	1350.16	1351.53	1352.23	1353.70	-3.54	-2.17	-1.47	-0.47	1353.23
45	Basement	1349.05	1350.30	1350.15	1351.52	1352.22	1352.96	-2.81	-1.44	-0.74	0.26	1353.22
46	Slab on Grade	1348.21	1349.13	1350.03	1351.42	1352.12	1349.13	0.90	2.29	2.99	3.99	1353.12
47	Basement	1352.31	1353.99	1351.29	1352.64	1353.32	1353.99	-2.70	-1.35	-0.67	0.33	1354.32
48	Slab on Grade	1352.51	1355.44	1351.52	1352.83	1353.51	1355.44	-3.92	-2.61	-1.93	-0.93	1354.51
49	No Observation	1353.13	1353.77	1352.01	1353.28	1353.96	1353.77	-1.76	-0.49	0.19	1.19	1354.96
50	Basement	1352.69	1353.81	1352.10	1353.38	1354.05	1353.81	-1.71	-0.43	0.23	1.23	1355.05
51	No Observation	1353.13	1353.77	1352.01	1353.28	1353.96	1353.77	-1.76	-0.49	0.19	1.19	1354.96
52	Basement	1353.63	1354.56	1352.18	1353.46	1354.13	1354.56	-2.38	-1.10	-0.43	0.57	1355.13
53	No Observation	1352.74	1353.65	1352.33	1353.61	1354.27	1353.65	-1.32	-0.04	0.62	1.62	1355.27
54	No Observation	1352.05	1353.88	1352.45	1353.71	1354.38	1353.88	-1.43	-0.17	0.49	1.49	1355.38
55	Open Lot	1352.05	1353.88	1352.45	1353.71	1354.38	NA	NA	NA	NA	1.49	1355.38

APPENDIX B – SCHUYLER PLATTE RIVER FLOW EVALUATION

Platte River Flow Evaluation
Schuyler, Nebraska
JEO Project # 170988.00
August 5, 2019

Introduction and Background

The City of Schuyler (City) is subject to flood risks from the Platte River to the south of the City. Special Flood Hazard Areas from the Platte River are mapped within the City limits on the current FEMA Flood Insurance Rate Map (FIRM). Flood hazards may change due to many reasons and analysis of such hazards are typically based on the best available data at the time. The current evaluation was conducted to determine at a preliminary level whether it is in the best interest of Schuyler to consider moving forward with any further flood risk analysis and potential floodplain map updates based on any available new data, including observations from the most recent flood event of March 2019. During this event rapid snowmelt and heavy rains, among other factors including ice jams along the lower Platte River, resulted in significant flooding throughout the region including areas adjacent to the Platte River at Schuyler. However, it was observed that property in Schuyler did not experience significant damage. The City provided to JEO various documentation of the resulting flooding from this event. This information, along with various other sources including USGS and NeDNR stream gage data and satellite imagery taken during the event was utilized in the current evaluation.

Hydrology

Previous Studies and USACE Lower Platte River Hydrology Analysis

The effective FIRM is based on hydrologic analysis completed for the FEMA Flood Insurance Study (FIS) for Colfax County. The Platte River flood risk related information published in the 2019 FIS and associated effective FIRM panels includes flow data records from regional gaging stations through 1994 and floodplain mapping using topographic information from the early 2000's that pre-dates the development of LiDAR terrain data for the region. The hydrologic analysis published in the FIS included a seasonal analysis which resulted in a combined season flow-frequency relationship for the gaging station locations computed using the combined probability equation.

In 2018 the USACE conducted a flood frequency analysis of the Lower Platte River in Nebraska from Duncan to Louisville (USACE 2018). This analysis included additional gaging station data incorporating additional periods of record for the flow frequency assessment, although it did not include the March 2019 flood event. This is the best available flood frequency based hydrologic analysis and was used as the basis for the frequency event hydraulic analysis. A review of published hydrologic analysis data was completed to support development of an updated hydraulic assessment. USACE reported peak discharges for the 100-Year event decreased by approximately 16% from the published effective FIS values. Flow values from the FIS and USACE 2018 study are shown in Table 1 below.

Table 1 - Effective FIS vs. USACE 2018 Study Peak Discharges

Location	Return Period	USACE 2018 Revised Peak Flow (cfs)*	FIS Peak Flow (cfs)**	% Change (USACE Revised vs. FIS)
Schuyler	10-Year	49,200	62,000	-26.0%
	50-Year	90,500	106,000	-17.1%
	100-Year	113,900	132,000	-15.9%
	500-Year	203,900	220,000	-7.9%

* Mixed population (peak rainfall season/snowmelt season flows combined on an annual basis) used for December 2018 USACE Study peak flow values. **The effective FIS peak flow evaluation was a combined season analysis with baseline flood frequency analysis based on gage data through 1994 using Bulletin 17B.

March 2019 Peak Flow Evaluation

To support hydraulic analysis scenarios and to compare the impacts of the recent major flood vs. the published flood risk information, peak flows during the 2019 flood event at Schuyler were estimated from area stream gage stations. The USGS has numerous stream gages on the Platte River including USGS Gage 06796000 just downstream of Schuyler at North Bend, NE and USGS Gage 06774000 just upstream of Schuyler at Duncan, NE. During the time of the peak discharge the gage at North Bend was not functioning due to ice affects. The USGS has since provided a provisional estimate of the flows at the North Bend gage with a peak flow of 151,000 cfs. A review of the other gages in the area along with satellite imagery taken near the peak of the March 2019 flood indicate the estimated peak flows may be higher than actual observed peak flows; this assumes there were no significant ice jams or impacts which skewed the discharge-elevation rating curve relationship. Flow hydrographs of all major stream gages directly upstream of the North Bend gage on the Platte River are shown in Figure 1. Assuming coincident peak flows by all upstream gaged streams would result in a peak flow of 136,350 cfs. A combined hydrograph assuming a simple compilation of flows based on recording times at each gage (partial coincidence of peaks) was created using the flow hydrographs from the Platte River at Duncan, the Loup River and Loup Power Canal at Columbus and the Clear Creek gages which resulted in an estimated event peak flow of 111,490 cfs. Notably this is very similar to the 1% annual chance, or 100-year, flood value calculated through the recent USACE hydrology study. This estimated peak flow based on the hydrograph assessment was adopted for the March 2019 flood event hydraulic evaluation.

