

Appendix E – Compensatory Storage Memo



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MEMORANDUM

TO: Shannon Ausen, PE (City of Sioux Falls)

FROM: Jeremy Walgrave, PE, CFM

DATE: March 22, 2023

RE: Big Sioux River - Compensatory Storage
SEH No. 156888 14.00

Project Background

The South Dakota Department of Transportation (SDDOT) proposes to reconstruct the I-229 Exit 3 Interchange, Minnesota Avenue (PCN 00OS), the I-229 Exit 4 Interchange and Cliff Avenue (PCN 05HN). In addition, the SDDOT proposes to construct a Cross-over project (PCN 07CY), which includes constructing a temporary bridge and diversion to maintain traffic for the construction of the two interchange projects.

- I-229 Exit 3 Interchange and Minnesota Ave. (Exit 3)
- I-229 Exit 4 Interchange and Cliff Ave (Exit 4)
- I-229 Exit 3 & Exit 4 Cross-over (Cross-over)

Both interchange projects and the Cross-over project include areas that lie within the Big Sioux River 100-yr Floodplain. Each of the respective projects will result in fill within the Big Sioux River 100-yr Floodplain.

Sioux Falls City Ordinance

The City of Sioux Falls Code of Ordinances, Chapter 156: Floodplain Management applies to the Cross-over project, the Exit 3 project, and the Exit 4 project, since each project has areas that lie within the FEMA Regulatory Floodplain of the Big Sioux River.

The City of Sioux Falls (City) passed an amendment to Chapter 156: Floodplain Management on July 6, 2021, which includes provisions for Compensatory Storage (Chapter 156.074). Chapter 156.074 includes the following language:

New development shall not reduce the effective flood storage volume of the regulatory floodplain. A development proposal shall provide compensatory storage if grading or other activity eliminates any effective flood storage volume. Compensatory storage shall:

- (a) Provide equivalent volume at equivalent elevations within the same drainage basin that is being displaced. For this purpose, "equivalent elevation" means having a similar relationship to ordinary high water and to the best available ten-year, 50-year, and 100-year water surface profiles; and*
- (b) Be hydraulically connected to the source of flooding; and*
- (c) Provide compensatory storage in the same construction season as when the displacement of flood storage volume occurs and before the flood season begins; and*
- (d) The newly created storage area shall be graded and vegetated to allow fish access during flood events without creating fish stranding sites.*

Exit 4

Significant portions of the Exit 4 project lie within the 100-yr floodplain as indicated on FEMA FIRM 46099C0464E, dated 7MAR2017. The Exit 4 project results in a total fill of approximately 50,000 CY below the 100-yr floodplain elevation.

Engineers | Architects | Planners | Scientists

Short Elliott Hendrickson Inc., 401 East 8th Street, Suite 309, Sioux Falls, SD 57103-7032

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Exit 3

Portions of the Exit 3 project lie within the 100-yr floodplain as indicated on FEMA FIRM 46099C0463E, dated 7MAR2017. The Exit 3 floodplain extents are questionable based on a review of the existing contours. The floodplain extents on the west side of Minnesota Ave. are located along the edge of I-229. The culvert drainage system that drains the areas west of Minnesota Ave. include flap gates which prevent the 100-yr event from reaching the north side of I-229.

On the east side of Minnesota Ave., the 100-yr flood elevation is higher than I-229, which is why areas on the north side of I-229 are shown in the 100-yr floodplain. However, a review of the contours indicates that the 100-yr floodplain extents are likely further west than the current floodplain mapping shows.

Based on a review of the 100-yr floodplain elevation and the existing Minnesota Ave. profile, there appears to be an area where floodwaters from the 100-yr event could potentially inundate areas west of Minnesota Ave. and north of I-229. However, the profile low point elevation is only slightly below the 100-yr flood elevation. For the purposes of this analysis, it was assumed that the 100-yr flood would not flow over Minnesota Ave. to the west.

The Exit 3 project results in a total fill of approximately 8,000 CY below the 100-yr floodplain elevation.

Cross-over Project

The Cross-over project will be constructed first and will serve as a means to maintain traffic during the construction of the Exit 3 and Exit 4 projects. Although the Cross-over project will be a temporary condition, it will remain in-place for more than one year. The Cross-over project results in a total floodplain fill of approximately 25,000 CY which spans Exit 3 (5,000 CY) and Exit 4 (20,000 CY).

