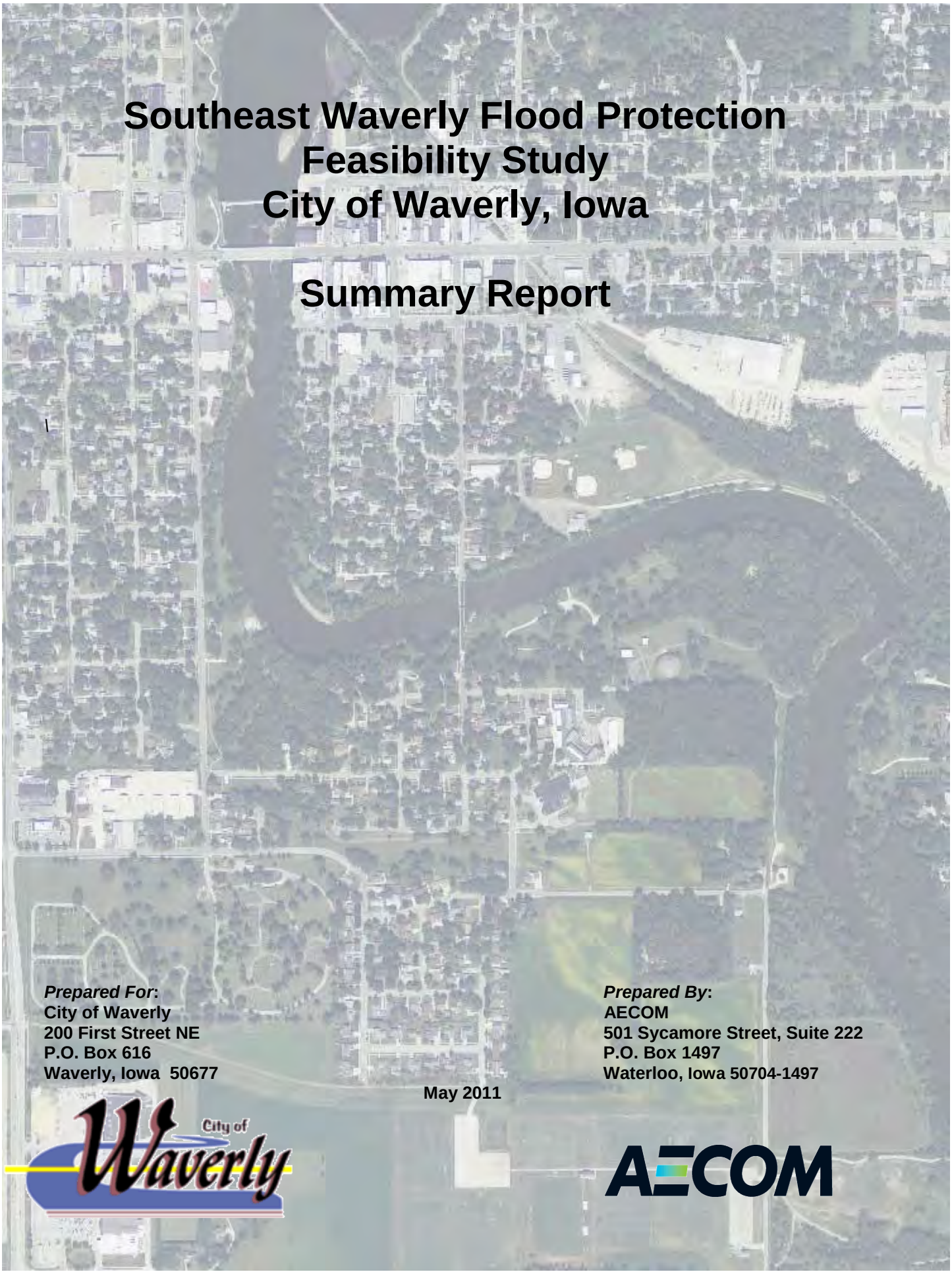
Southeast Waverly Flood Protection Feasibility Study
City of Waverly, Iowa

Summary Report



***Prepared For*:**
City of Waverly
200 First Street NE
P.O. Box 616
Waverly, Iowa 50677

***Prepared By*:**
AECOM
501 Sycamore Street, Suite 222
P.O. Box 1497
Waterloo, Iowa 50704-1497

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SUMMARY REPORT

I. INTRODUCTION

This project consists of completing a feasibility study for protecting the southeast portion of the City of Waverly from flooding associated with the Cedar River. During the extreme flood events in 1999 and 2008, the southeast portion of Waverly sustained large-scale flooding associated with the Cedar River. The City of Waverly requested AECOM to study the possibility of a proposed levee system to protect this area of the community from flooding. The study limits include the Cedar River floodplain area on both sides of the Cedar River, from East Bremer Avenue south and east to near the proposed Cedar River Parkway and west to 4th Street SW, south of Dry Run Creek. A location map outlining the study limits is shown in Figure 1.

The study consisted of reviewing the existing Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) Cedar River Flood Profiles and associated floodplain and floodway mapping for the City of Waverly. In addition, aerial photography and LiDAR contours were used to develop preliminary alignments for the proposed Levee Protection System. Three levee alternatives were developed for the flood study area, as follows: Option 1 – 100-Year Flood Protection With 4 Feet of Freeboard (provides 2 feet above 500-year protection), Option 2 – 100-Year Flood Protection With 2 Feet of Freeboard (provides 0-foot above 500-year protection), and Option 3 – 100-Year Flood Protection With 0 Foot of Freeboard. Freeboard is required above specified protection elevations to provide for certain variables that may be encountered within the hydrologic and hydraulic uncertainties used to determine predicted water surface elevations. For each of the above options, interior drainage, typical cross sections, and approximate construction limits and planning level construction estimates were determined and are summarized within this summary report.

II. SCOPE OF STUDY

The scope of this study is to provide a review of the proposed Southeast Waverly Flood Protection Project, including a review of existing floodplain data available, development of preliminary levee alignment and typical sections, interior drainage review, utility reviews, development of planning level construction estimates, and the completion of this summary report.

The scope of the study for the Southeast Waverly Flood Protection Feasibility Study specifically includes the following items:

- Existing Data Collection and Review
  - Review of Existing FEMA Flood Insurance Study for the Cedar River
  - Review of 1999 and 2008 Floodplain Mapping
  - Review of existing Utilities in Area of Proposed Flood Protection
  - Development of Base Mapping for Study
- Conceptual Design Development
  - Development of Levee Alignment Concepts for Up to Three Design Frequencies
  - Develop Typical Levee Cross Sections
  - Interior Drainage Review
  - Existing Utility Reviews
  - Property Impact Reviews
  - Development of Estimated Construction Quantities

- Summary Report and Construction Cost Estimates
  - Develop Planning Level Construction Cost Estimates for Each Concept
  - Development of Plan View Drawings and Typical Sections
  - Preparation of Summary Report

III. METHODOLOGY

The current City of Waverly FIS was used in conjunction with aerial mapping and LiDAR contours to determine possible alignments for the proposed levee protection system. Based on the Cedar River profiles published in the Waverly FIS, the 500-year flood elevation varies from approximately 912 feet at East Bremer Avenue to 910 feet at the downstream end of the study area, and the 100-year flood elevation varies from 910 feet to 908 feet, respectively. These elevations were then used in conjunction with Iowa Department of Natural Resources (DNR) LiDAR contour information for the study area and the regulatory floodway to determine the alignment for the proposed flood protection.