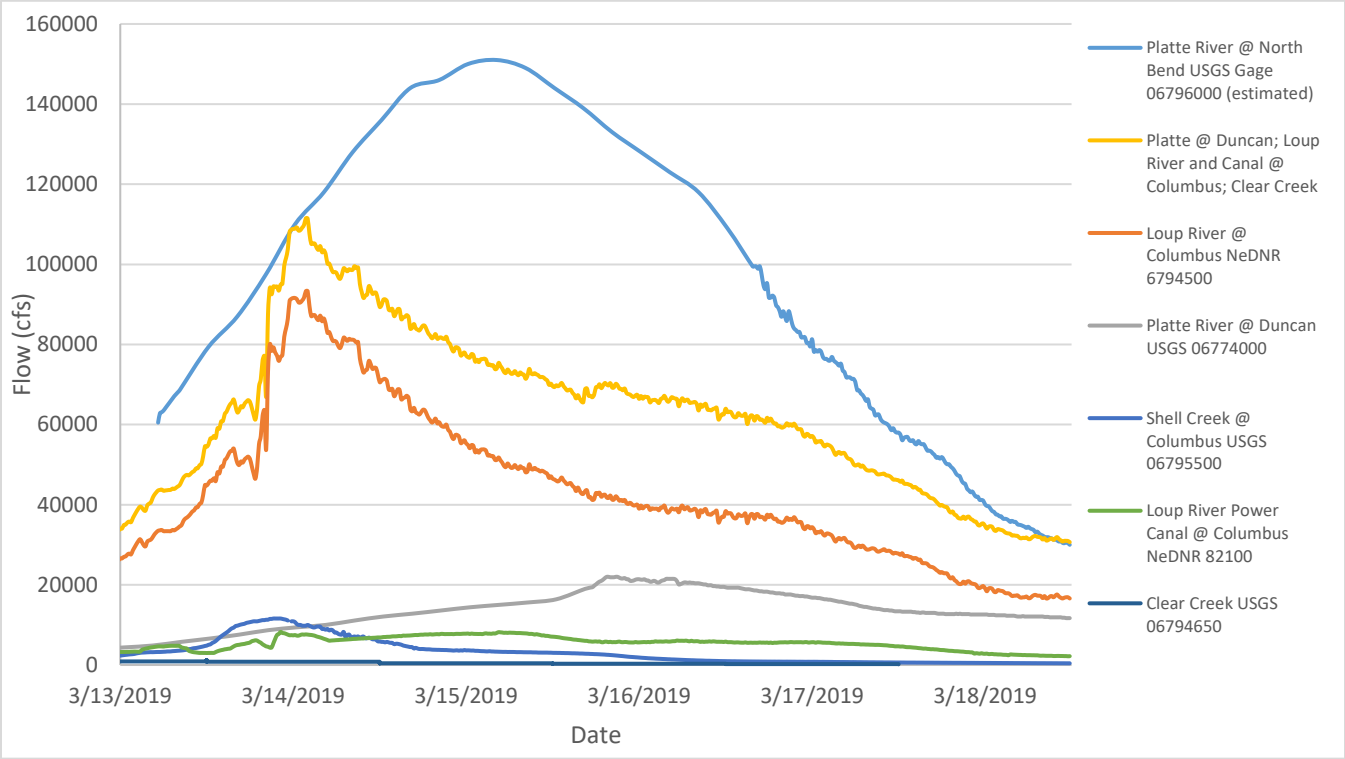
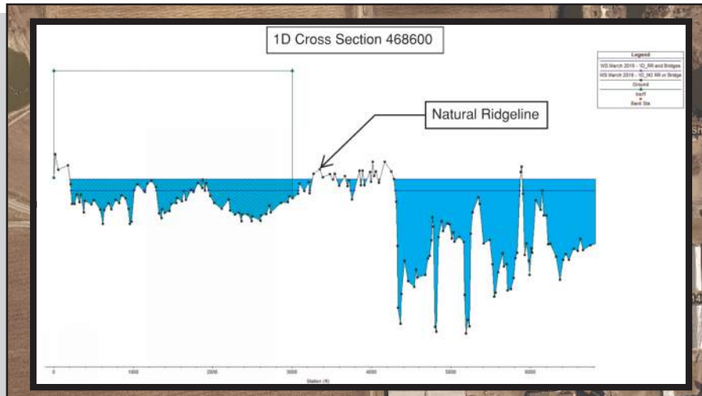


Figure 1: March 2019 Gage Analysis

Hydraulics

One-Dimensional Model Review

Several historical hydraulic studies have been completed on the Platte River. Most recently, as part of a Section 205 Flood Risk Management Project evaluation, the USACE developed a hydraulic model of the Platte River at Schuyler to evaluate a recommended plan for addressing the flooding risks along the Platte River for Schuyler. As part of this study a HEC-RAS one-dimensional (1D) steady state model was created; however, the topography used for the model pre-dated the current best available LiDAR topography data. JEO received this model from the USACE for use in the current analysis. This existing model was then updated to incorporate new data including the availability of LiDAR topography. Analysis scenarios were developed using both the updated USACE 2018 hydrology and the March 2019 estimated peak flow. A preliminary review of the results showed significant flooding in the City in all scenarios, beyond what was observed by city staff during the March 2019 event. Included in the base model geometry file was the Highway 15 bridge and the old railroad embankments just downstream of the Highway 15 bridge. The model was modified by removing the bridge and embankments from the analysis to assess whether the inclusion of the bridge and embankments in the 1D model overstated the flooding impacts. Results from this analysis still indicated flooding beyond what was observed during the March 2019 flooding as can be seen in Figures 2 and 3 . Based on this result, it appeared necessary to model the flood risk at Schuyler using two-dimensional (2D) methods to determine if this approach better replicates observed flooding.