Compensatory Storage

The city requires compensatory storage for fill below the 100-yr floodplain elevation. The Cross-over Project will require compensatory storage since the floodplain fill will remain in place for more than one year. Several locations within each interchange project were evaluated to provide the required compensatory storage. **Tables 1 & 2** provide a summary of the fills and potential cuts below the 100-yr floodplain for each project.

Table 1: Exit 4 Cut and Fill Summary Below the 100-yr Regulatory Floodplain

05HN (Exit 4)	Fill (CY)	Cut (CY)
Exit 4 Interchange Project	50,000	
North of Pam Rd		
• #3016 S 10 th Ave*		1,200
• David Kerkhove parcel (#3005 S Cliff Ave)**		4,600
Pam Rd. (10 th Ave – Cliff Ave)		1,700
Between proposed 41st St and Pam Rd		
• #1105 Pam Rd.**		2,200
• #1109,#1111,#1115 Pam Rd.*		1,000
Between Former Railroad ROW and proposed 41 st St		
• Former ATM parcel (#1100 E 41 st St)*		5,000
• Former Schoppert parcel (#1020 E 41 st St)*		3,800
• South Central Veterinary (#1010 E 41st St)**		
Between Ramp D & proposed 41 st St		11,100
Between Ramp A & Lincoln HS		14,000
Total (Exit 4)	50,000	44,600
Balance (Exit 4)		5,400

* City Owned Parcel
 ** Potential Acquisition

Table 2: Exit 3 Cut and Fill Summary Below the 100-yr Regulatory Floodplain

00OS / 08DN (Exit 3)	Fill (CY)	Cut (CY)
Ramp C	4,000	
Ramp A		4,000
Ramp B	0	0
Ramp E		22,000
Ramp F	4,000	0
Total (Exit 3)	8,000	26,000
Balance (Exit 3)		
		-18,000

Areas indicated in green are not currently shown in the 100-yr floodplain map.

Construction Sequence

The construction of Exit 3 and Exit 4 will take place over multiple years. **Table 3** below shows the compensatory storage breakdown for each stage of construction.

	2024 Cross-Over Project Exit 4 (Temp Bridge)	2025 Exit 4 (North)	2026 Exit 4 (South) Exit 3 (Temp Bridge)	2027 Exit 3 (North)	2028 Exit 3 (South)
FILL	20,000	45,000	55,000	55,000	58,000
	<i>Exit 4 temp bridge</i>	<i>Exit 4 temp bridge + Exit 4 (north) (20,000+25,000)</i>	<i>Total Exit 4 + Exit 3 temp bridge (50,000+5,000)</i>	<i>Total Exit 4 + Exit 3 temp bridge (50,000+5,000)</i>	<i>Total Exit 4 + Total Exit 3 (50,000+8,000)</i>
CUT	22,000	66,600	66,600	70,600	70,600
	<i>Exit 3 Ramp E</i>	<i>Exit 3 Ramp E + Exit 4 cut areas (22,000+44,600)</i>	<i>Exit 3 Ramp E + Exit 4 cut areas (22,000+44,600)</i>	<i>Exit 3 cut areas + Exit 4 cut areas (22,000+44,600+4,000)</i>	<i>Exit 3 cut areas + Exit 4 cut areas (22,000+44,600+4,000)</i>
BALANCE	-2,000	-21,600	-11,600	-15,600	-12,600

Stormwater Rate Control

The compensatory storage areas will provide a secondary benefit during precipitation events by temporarily storing stormwater runoff. Stormwater flow rates to the downstream drainage system will be reduced. This will generally allow smaller stormwater pipes and culverts, which will result in a cost savings to the projects.

Preliminary cost savings as a result of a reduction in pipe sizes, specifically for the David Kerkhove property have been estimated to be on the order of \$150,000.