The proposed flood protection system was located outside of the regulatory floodway shown in the FIS, as required by floodplain management criteria. Flood elevations were delineated on the floodplain mapping and reviewed with existing topography to determine where flood protection should be placed and what type of flood protection would be needed based on height and width restrictions. Earthen levees, floodwalls and a combination of earthen levee and floodwall were used, depending on topographical characteristics of the location. Typical sections were developed based on height and width requirements and are shown in Figure 2. These typical sections were used to determine approximate construction quantities and planning level construction estimates for the three options studied. It should be noted that each option will have a different design height requirement, as stated previously, which will result in varying construction limits and associated construction estimates. A more detailed analyses of each option described in Section V.

IV. PUBLIC INVOLVEMENT

Two Public Participation meetings were held for the Southeast Waverly Flood Protection Feasibility Study. The first meeting was an Initial Public Input meeting held on November 16, 2010, at the Waverly Civic Center. This meeting was an open-house format which allowed the public to view initial flood protection concepts developed for the project and ask questions regarding the project. The meeting was well attended and included local politicians, citizens in the project area, city staff and AECOM representatives.

The second meeting was held on February 22, 2011, and included an open-house format in addition to a presentation reviewing the overall project summary. This meeting was also well attended, with between 50 and 75 people in attendance. Major concerns expressed at the meeting included specific impacts the flood control project would have to property owners owning property on which the levee would be constructed.

Comment forms for citizens to express their ideas and concerns regarding the Southeast Waverly Flood Protection Feasibility Study were available at both of the Public Input meetings. Comments received were reviewed and filed for the project. Comments ranged from both proponents of the flood control project to those who were not in support of the project. In addition, some of the comments recommended additional hydraulic modeling for the project. It should be noted, if this project would further develop into preliminary design, additional hydraulic modeling would be completed. For the purpose of the feasibility study, however, the regulatory floodway was used to define the limits of encroachment by the levee system.

V. CONCEPTUAL DESIGN OPTIONS REVIEWED

As indicated previously, three alternatives were developed for the Southeast Waverly Flood Protection Feasibility Study. These alternatives will be defined in detail within the description of each option. In

general, each of the options reviewed have similar physical characteristics, with the difference being the level of protection provided and the associated heights of the flood protection system.

Each of the options reviewed include a combination of earthen levees and floodwalls. In addition to the levees, additional infrastructure is required for the flood protection system for each of the options, as summarized below:

Temporary Closure Structures (Invisible Floodwall) - Structures required at street crossings to effectively close the levee at times of flooding. These are temporary structures that are required to be installed prior to a flood event.

Storm Sewer Gatewells and Storm Water Pump Stations - Each storm sewer crossing the line of flood protection will require a gatewell to prevent river back-up on the dry side of the levee. In addition, storm water pump stations will be required to pump storm water during a rainfall event at times when the Cedar River is high and the gatewells are closed.

Sanitary Sewer Gatewells - Each sanitary sewer crossing the line of protection will also be required to have a gatewell installed on the sewer.

A detailed description for each of the three options reviewed is provided in the following paragraphs.

- **<u>Option 1</u> – 100-Year Flood Protection With 4 Feet of Freeboard (Provides 2 Feet Above 500-Year Protection):**

  Option 1 is the highest level of protection reviewed for the Southeast Waverly Flood Protection Feasibility Study. This design will provide 4 feet of freeboard over the 100-year elevation, which will also provide 2 feet of freeboard over the 500-year elevation. This is the typical level of protection that would be required by FEMA to remove areas from the floodplain designations (FEMA regulations require a minimum of 3 feet of freeboard above the regulatory flood elevation and an additional 1 foot above the minimum is required within 100 feet on either side of bridges). Figure 3 shows an overall plan view of the Option 1 Levee Protection Layout. This option was broken into two sections, as shown on Figure 3: Section 1 is north of the Cedar River and is approximately 4,000 linear feet in length, and Section 2 is south of the Cedar River and approximately 6,000 linear feet in length. Section 2 is separated into Sections 2A and 2B because there are essentially two lines of protection that are separated by a high point located northwest of the intersection of 7th Avenue SE and 2nd Street SE. Figure 3 shows the proposed alignment that would be followed to provide the required protection. This option combines the use of floodwalls, earthen levees, and a combination earthen levee with floodwall.

  Option 1 will have the largest construction limits and costs of all of the options reviewed because of the height required for the walls, levees, and earthen levee wall combinations. As the height of protection is increased, the footprint of the protection is increased to provide sufficient structural support. A planning level cost analysis, including approximate right-of-way acquisition costs, is shown in Table 1. This table, as well as Figure 3, shows the number and probable locations of interior drainage structures and pump stations that would be required to drain the interior (dry side) of the levee system during rain events that may occur at times of elevated water levels. In order to protect the interior of the levee system, gatewells and pump stations would be added to the existing storm sewer systems so that during high water events these systems could be closed where they cross the levee to prevent water from backing up and flooding the interior of the levee protection system. The pumps would then be used to drain the system if a rainfall event were to occur while the gatewells were closed. Locations of street closure structures are also shown on Figure 3.

TABLE 1
SOUTHEAST WAVERLY FLOOD PROTECTION FEASIBILITY STUDY
CITY OF WAVERLY, IOWA
OPTION 1 - PLANNING LEVEL COST ESTIMATE*
100-YEAR DESIGN WIT 4'-0 FREEBOARD