Created By: Ann Nissen
Date: 5/10/2019
Software: ArcGIS 10.2

Figure 2 - March 2019 Flood Event 1D Model Calibration

Schuyler, NE

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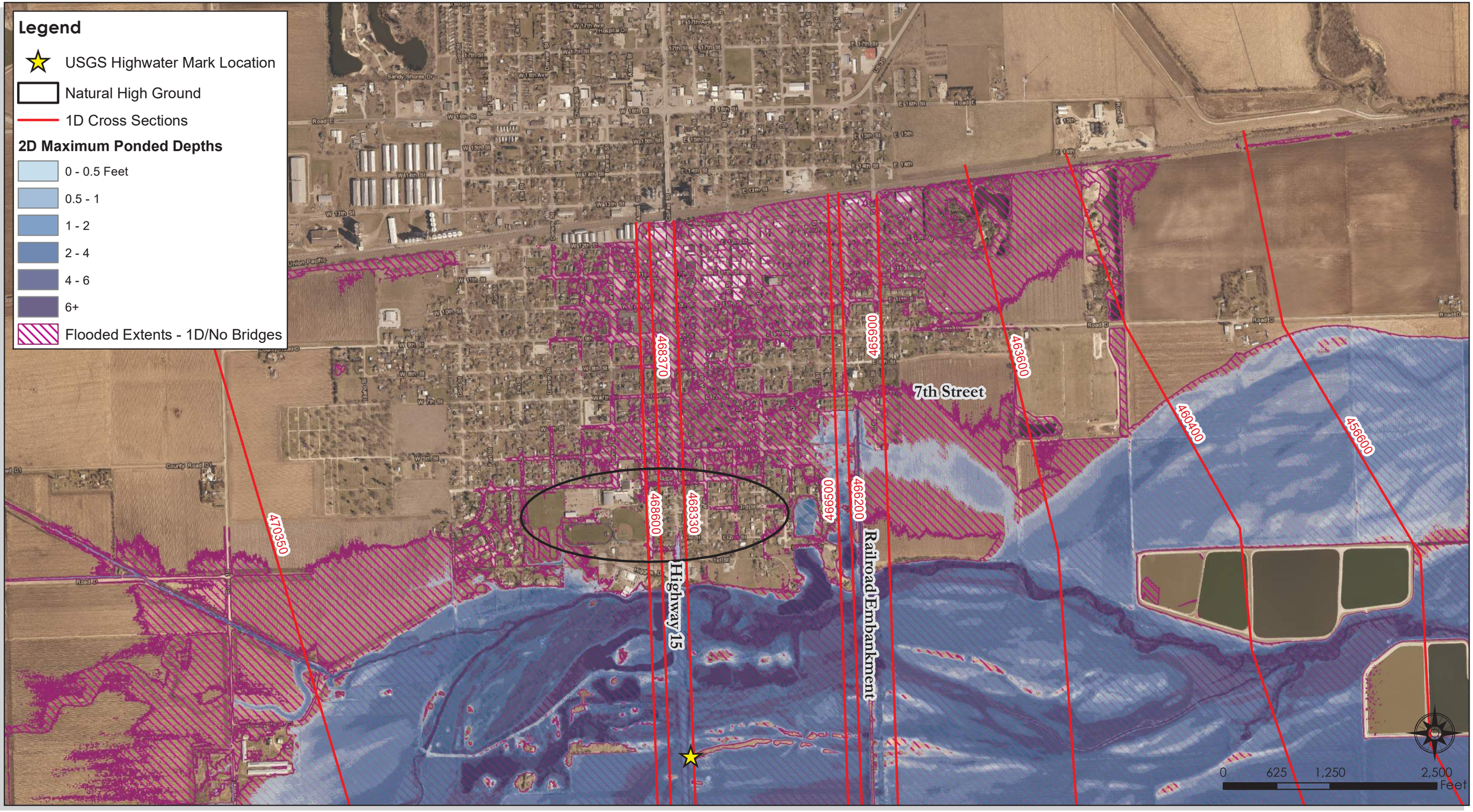

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Software: ArcGIS 10.2

Figure 3 - March 2019 Flood Event 2D Model Calibration

Schuyler, NE

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Two-Dimensional Model Analysis

Based on the results of the one-dimensional model, it was determined a two-dimensional unsteady state model may better indicate the actual flood risk to the City based on March 2019 flooding observations. In two-dimensional unsteady state models, water can flow both in the longitudinal and lateral directions (two-dimensional) and flows can change with time (unsteady). A two-dimensional existing conditions surface was created using LiDAR topographic data with a land cover surface created from the 2011 National Land Cover Database. Manning's 'n' values were assigned based upon the land cover surface and modified at the Lost Creek channel extents. The Platte River manning's 'n' value in the 2D model was set lower than what was used in the 1D model to account for the lack of bathymetric data in the LiDAR surface.