Limitations

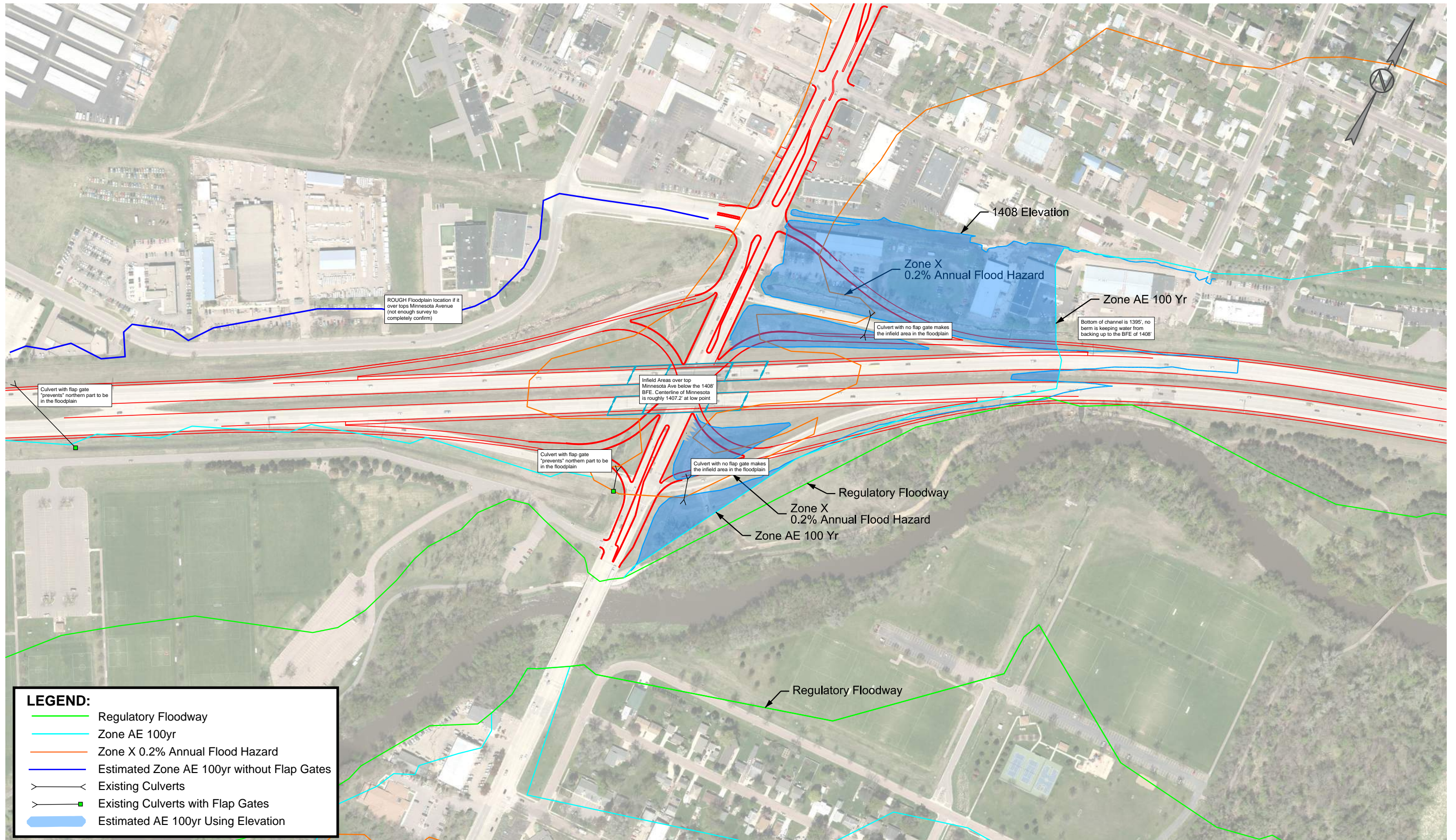
- Storm sewer revisions based on the David Kerkhove property removal have not gone through final design.
- Cut areas for the Exit 4 project have been rough graded to understand relative magnitude. Cut volumes are subject to change pending final design.
- The Exit 3 project is currently in the early stages of design. Cut and fill volumes are subject to change.

Emergency Action Plan (EAP)

An Emergency Action Plan (EAP) is currently being developed for the Exit 3 and Exit 4 projects. The EAP will define operation, maintenance, monitoring, and emergency actions to be taken by the construction contractor during each stage of the project.