Item No.	Bid Item	Unit	Unit Cost	100-Year Flood Protection With 4' Freeboard	
				Quantity	Cost
1	Clearing and Grubbing	Acre	$5,000.00	4.0	$20,000.00
2	Class 10 Excavation (Earthen Levee)	CY	10.00	22,084.0	220,840.00
3	Excavation for Floodwall, Class 20	CY	10.00	6,214.0	62,140.00
4	Structural Concrete, Class C (Floodwall)	CY	400.00	3,441.0	1,376,400.00
5	Subdrain, Longitudinal, 4-In. Dia.	LF	6.00	2,660.0	15,960.00
6	Closure Structures (3)	SF	500.00	939.0	469,500.00
7	Storm Sewer	LF	25.00	1,000.0	25,000.00
8	Storm Water Gatewell	Each	15,000.00	3.0	45,000.00
9	Storm Water Pump Station	Each	85,000.00	3.0	255,000.00
10	Sanitary Sewer Gatewell	Each	15,000.00	2.0	30,000.00
11	Silt Fence	LF	3.00	4,000.0	12,000.00
12	Clean-Out of Silt Fence	LF	1.00	4,000.0	4,000.00
13	Removal of Silt Fence	LF	1.00	4,000.0	4,000.00
14	Mobilization	LS	127,000.00	1.0	127,000.00
	Subtotal (Section 1)				$2,666,840.00
	Contingency				533,368.00
	Engineering and Construction Administration				576,037.44
	Estimated ROW Costs				1,224,736.00
	TOTAL (SECTION 1)				**$5,000,981.44**
15	Clearing and Grubbing	Acre	$5,000.00	2.0	$10,000.00
16	Class 10 Excavation (Earthen Levee)	CY	10.00	5,591.0	55,910.00
17	Excavation for Floodwall, Class 20	CY	10.00	3,000.0	30,000.00
18	Structural Concrete, Class C (Floodwall)	CY	400.00	1,500.0	600,000.00
19	Subdrain, Longitudinal, 4-In. Dia.	LF	6.00	1,360.0	8,160.00
20	Closure Structures (2)	SF	500.00	324.0	162,000.0
21	Storm Sewer	LF	25.00	300.0	7,500.00
22	Storm Water Gatewell	Each	15,000.00	1.0	15,000.00
23	Storm Water Pump Station	Each	85,000.00	1.0	85,000.00
24	Sanitary Sewer Gatewell	Each	15,000.00	1.0	15,000.00
25	Silt Fence	LF	3.00	2,000.0	6,000.00
26	Clean-Out of Silt Fence	LF	1.00	2,000.0	2,000.00
27	Removal of Silt Fence	LF	1.00	2,000.0	2,000.00
28	Mobilization	LS	50,000.00	1.0	50,000.00
	Subtotal (Section 2A)				$1,048,570.00
	Contingency				209,714.00
	Engineering and Construction Administration				226,491.12
	Estimated ROW Costs				245,458.00
	TOTAL (SECTION 2A)				**$1,730,233.12**
29	Clearing and Grubbing	Acre	$5,000.00	4.0	$20,000.00
30	Class 10 Excavation (Earthen Levee)	CY	10.00	41,037.0	410,370.00
31	Excavation for Floodwall, Class 20	CY	10.00	667.0	6,670.00
32	Structural Concrete, Class C (Floodwall)	CY	400.00	1,080.0	432,000.00
33	Subdrain, Longitudinal, 4-In. Dia.	LF	6.00	975.0	5,850.00
34	Closure Structures (3)	SF	500.00	655.0	327,500.00
35	Storm Water Gatewell	Each	15,000.00	2.0	30,000.00
36	Storm Water Pump Station	Each	85,000.00	2.0	170,000.00
37	Sanitary Sewer Gatewell	Each	15,000.00	5.0	75,000.00
38	Silt Fence	LF	3.00	3,300.0	9,900.00
39	Clean-Out of Silt Fence	LF	1.00	3,300.0	3,300.00
40	Removal of Silt Fence	LF	1.00	3,300.0	3,300.00
41	Mobilization	LS	75,000.00	1.0	75,000.00
	Subtotal (Section 2B)				$1,568,890.00
	Contingency				313,778.00
	Engineering and Construction Administration				338,880.24
	Estimated ROW Costs				589,306.00
	TOTAL (SECTION 2B)				**$2,810,854.24**
	SUBTOTAL (SECTIONS 2A AND 2B)				**$4,541,087.36**
	TOTAL (SECTIONS 1 AND 2)				**$9,542,068.80**
NOTES: Section 1 - North Flood Protection Area; Section 2A - Southwest Flood Protection Area; Section 2B - Southeast Flood Protection Area		Estimated Project Cost (Sections 1 and 2) (Rounded)			$9,542,000.00

*Construction estimate prepared for planning purposes. Estimated ROW costs shown are approximate estimates only and will need to be verified by appraisals should the project move forward.

Option 1 will protect the largest number of existing properties from flooding. There are currently 7 properties in Section 1 and 18 properties in Section 2 that are participating in the current flood buyout program, which leaves a remaining 18 properties in Section 1 and 65 properties in Section 2 in the 100-year floodplain that will be protected with this option. This option will also protect another 65 properties in Section 1 and 25 properties in Section 2 that are located in the 500-year floodplain if such an event were to occur. The total number of properties that would be protected from a 500-year event with this level of protection would be approximately 173 properties, not including the property owners participating in the buyout program.

- **Option 2 – 100-Year Flood Protection With 2 Feet of Freeboard (Provides 0-Foot Above 500- Year Protection):**

  Option 2 is the middle level of protection of the three options reviewed. This design will provide 2 feet of freeboard over the 100-year elevation, which is approximately the 500-year elevation level. Figure 4 shows an overall view of the Option 2 Levee Protection Layout. This option follows the same layout as Option 1 but requires less overall length in certain areas because of the reduced height. For instance, if you compare Option 2 and Option 1, the invisible floodwall located along East Bremer Avenue and the earthen levee section along 4th Street SW are no longer required for this level of flood protection. The height of the rest of the floodwalls, earthen levees, and earthen levee floodwall combinations are 2 feet lower than Option 1, which reduces the footprint of construction leading to a reduction in right-of-way needed. A planning level cost analysis, including approximate right-of-way acquisition costs, is shown in Table 2. Although the height of the protection is reduced in Option 2, the number of gatewells and pumping station needed for the interior drainage would remain the same. Refer to Table 2 and Figure 4 for the number and locations of interior drainage structures and pump stations. This option would only protect the properties described in Option 1 that are located within the 100-year floodplain (approximately 83 properties) because there is no freeboard above the 500-year elevation. In addition, the properties would remain in the FEMA designated 100-year floodplain.

- **Option 3 – 100-Year Flood Protection With 0 Foot of Freeboard:**

  Option 3 is the lowest level of protection of the three options reviewed. This design will provide 0-foot of freeboard over the 100-year elevation. Figure 5 shows an overall view of the Option 3 Levee Protection Layout. This option follows the same layout as Options 1 and 2 but requires significantly less length in certain areas because of the reduced height. For instance, there will be no wall required along the Cedar River in Section 1 from East Bremer Avenue to 3rd Avenue SE, as shown in Options 1 and 2. The height reduction in the level of flood protection will reduce the footprint of construction leading to a further reduction of right-of-way needed.

  This option will also require fewer interior drainage structures and pump stations than the previous two options, as shown in Figure 5. A planning level cost analysis, including approximate right-of-way acquisition costs, is shown in Table 3. This option would protect up to the 100-year flood elevation but does not provide freeboard requirements to protect properties shown in the 100-year floodplain.