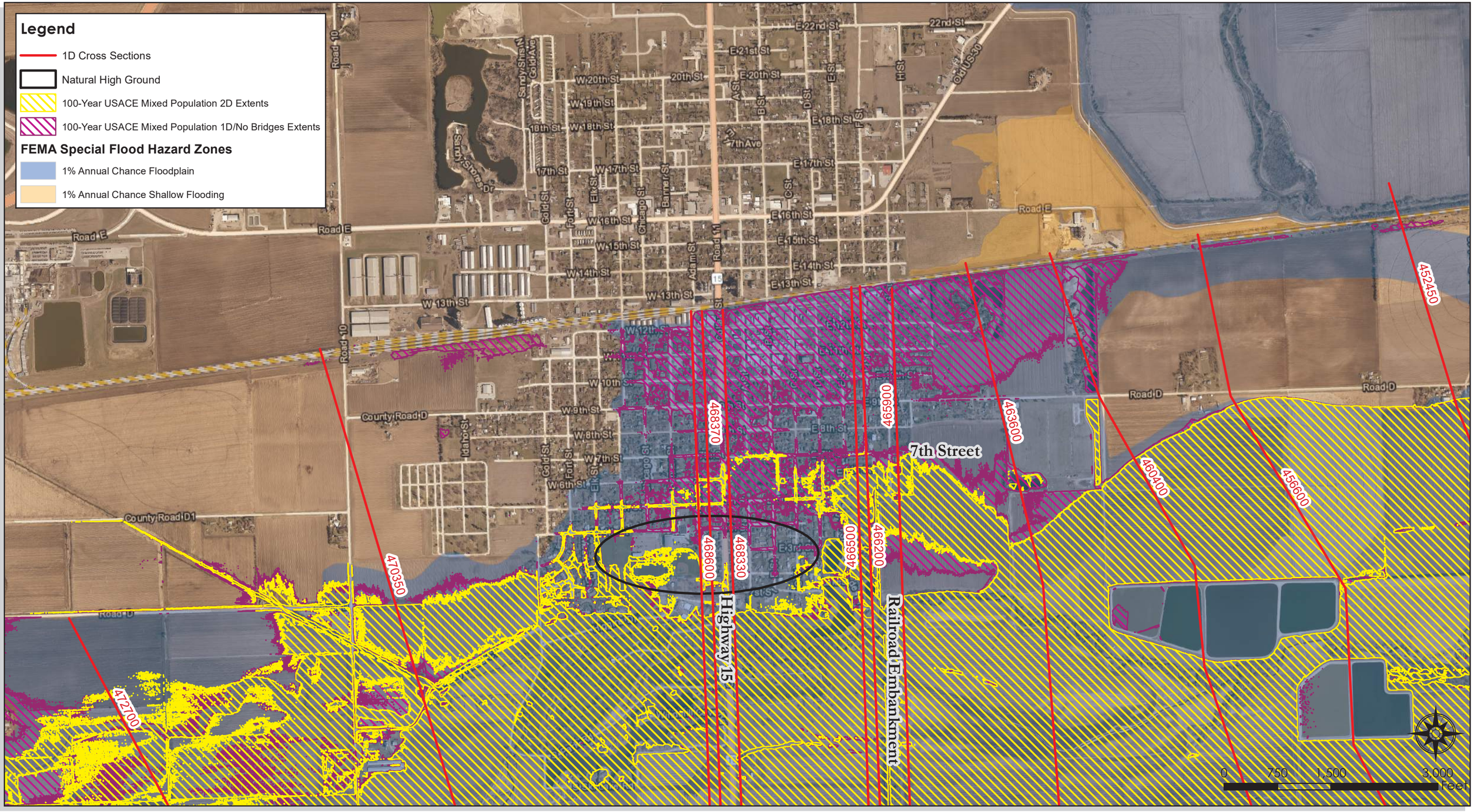
Analysis was completed using the March 2019 estimated flow hydrograph. Manning's 'n' values were modified to calibrate the model to the observed flooding. Results of the analysis are shown in Figure 3. These results both better replicate the apparent inundation area from the satellite imagery in comparison with the 1D hydraulic model and also compare well with high water mark data collected by USGS after the March 2019 flood event. The USGS high water mark elevation of 1351.171 NAVD 88 compares well to, and is in fact lower than, the JEO 2D model predicted water surface of approximately 1351.61 NAVD 88 near the City just downstream of HWY 15. It was also noted that while March 2019 peak flow values are at or near the USACE 2018 study calculated 1% annual chance peak flow, the actual flooding extent in March 2019 was somewhat less in comparison to 1D model results and the effective FIRM. This was most notable near the developed areas of the City and downtown areas, many of which are shown as floodprone on the effective FIRM. Based on review of the 1D cross sections for this area, it appears that terrain variations along the cross sections where they cross the City result in identification of potential flood risk areas that may not actually be hydraulically connected. When analyzed using 2D methods, this lack of connection results in an apparently lower flood risk for certain areas. It was also noted that better terrain data (LiDAR) results in a more refined and likely more accurate flood risk area.

Floodplain Mapping

A final analysis was completed using the calibrated two-dimensional model to determine the flooding extents expected based on the updated USACE 2018 hydrology. A flood hydrograph was created for the analysis by scaling of the USGS Platte River at North Bend 3/14/2019 to 3/16/2019 flow hydrograph to the USACE reported peak flow of 113,900 cfs for the 100-Year mixed population (rainfall season/snowmelt season flows). Resulting flood extents from the two-dimensional model and the FIS mapped floodplain are shown in Figure 4.

Two-Dimensional Modeling and Floodplain Mapping Limitations

Results shown in Figure 4 from the current model analysis do not reflect the actual maximum flood risk and are not necessarily what would be expected to be mapped should the City choose to pursue floodplain map updates. A full analysis of the flood hazard due to the Platte River would include analysis of ice impacts which is not currently possible in two-dimensional modeling with HEC-RAS. Final floodplain mapping would also take into consideration the impacts of non-levee embankments and how they can be mapped on the FIRM considering whether these embankments play a role in flood risk reduction shown on the FIRM.



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Date: 5/10/2019
Software: ArcGIS 10.2

Figure 4 - FIS Mapped and Modeled Flood Extents

Schuyler, NE

JEO CONSULTING GROUP INC

Results and Recommendations

The hydraulic scenarios in this evaluation provide significant benefit in understanding the differences in flood risk analysis results between 1D and 2D hydraulic methodologies as well as demonstrating that the 2D approach appears to reproduce the March 2019 flooding results more effectively. However, the results are preliminary and in order to be implemented further for the purposes of floodplain mapping would require additional details and technical review as outlined below.

Ice Effects and Non-levee Embankment Considerations

Recommendations:

- ***At a minimum coordinate with NeDNR and FEMA during the analysis phase of a FEMA mapping update to illustrate the complexity of the area and the need for a high resolution analysis.***
- ***Consider an additional phase of analysis to further evaluate ice impacts for use in a future FIS and other mitigation activities.***

Flood risk for the Platte River at Schuyler can be impacted by ice effects which can create localized higher flood levels due to ice jams. While this can occur anywhere along the lower Platte River, bridge locations can be particularly susceptible. In order to determine the flood risk due to ice effects for the 1% annual chance snowmelt season flood, further ice effected stage analysis is required. Currently, this is only available in the 1D steady state mode of HEC-RAS which limits the capability of using the draft 2D model for this purpose. Further coordination with NeDNR and FEMA Region VII would be needed to determine a technical approach to consider the effects of ice on flood stages while still utilizing the flood risk analysis benefits of the 2D model. A possible solution is to consider using an unsteady combined 1D/2D model for this purpose, with the 1D portion being the channel and the 2D portion the overbanks/floodplain. This unsteady model would be coordinated with the 1D steady ice analysis model to determine the flood risks due to ice effects. The final hydraulic analysis would need to be completed in order to determine the final flood risk details of a potential FIRM map revision.