I229 EXIT 3: FEMA BOUNDARY

	PROJECT	SECTION	SHEET
	IM 2292(84)2 NH 2115(46)	B	???
Plotting Date: 2/16/2023			



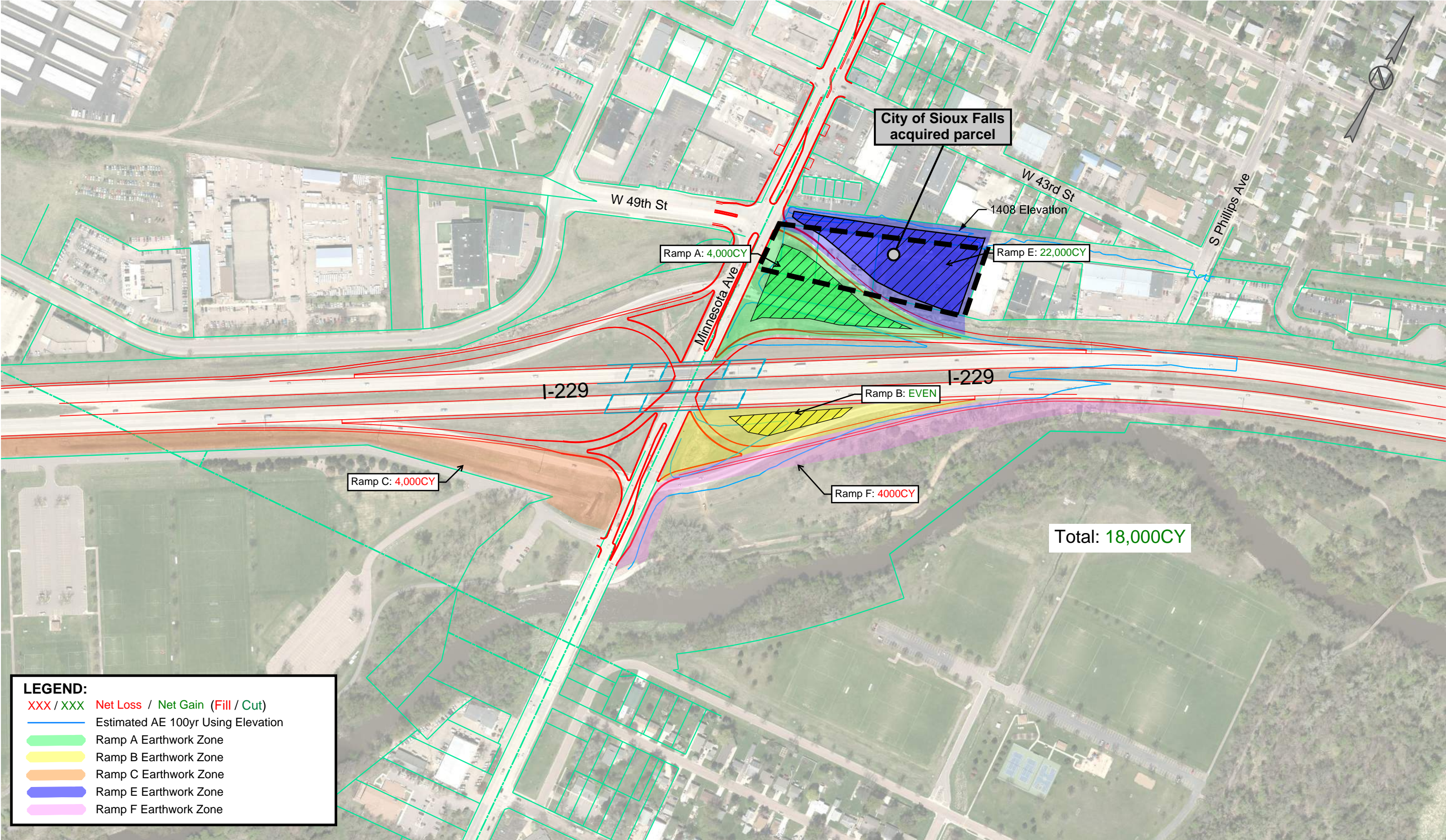
LEGEND:

	Regulatory Floodway
	Zone AE 100yr
	Zone X 0.2% Annual Flood Hazard
	Estimated Zone AE 100yr without Flap Gates
	Existing Culverts
	Existing Culverts with Flap Gates
	Estimated AE 100yr Using Elevation