TABLE 2
SOUTHEAST WAVERLY FLOOD PROTECTION FEASIBILITY STUDY
CITY OF WAVERLY, IOWA
OPTION 2 - PLANNING LEVEL COST ESTIMATE*
100-YEAR DESIGN WIT 2'-0 FREEBOARD

Item No.	Bid Item	Unit	Unit Cost	100-Year Flood Protection With 4' Freeboard	
				Quantity	Cost
1	Clearing and Grubbing	Acre	$5,000.00	3.8	$19,000.00
2	Class 10 Excavation (Earthen Levee)	CY	10.00	20,520.0	205,200.00
3	Excavation for Floodwall, Class 20	CY	10.00	6,214.0	62,140.00
4	Structural Concrete, Class C (Floodwall)	CY	400.00	2,775.0	1,110,000.00
5	Subdrain, Longitudinal, 4-In. Dia.	LF	6.00	2,410.0	14,460.00
6	Closure Structures (2)	SF	500.00	130.0	65,000.00
7	Storm Sewer	LF	25.00	1,000.0	25,000.00
8	Storm Water Gatewell	Each	15,000.00	3.0	45,000.00
9	Storm Water Pump Station	Each	85,000.00	3.0	255,000.00
10	Sanitary Sewer Gatewell	Each	15,000.00	2.0	30,000.00
11	Silt Fence	LF	3.00	3,850.0	11,550.00
12	Clean-Out of Silt Fence	LF	1.00	3,850.0	3,850.00
13	Removal of Silt Fence	LF	1.00	3,850.0	3,850.00
14	Mobilization	LS	93,000.00	1.0	93,000.00
	Subtotal (Section 1)				$1,943,050.00
	Contingency				388,610.00
	Engineering and Construction Administration				419,698.80
	Estimated ROW Costs				1,038,290.00
	TOTAL (SECTION 1)				**$3,789,648.80**
15	Clearing and Grubbing	Acre	$5,000.00	2.0	$10,000.00
16	Class 10 Excavation (Earthen Levee)	CY	10.00	5,430.0	54,300.00
17	Excavation for Floodwall, Class 20	CY	10.00	3,000.0	30,000.00
18	Structural Concrete, Class C (Floodwall)	CY	400.00	1,200.0	480,000.00
19	Subdrain, Longitudinal, 4-In. Dia.	LF	6.00	1,000.0	6,000.00
20	Closure Structures (2)	SF	500.00	180.0	90,000.00
21	Storm Sewer	LF	25.00	300.0	7,500.00
22	Storm Water Gatewell	Each	15,000.00	1.0	15,000.00
23	Storm Water Pump Station	Each	85,000.00	1.0	85,000.00
24	Sanitary Sewer Gatewell	Each	15,000.00	1.0	15,000.00
25	Silt Fence	LF	3.00	2,000.0	6,000.00
26	Clean-Out of Silt Fence	LF	1.00	2,000.0	2,000.00
27	Removal of Silt Fence	LF	1.00	2,000.0	2,000.00
28	Mobilization	LS	40,000.00	1.0	40,000.00
	Subtotal (Section 2A)				$842,800.00
	Contingency				168,560.00
	Engineering and Construction Administration				182,044.80
	Estimated ROW Costs				245,458.00
	TOTAL (SECTION 2A)				**$1,438,862.80**
29	Clearing and Grubbing	Acre	$5,000.00	3.8	$19,000.00
30	Class 10 Excavation (Earthen Levee)	CY	10.00	21,312.0	213,120.00
31	Excavation for Floodwall, Class 20	CY	10.00	667.0	6,670.00
32	Structural Concrete, Class C (Floodwall)	CY	400.00	324.0	129,600.00
33	Subdrain, Longitudinal, 4-In. Dia.	LF	6.00	300.0	1,800.00
34	Closure Structures (3)	SF	500.00	423.0	211,500.00
35	Storm Water Gatewell	Each	15,000.00	2.0	30,000.00
36	Storm Water Pump Station	Each	85,000.00	2.0	170,000.00
37	Sanitary Sewer Gatewell	Each	15,000.00	5.0	75,000.00
38	Silt Fence	LF	3.00	2,850.0	8,550.00
39	Clean-Out of Silt Fence	LF	1.00	2,850.0	2,850.00
40	Removal of Silt Fence	LF	1.00	2,850.0	2,850.00
41	Mobilization	LS	44,000.00	1.0	44,000.00
	Subtotal (Section 2B)				$914,940.00
	Contingency				182,988.00
	Engineering and Construction Administration				197,627.04
	Estimated ROW Costs				589,306.00
	TOTAL (SECTION 2B)				**$1,884,861.04**
	SUBTOTAL (SECTIONS 2A AND 2B)				**$3,323,723.84**
	TOTAL (SECTIONS 1 AND 2)				**$7,113,372.64**
NOTES: Section 1 - North Flood Protection Area; Section 2A - Southwest Flood Protection Area; Section 2B - Southeast Flood Protection Area		Estimated Project Cost (Sections 1 and 2) (Rounded)			$7,113,000.00

*Construction estimate prepared for planning purposes. Estimated ROW costs shown are approximate estimates only and will need to be verified by appraisals should the project move forward.

TABLE 3
SOUTHEAST WAVERLY FLOOD PROTECTION FEASIBILITY STUDY
CITY OF WAVERLY, IOWA
OPTION 3 - PLANNING LEVEL COST ESTIMATE*
100-YEAR DESIGN WIT 0'-0 FREEBOARD

Item No.	Bid Item	Unit	Unit Cost	100-Year Flood Protection With 4' Freeboard	
				Quantity	Cost
1	Clearing and Grubbing	Acre	$5,000.00	3.6	$18,000.00
2	Class 10 Excavation (Earthen Levee)	CY	10.00	19,274.0	192,740.00
3	Excavation for Floodwall, Class 20	CY	10.00	2,410.0	24,100.00
4	Structural Concrete, Class C (Floodwall)	CY	400.00	796.0	318,400.00
5	Subdrain, Longitudinal, 4-In. Dia.	LF	6.00	650.0	3,900.00
6	Closure Structures (1)	SF	500.00	30.0	15,000.00
7	Storm Sewer	LF	25.00	620.0	15,500.00
8	Storm Water Gatewell	Each	15,000.00	2.0	30,000.00
9	Storm Water Pump Station	Each	85,000.00	2.0	170,000.00
10	Sanitary Sewer Gatewell	Each	15,000.00	2.0	30,000.00
11	Silt Fence	LF	3.00	3,500.0	10,500.00
12	Clean-Out of Silt Fence	LF	1.00	3,500.00	3,500.00
13	Removal of Silt Fence	LF	1.00	3,500.00	3,500.00
14	Mobilization	LS	42,000.00	1.0	42,000.00
	Subtotal (Section 1)				$877,140.00
	Contingency				175,428.00
	Engineering and Construction Administration				189,462.24
	Estimated ROW Costs				539,726.00
	TOTAL (SECTION 1)				**$1,781,756.24**
15	Clearing and Grubbing	Acre	$5,000.00	1.5	7,500.00
16	Class 10 Excavation (Earthen Levee)	CY	10.00	4,420.0	44,200.00
17	Excavation for Floodwall, Class 20	CY	10.00	---	---
18	Structural Concrete, Class C (Floodwall)	CY	400.00	---	---
19	Subdrain, Longitudinal, 4-In. Dia.	LF	6.00	---	---
20	Closure Structures (2)	SF	500.00	1,572.0	786,000.00
21	Storm Sewer	LF	25.00	300.0	7,500.00
22	Storm Water Gatewell	Each	15,000.00	1.0	15,000.00
23	Storm Water Pump Station	Each	85,000.00	1.0	85,000.00
24	Sanitary Sewer Gatewell	Each	15,000.00	1.0	15,000.00
25	Silt Fence	LF	3.00	1,000.0	3,300.00
26	Clean-Out of Silt Fence	LF	1.00	1,000.0	1,000.0
27	Removal of Silt Fence	LF	1.00	1,000.0	1,000.0
28	Mobilization	LS	48,000.00	1.0	48,000.00
	Subtotal (Section 2A)				$1,013,200.00
	Contingency				202,640.00
	Engineering and Construction Administration				218,851.20
	Estimated ROW Costs				121,613.00
	TOTAL (SECTION 2A)				**$1,556,304.20**
29	Clearing and Grubbing	Acre	$5,000.00	3.8	$19,000.00
30	Class 10 Excavation (Earthen Levee)	CY	10.00	10,713.0	107,130.00
31	Excavation for Floodwall, Class 20	CY	10.00	445.0	4,450.00
32	Structural Concrete, Class C (Floodwall)	CY	400.00	207.0	82,800.00
33	Subdrain, Longitudinal, 4-In. Dia.	LF	6.00	200.0	1,200.00
34	Closure Structures (3)	SF	500.00	191.0	95,500.00
35	Storm Water Gatewell	Each	15,000.00	2.0	30,000.00
36	Storm Water Pump Station	Each	85,000.00	2.0	170,000.00
37	Sanitary Sewer Gatewell	Each	15,000.00	5.0	75,000.00
38	Silt Fence	LF	3.00	2,850.0	8,550.00
39	Clean-Out of Silt Fence	LF	1.00	2,850.0	2,850.00
40	Removal of Silt Fence	LF	1.00	2,850.0	2,850.00
41	Mobilization	LS	30,000.00	1.0	30,000.00
	Subtotal (Section 2B)				$629,330.00
	Contingency				125,866.00
	Engineering and Construction Administration				135,935.28
	Estimated ROW Costs				589,306.00
	TOTAL (SECTION 2B)				**$1,480,437.28**
	SUBTOTAL (SECTIONS 2A AND 2B)				**$3,036,741.48**
	TOTAL (SECTIONS 1 AND 2)				**$4,818,497.72**
NOTES: Section 1 - North Flood Protection Area; Section 2A - Southwest Flood Protection Area; Section 2B - Southeast Flood Protection Area		Estimated Project Cost (Sections 1 and 2) (Rounded)			$4,818,000.00