Potential non-levee embankments such as intervening high ground between the Platte River and the downtown area and/or the railroad embankment that passes through central Schuyler are considered special cases for floodplain mapping purposes. Depending on the circumstances, the floodplain may be mapped behind non-levee embankments due to the potential for failure risk and because the embankments are not certified levees. In the case of the natural topographic ridge/intervening high ground that runs approximately along 7th Street in Schuyler and appears to play a role in surface flooding risk, further coordination with NeDNR and FEMA Region VII is likely required to determine if this location will be treated as a non-levee embankment or as natural topography. Completing this coordination will be required to finalize the analysis and floodplain mapping approach of any potential FIRM map revision.

Potential for Letter of Map Revision (LOMR)

Recommendations:

- ***Depending on the potential timing of a NeDNR/FEMA mapping effort consider moving forward with a LOMR to take advantage of the more detailed analysis.***

Preliminarily it appears there is a benefit of considering pursuit of a LOMR based on the 2D modeling results; however, the potential for successful floodplain mapping outcomes will likely be impacted by the consideration of ice effects and non-levee embankments. Due to this it is recommended that the agency coordination identified below be completed along with additional technical analysis to assess further the anticipated floodplain mapping outcomes based on these items.

NeDNR and FEMA Coordination

Recommendations:

- ***At a minimum coordinate with NeDNR and FEMA during the analysis phase of a FEMA mapping update to illustrate the complexity of the area and the need for a high resolution analysis.***

Due to the impacts of the March 2019 flood and as a follow up to the USACE hydrologic analysis for the lower Platte River, there is potential NeDNR will be pursuing a comprehensive flood risk analysis and floodplain map update for the lower Platte River. As part of this effort, the draft findings from this evaluation will be important to represent Schuyler's interests and actual flood risk circumstances. Additionally, NeDNR and FEMA will consider factors such as ice effects and the approach to non-levee embankments with this process. It is recommended Schuyler coordinate with NeDNR further to assess how the findings of this evaluation fit into the long-term flood risk assessment and floodplain mapping plan for this reach of the lower Platte River and how that information impacts moving forward with a potential LOMR.

Lost Creek Analysis

Recommendations:

- ***Consider including more detail to smaller but important features of the floodplain, such as Lost Creek, in future analyses.***

Through this effort to evaluate flood risks for the Platte River at Schuyler, it was noted that there is not a separate flood risk analysis for Lost Creek. Lost Creek is in between the Platte River and the City and runs through the golf course, near the Oak Ballroom, and between the wastewater lagoons. During high water events on the Platte, floodwaters enter the Lost Creek channel and regions along Lost Creek may experience additional flood damage/flow velocity impact risk for this reason. As additional Platte River evaluations continue, it is recommended to consider including additional evaluation of the impacts of flooding along Lost Creek as part of this process.

Coordinate Results with Other Efforts

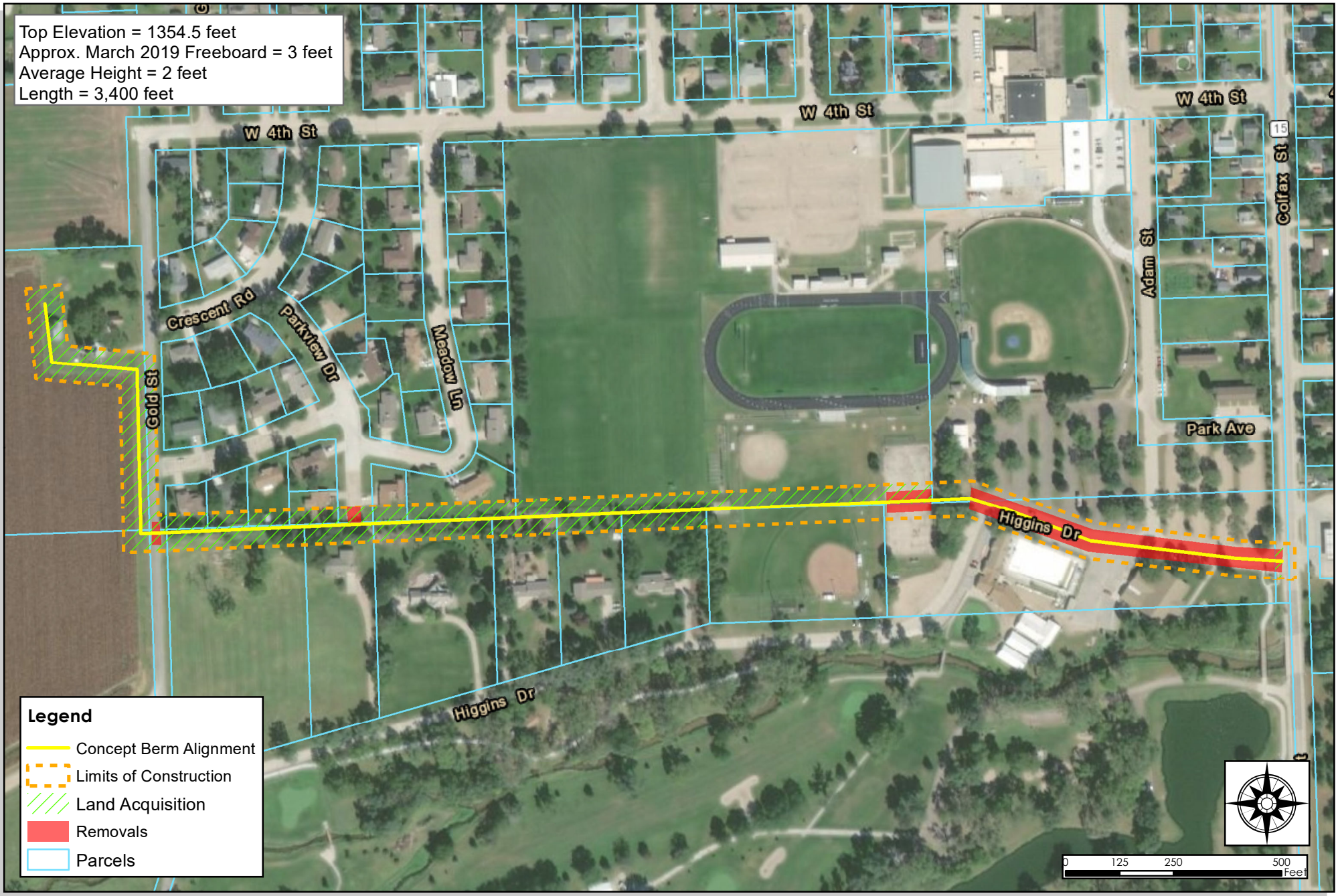
Recommendations:

- ***Coordinate these findings with other ongoing efforts being undertaken by the City or related entities to better identify/prioritize opportunities.***

This higher resolution analysis has identified nuances in the floodplain which can be used to better plan infrastructure and flood risk mitigation projects. Two ongoing efforts known to this project team include the Lower Platte North Hazard Mitigation Plan (HMP) as well as efforts underway by the Utilities Department. This higher resolution flood risk data can help prioritize activities and better identify opportunities for placement of new infrastructure in a more resilient manner as well as help prioritize potential mitigation efforts that may be part of the HMP.

For example, as nonstructural flood risk reduction efforts are evaluated as a part of the HMP through the parcel level mitigation assessment, perhaps areas shown as having flood risk in this analysis may be prioritized higher due to a more definitive evaluation of their risk. Conversely, perhaps potential flood mitigation activities may not be prioritized at structures within the current effective SFHA but outside of this evaluation's flood extents; this would reduce the potential for investing in mitigation at these properties prior to a flood mapping project that may reduce their future mapped flood risk profile.

APPENDIX C – CONCEPT SOUTHWEST BERM ALTERNATIVES AND COSTS



Created By: MRG
Date Created: 11/5/2019
Date Revised: 04/01/2020
Software: ArcGIS 10.7.1

Conceptual Berm Alignment
Alternative 1
Schuyler, NE

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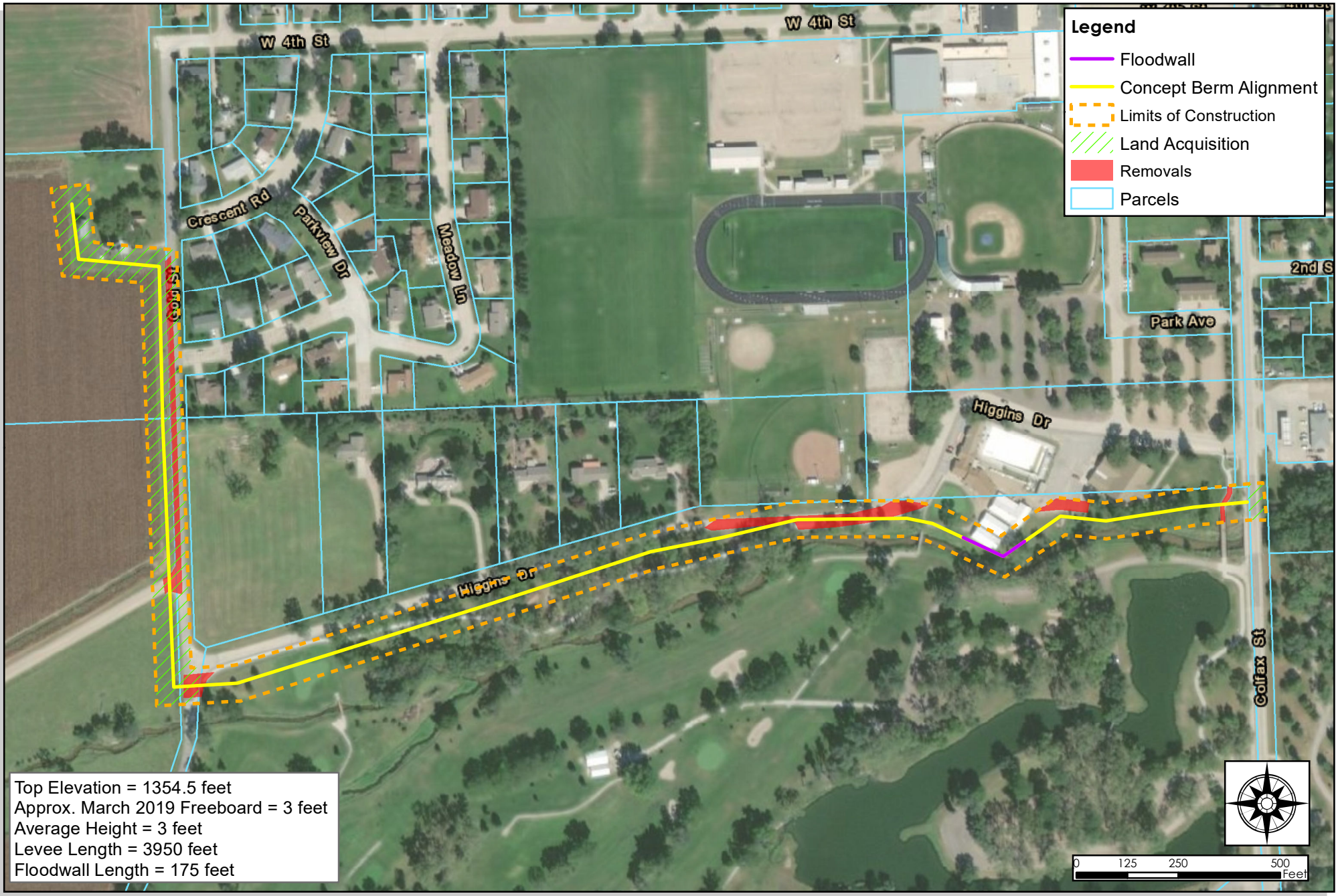