Exit 3: Floodplain Boundaries

I229 EXIT 3: FEMA BOUNDARY

	PROJECT	SECTION	SHEET
	IM 2292(84)2 NH 2115(46)	B	???
Plotting Date: 2/16/2023			



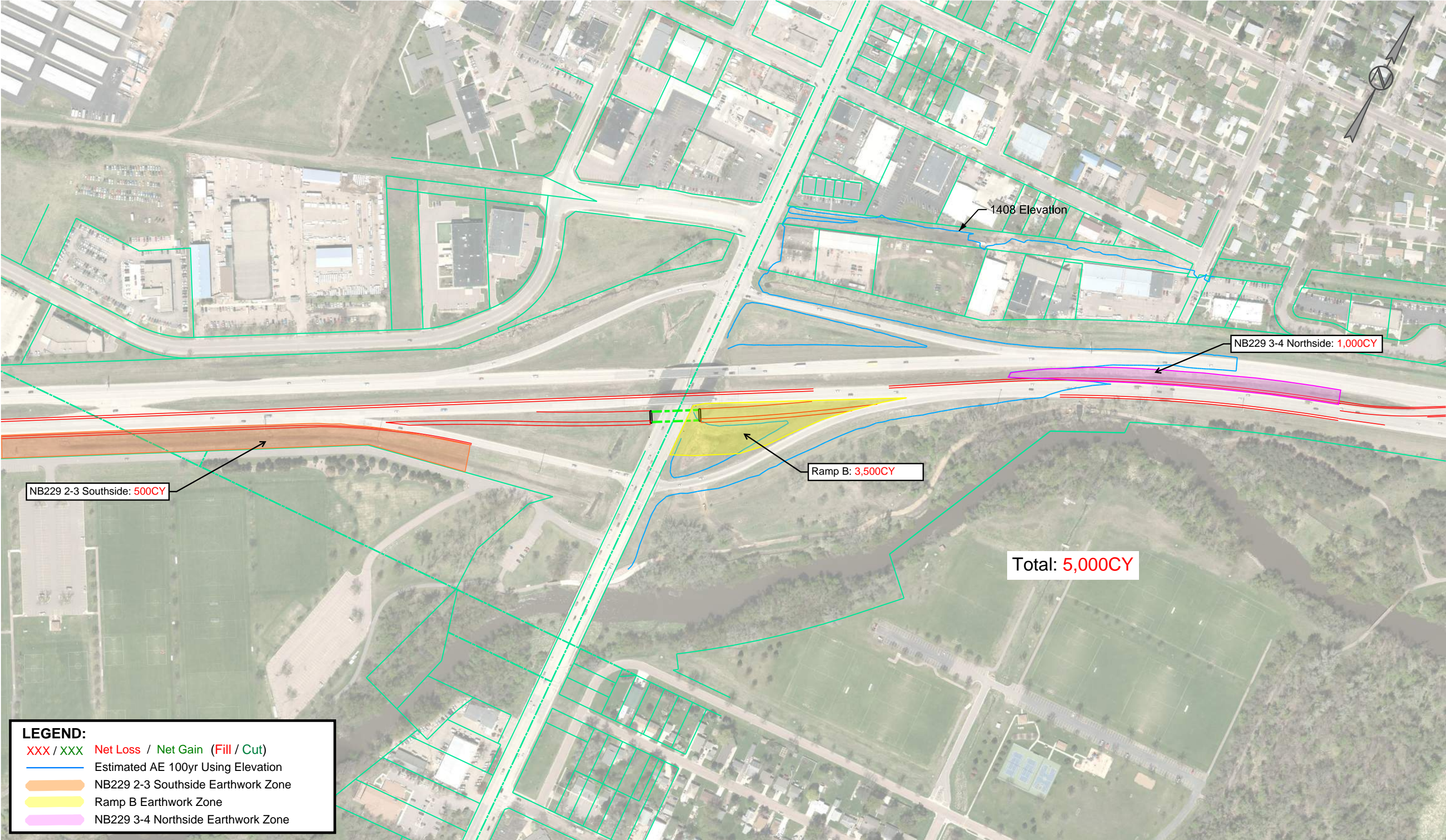
LEGEND:

- XXX / XXX Net Loss / Net Gain (Fill / Cut)
- Estimated AE 100yr Using Elevation
- █ Ramp A Earthwork Zone
- █ Ramp B Earthwork Zone
- █ Ramp C Earthwork Zone
- █ Ramp E Earthwork Zone
- █ Ramp F Earthwork Zone

Exit 3: Final Cut/Fill

I229 EXIT 3: FEMA BOUNDARY

SD DOT	PROJECT	SECTION	SHEET
	IM 2292(84)2 NH 2115(46)	B	???
Plotting Date: 2/20/2023			