*Construction estimate prepared for planning purposes. Estimated ROW costs shown are approximate estimates only and will need to be verified by appraisals should the project move forward.

VI. SUMMARY

A detailed layout showing typical cross sections, construction limits and planning level construction cost estimates for each option are summarized in Figures 2-5 and Tables 1-3. Option 1 will have the highest cost as well as the largest construction impact. It will also provide the highest level of protection and include 2 feet of freeboard over the 500-year flood elevation. Option 1 will provide protection for properties in both the 500-year and 100-year floodplains. The estimated planning level construction cost for Option 1 is approximately $9,542,000.

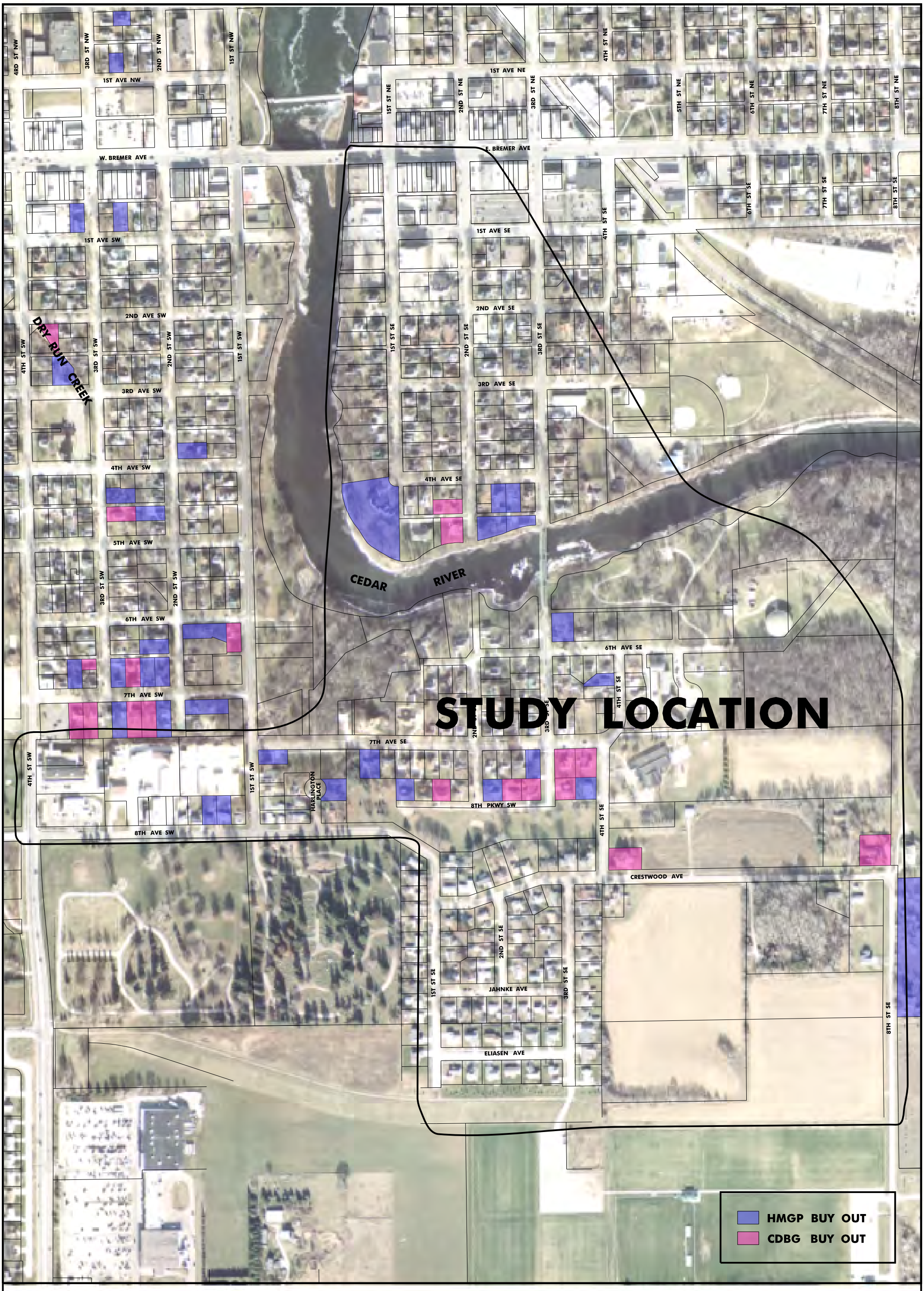
Option 1 would be designed to FEMA Standards (minimum 3 feet of freeboard on regulatory 100-year flood), and existing property within the 100-year floodplain would be removed from Zone AE designation. Option 2 will provide protection for properties in the 100-year floodplain with 2 feet of freeboard and up to the 500-year elevation with zero freeboard. The reduction in height will also reduce the construction impact when compared to Option 1. The estimated planning level construction cost for Option 2 is approximately $7,113,000. Option 3 will provide protection up to the 100-year elevation but will provide no freeboard in protecting the properties within the 100-year floodplain. This option is 4 feet lower than Option 1 and 2 feet lower than Option 2. The estimated planning level construction cost for Option 3 is approximately $4,818,000. A summary comparison of all three options and their protection levels is shown in Table 4.