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Date Revised: 04/01/2020
Software: ArcGIS 10.7.1

Conceptual Berm Alignment
Alternative 2
Schuyler, NE

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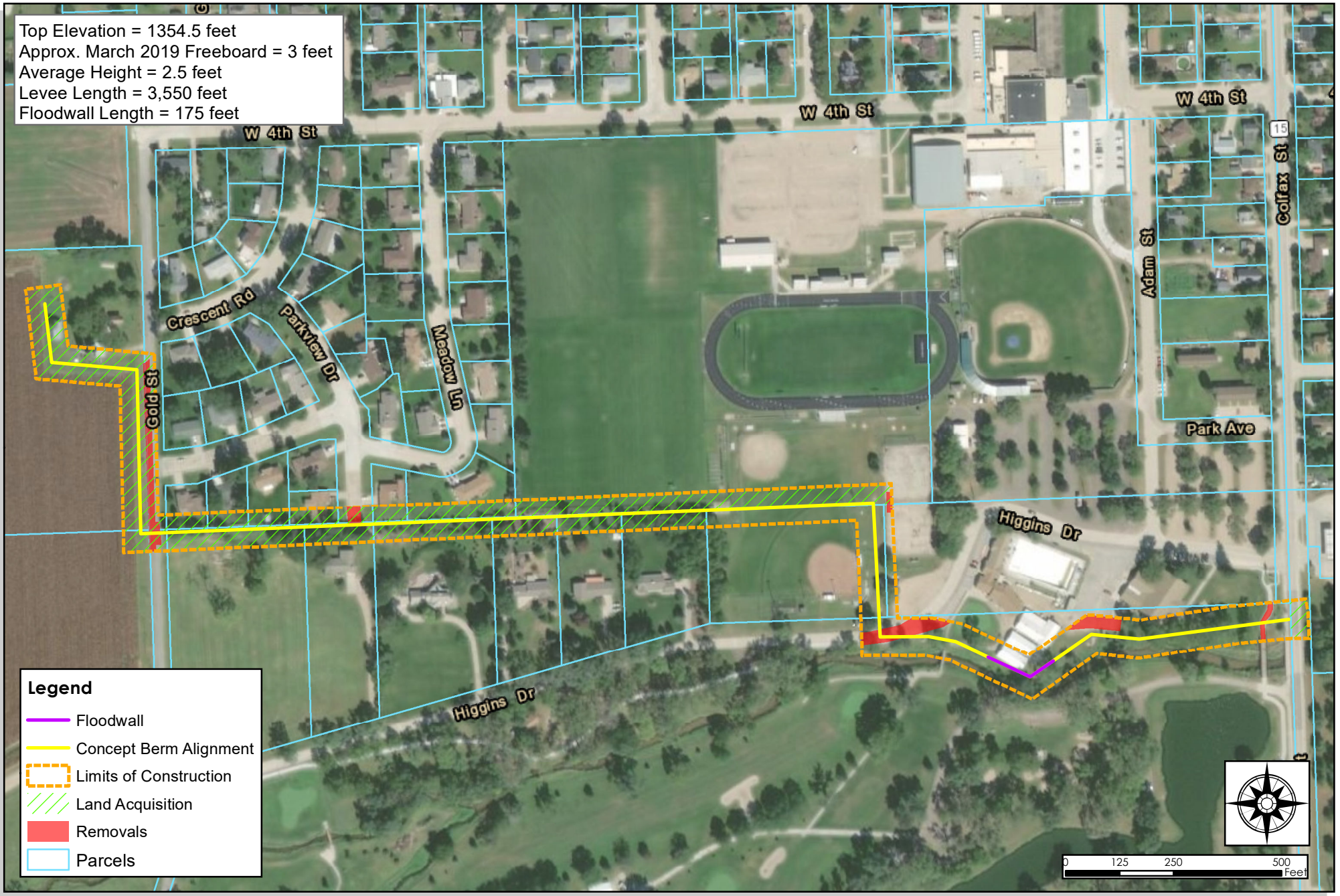

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Date Created: 04/01/2020
Date Revised:
Software: ArcGIS 10.7.1

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Conceptual Berm Alignment
Alternative 3
Schuyler, NE

JEO CONSULTING GROUP INC

ENGINEER'S CONCEPTUAL OPINION OF PROBABLE COST

Conceptual Berm Extension - Alternative 1

Schuyler, NE

JEO Project No. 170337.00

DRAFT

Date Prepared:

April 28, 2020

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
BASE BID					
1.	Mobilization	LS	1	$74,800.00	$74,800
2.	Bonding and Insurance	LS	1	$24,940.00	$24,940
3.	Land Acquisition	ACRE	4.5	$12,000.00	$54,000
4.	Temporary Traffic Control Measures	LS	1	$15,000.00	$15,000
5.	Clearing and Grubbing	ACRE	4.0	$10,000.00	$40,000
6.	Remove Pavement (Concrete and Asphalt)	SY	5,000	$25.00	$125,000
7.	Stripping and Topsoiling	CY	3,230	$5.00	$16,150
8.	Excavation (for berm not located along roadways)	CY	10,800	$8.00	$86,400
9.	Earthwork Measured in Embankment (not along roadways)	CY	13,940	$15.00	$209,100
10.	Earthwork Measured in Embankment (along roadways)	CY	890	$15.00	$13,350
11.	Topsoil, 6" Thick, On Site	CY	1,615	$4.00	$6,460
12.	Topsoil, 6" Thick, Off Site	CY	1,615	$25.00	$40,375
13.	Subgrade Preparation	SY	5,000	$4.00	$20,000
14.	Pavement, HMA, 4" Thickness	SY	630	$30.00	$18,900
15.	10" Concrete Pavement	SY	4,420	$75.00	$331,500
16.	Temporary Erosion Control	LS	1.0	$3,000.00	$3,000
17.	Seeding, Fertilizer and Mulch	ACRE	4.0	$4,500.00	$18,000
			Construction Subtotal	Base Bid	$1,096,975
			Contingency	20%	$219,395
			Total Opinion of Construction Cost		**$1,316,370**
PROFESSIONAL SERVICES					
1.	Design Services (Geotechnical Evaluation, Engineering, Survey, Legal)				$40,000
				Subtotal	$40,000
				Total Opinion of Project Cost	**$1,356,370**