TABLE 4
SOUTHEAST WAVERLY FLOOD PROTECTION FEASIBILITY STUDY
CITY OF WAVERLY, IOWA
TOTAL COST COMPARISON of OPTIONS REVIEWED

Option	Option Description	Planning Level Construction Costs	Properties in Buyout Program		Protected Properties With Freeboard 100-Year Elevation		Protected Properties With Freeboard 500-Year Elevation*	
			Section 1	Section 2	Section 1	Section 2	Section 1	Section 2
1	100-Year Design With 4'-0 Freeboard	$9,542,000.00	7	18	18	65	65	25
2	100-Year Design With 2'-0 Freeboard	$7,113,000.00	7	18	18	65	---	---
3	100-Year Design With 0'-0 Freeboard	$4,818,000.00	7	18	---	---	---	---

*Option 1 allows 2 feet of freeboard for 500-year flood event.

FIGURES



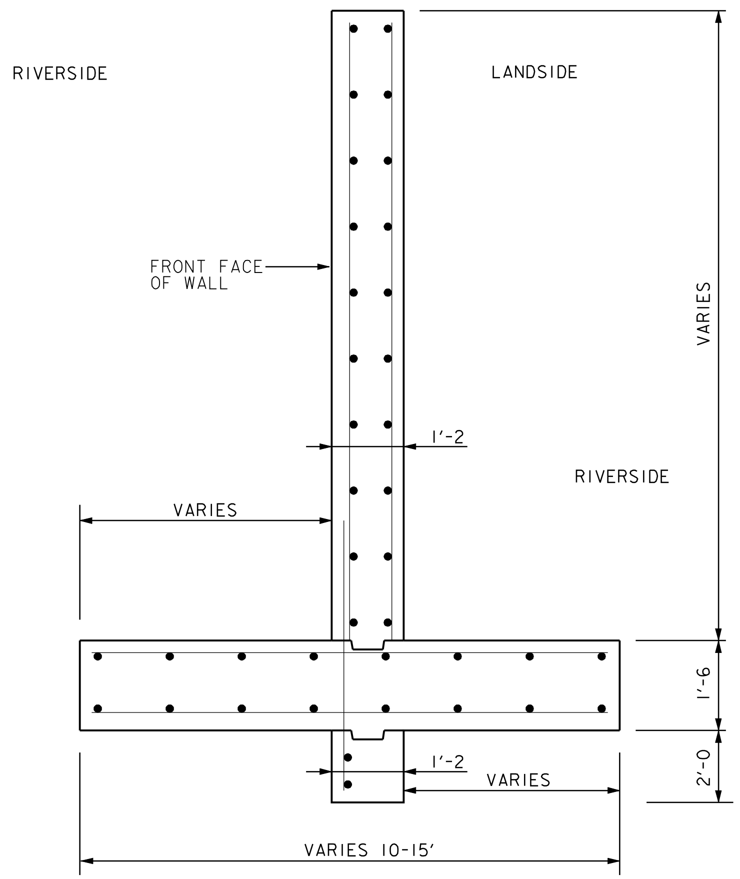
N

0 100 200
FEET

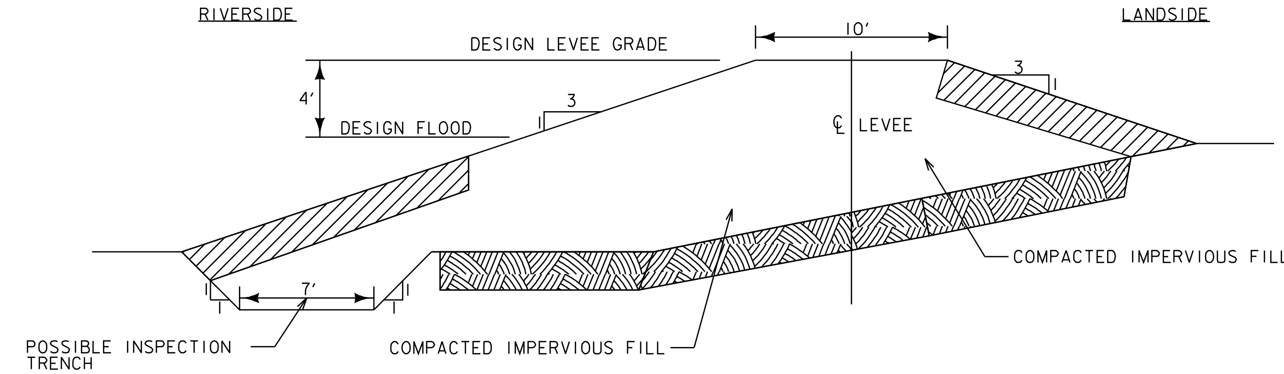
FIGURE 1
SOUTHEAST WAVERLY FLOOD PROTECTION FEASIBILITY STUDY
CITY OF WAVERLY, IOWA

LOCATION MAP

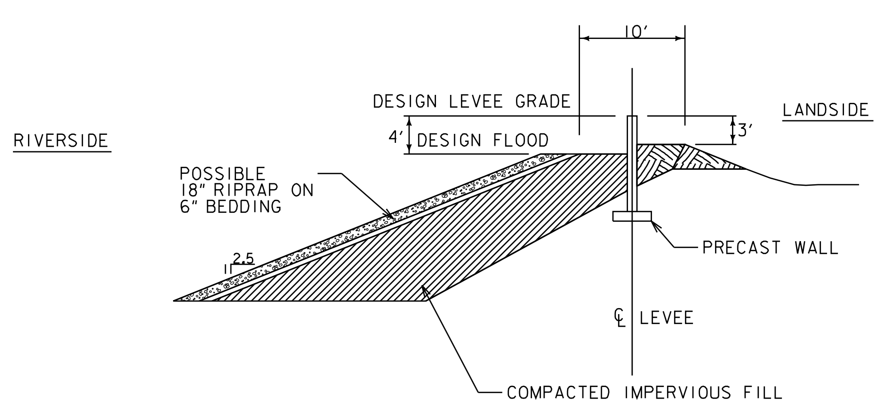
AECOM



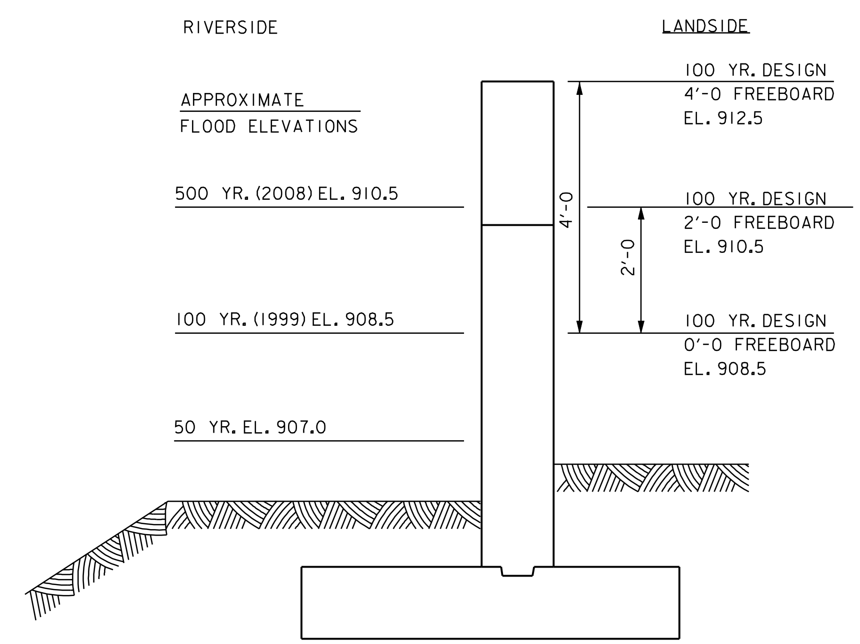
SECTION A1 - FLOOD WALL



SECTION A4 - EARTHEN LEVEE



SECTION A3 - COMBINATION EARTHEN LEVEE WITH WALL



FLOOD LEVEL DETAIL
UPSTREAM OF 3RD ST. SE.

VERIFY SCALE IF PLAN SHEET IS REDUCED — 1-INCH —

REV	DESCRIPTION	DRN	CHK	DATE

DRN | DES | CHK | APP

AECOM
501 Sycamore Street, Suite 222
Waterloo, Iowa 50704-1497
T 319.232.6531 F 319.232.0271
WWW.AECOM.COM

SOUTHEAST WAVERLY FLOOD PROTECTION FEASIBILITY STUDY
CITY OF WAVERLY, IOWA

TYPICAL SECTIONS

DATE 5/4/2011
PROJECT NO 60161766
FILENAME Waverly-B-Shts.dsn
MODELNAME B.01
SHEET NO Figure 2