Notes:

1. Clearing and Grubbing, Stripping and Topsoiling, Topsoil, and Seeding areas estimated for 15' outside of berm footprint.
2. Land Acquisition estimated as area outside existing City and DOU owned property and within LOCs (temporary and permanent easements).
3. 5' overexcavation of existing material along entire berm alignment in areas where berm is not proposed along roadway.
4. Berm material is assumed to be all new, no overexcavated material is reused.
5. Pavement of roads is assumed to be concrete.
6. All removed pavement is assumed to be replaced.
7. Berm top elevation is 1354.5 feet, approximately 3' higher than the March 2019 flood event.

ENGINEER'S CONCEPTUAL OPINION OF PROBABLE COST
Conceptual Berm Extension - Alternative 2
Schuyler, NE
JEO Project No. 170337.00

DRAFT

Date Prepared:
April 28, 2020

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
BASE BID					
1.	Mobilization	LS	1	$91,570.00	$91,570
2.	Bonding and Insurance	LS	1	$30,530.00	$30,530
3.	Land Acquisition	ACRE	3.0	$12,000.00	$36,000
4.	Temporary Traffic Control Measures	LS	1	$15,000.00	$15,000
5.	Clearing and Grubbing	ACRE	5.6	$10,000.00	$56,000
6.	Remove Pavement (Concrete and Asphalt)	SY	3,970	$25.00	$99,250
7.	Stripping and Topsoiling	CY	4,520	$5.00	$22,600
8.	Excavation (for berm not located along roadways)	CY	18,410	$8.00	$147,280
9.	Earthwork Measured in Embankment (not along roadways)	CY	25,910	$15.00	$388,650
10.	Earthwork Measured in Embankment (along roadways)	CY	850	$15.00	$12,750
11.	Concrete Floodwall	CY	39	$900.00	$35,000
12.	Topsoil, 6" Thick, On Site	CY	2,260	$4.00	$9,040
13.	Topsoil, 6" Thick, Off Site	CY	2,260	$25.00	$56,500
14.	Subgrade Preparation	SY	3,970	$4.00	$15,880
15.	10" Concrete Pavement	SY	3,970	$75.00	$297,750
16.	Temporary Erosion Control	LS	1.0	$4,000.00	$4,000
17.	Seeding, Fertilizer and Mulch	ACRE	5.6	$4,500.00	$25,200
			Construction Subtotal	Base Bid	$1,343,000
			Contingency	20%	$268,600
			Total Opinion of Construction Cost		**$1,611,600**
PROFESSIONAL SERVICES					
1.	Design Services (Geotechnical Evaluation, Engineering, Survey, Legal)				$40,000
				Subtotal	$40,000
				Total Opinion of Project Cost	**$1,651,600**

Notes:

1. Clearing and Grubbing, Stripping and Topsoiling, Topsoil, and Seeding areas estimated for 15' outside of berm footprint.
2. Land Acquisition estimated as area outside existing City and DOU owned property and within LOCs (temporary and permanent easements).
3. 5' overexcavation of existing material along entire berm alignment in areas where berm is not proposed along roadway.
4. Berm material is assumed to be all new, no overexcavated material is reused.
5. Pavement of roads is assumed to be concrete.
6. All removed pavement is assumed to be replaced.
7. Berm and floodwall top elevations are 1354.5 feet, approximately 3' higher than the March 2019 flood event.

ENGINEER'S CONCEPTUAL OPINION OF PROBABLE COST
Conceptual Berm Extension - Alternative 3
Schuyler, NE
JEO Project No. 170337.00

DRAFT

Date Prepared:
April 28, 2020

ESTIMATE OF QUANTITIES

Item #	Description	Unit	Quantity	Unit Price	Total
BASE BID					
1.	Mobilization	LS	1	$58,620.00	$58,620
2.	Bonding and Insurance	LS	1	$19,540.00	$19,540
3.	Land Acquisition	ACRE	4.5	$12,000.00	$54,000
4.	Temporary Traffic Control Measures	LS	1	$20,000.00	$20,000
5.	Clearing and Grubbing	ACRE	4.7	$10,000.00	$47,000
6.	Remove Pavement (Concrete and Asphalt)	SY	2,230	$25.00	$55,750
7.	Stripping and Topsoiling	CY	3,800	$5.00	$19,000
8.	Excavation (for berm not located along roadways)	CY	9,450	$8.00	$75,600
9.	Earthwork Measured in Embankment (not along roadways)	CY	14,960	$15.00	$224,400
10.	Earthwork Measured in Embankment (along roadways)	CY	250	$15.00	$3,750
11.	Concrete Floodwall	CY	32	$900.00	$29,167
12.	Topsoil, 6" Thick, On Site	CY	1,900	$4.00	$7,600
13.	Topsoil, 6" Thick, Off Site	CY	1,900	$25.00	$47,500
14.	Subgrade Preparation	SY	2,230	$4.00	$8,920
15.	Pavement, HMA, 4" Thickness	SY	80	$30.00	$2,400
16.	10" Concrete Pavement	SY	2,150	$75.00	$161,250
17.	Temporary Erosion Control	LS	1.0	$4,000.00	$4,000
18.	Seeding, Fertilizer and Mulch	ACRE	4.7	$4,500.00	$21,150
			Construction Subtotal	Base Bid	$859,647
			Contingency	20%	$171,929
			Total Opinion of Construction Cost		**$1,031,576**
PROFESSIONAL SERVICES					
1.	Design Services (Geotechnical Evaluation, Engineering, Survey, Legal)				$40,000
				Subtotal	$40,000
				Total Opinion of Project Cost	**$1,071,576**

Notes:

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