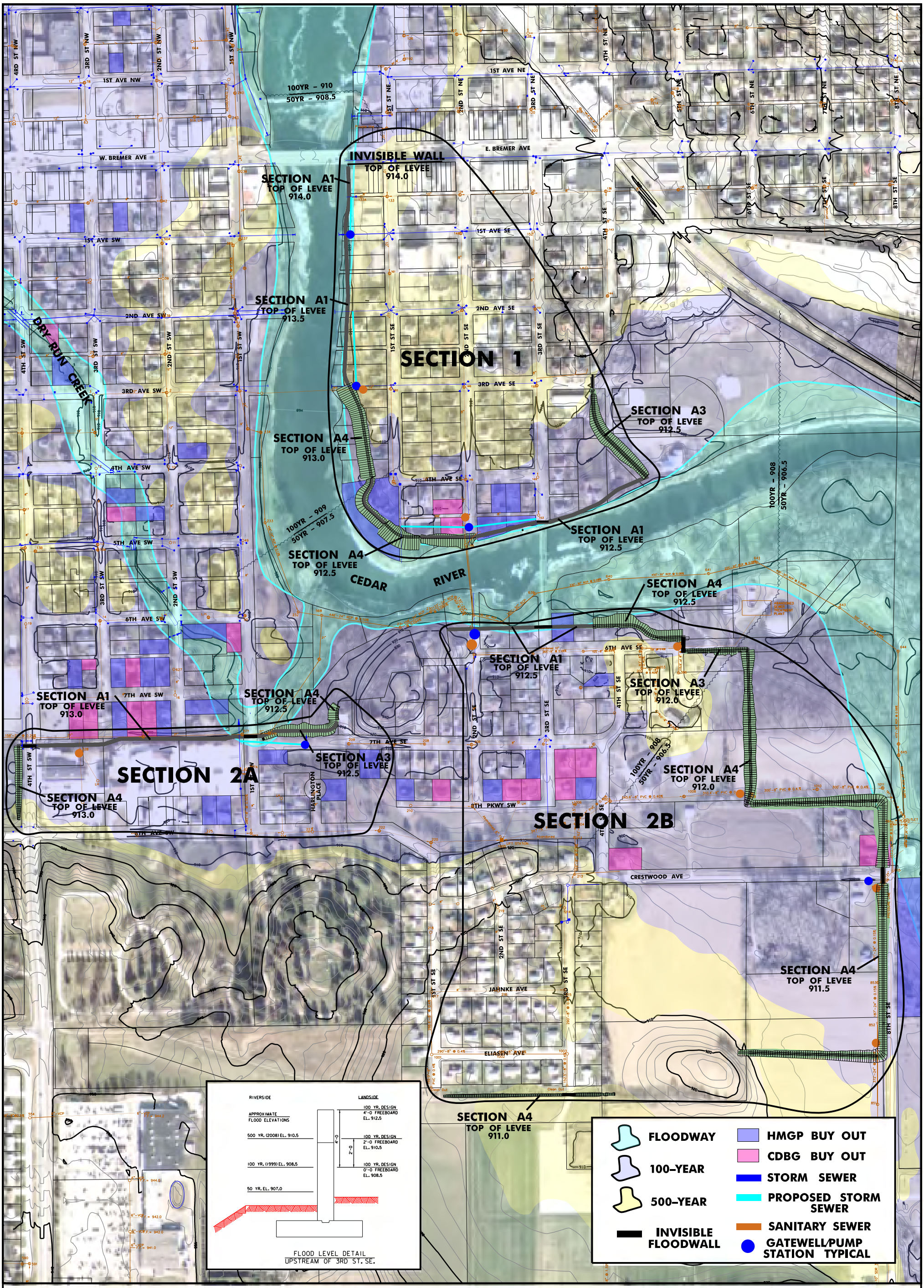


FIGURE 3
SOUTHEAST WAVERLY FLOOD PROTECTION FEASIBILITY STUDY
CITY OF WAVERLY, IOWA

100-YR DESIGN WITH 4'-0 FREEBOARD

AECOM

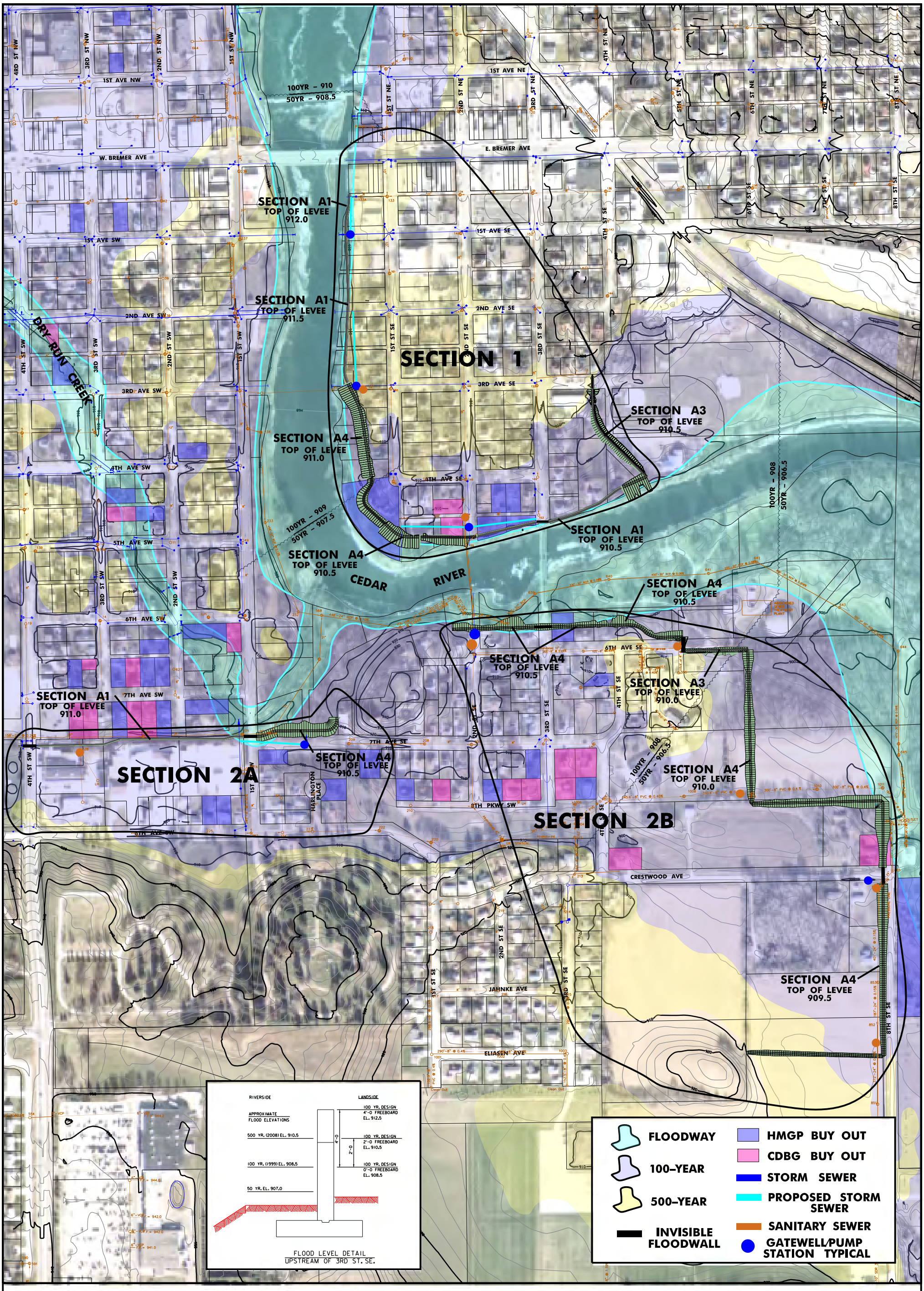


FIGURE 4
SOUTHEAST WAVERLY FLOOD PROTECTION FEASIBILITY STUDY
CITY OF WAVERLY, IOWA
100-YR DESIGN WITH 2'-0 FREEBOARD

AECOM

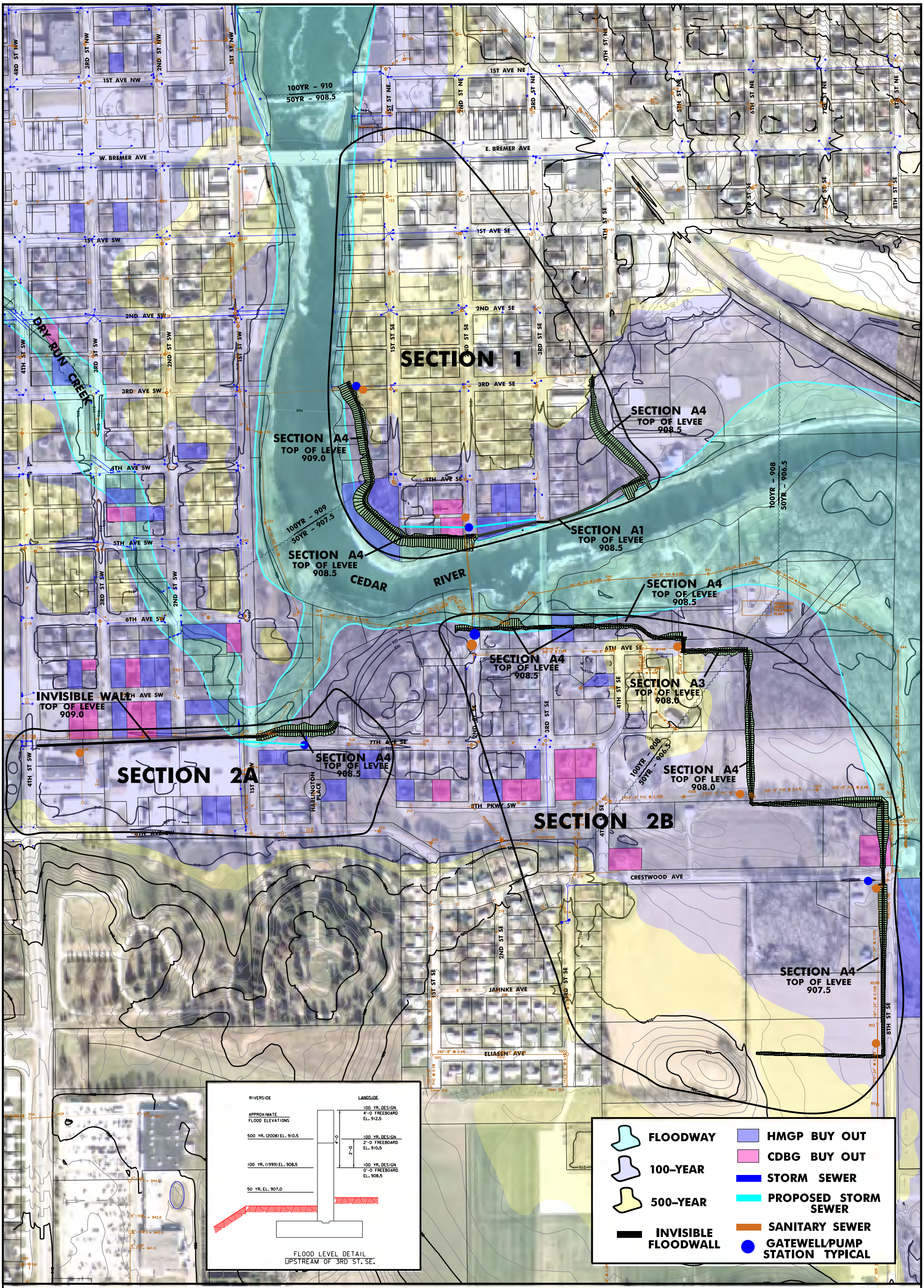


FIGURE 5
SOUTHEAST WAVERLY FLOOD PROTECTION FEASIBILITY STUDY
CITY OF WAVERLY, IOWA
100-YR DESIGN WITH 0'-0 FREEBOARD

AECOM