LEGEND:

- XXX / XXX Net Loss / Net Gain (Fill / Cut)
- Estimated AE 100yr Using Elevation
- Orange NB229 2-3 Southside Earthwork Zone
- Yellow Ramp B Earthwork Zone
- Purple NB229 3-4 Northside Earthwork Zone

Exit 3: Cross-over Cut/Fill

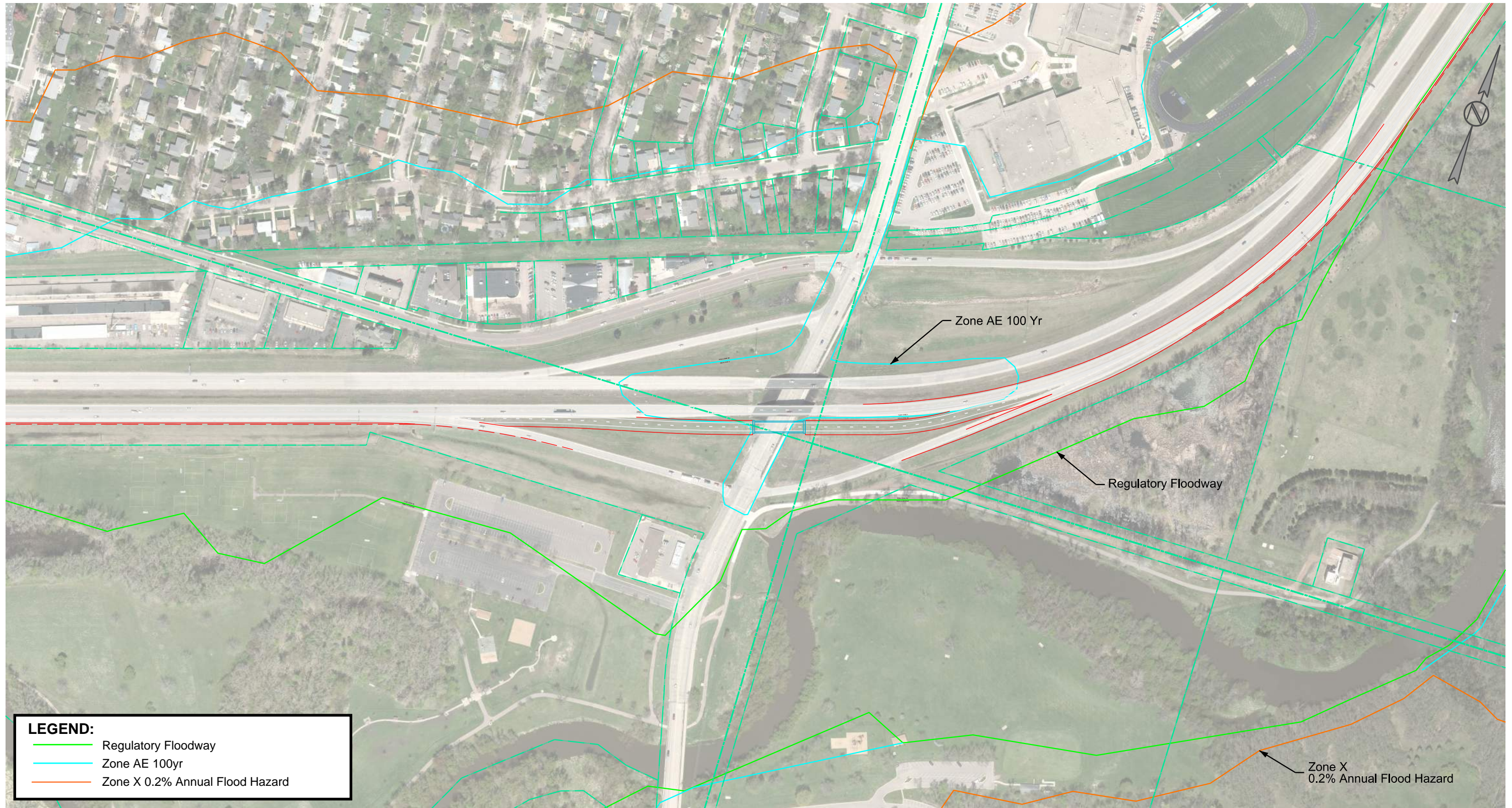
I229 EXIT 4 FEMA BOUNDARY



PROJECT

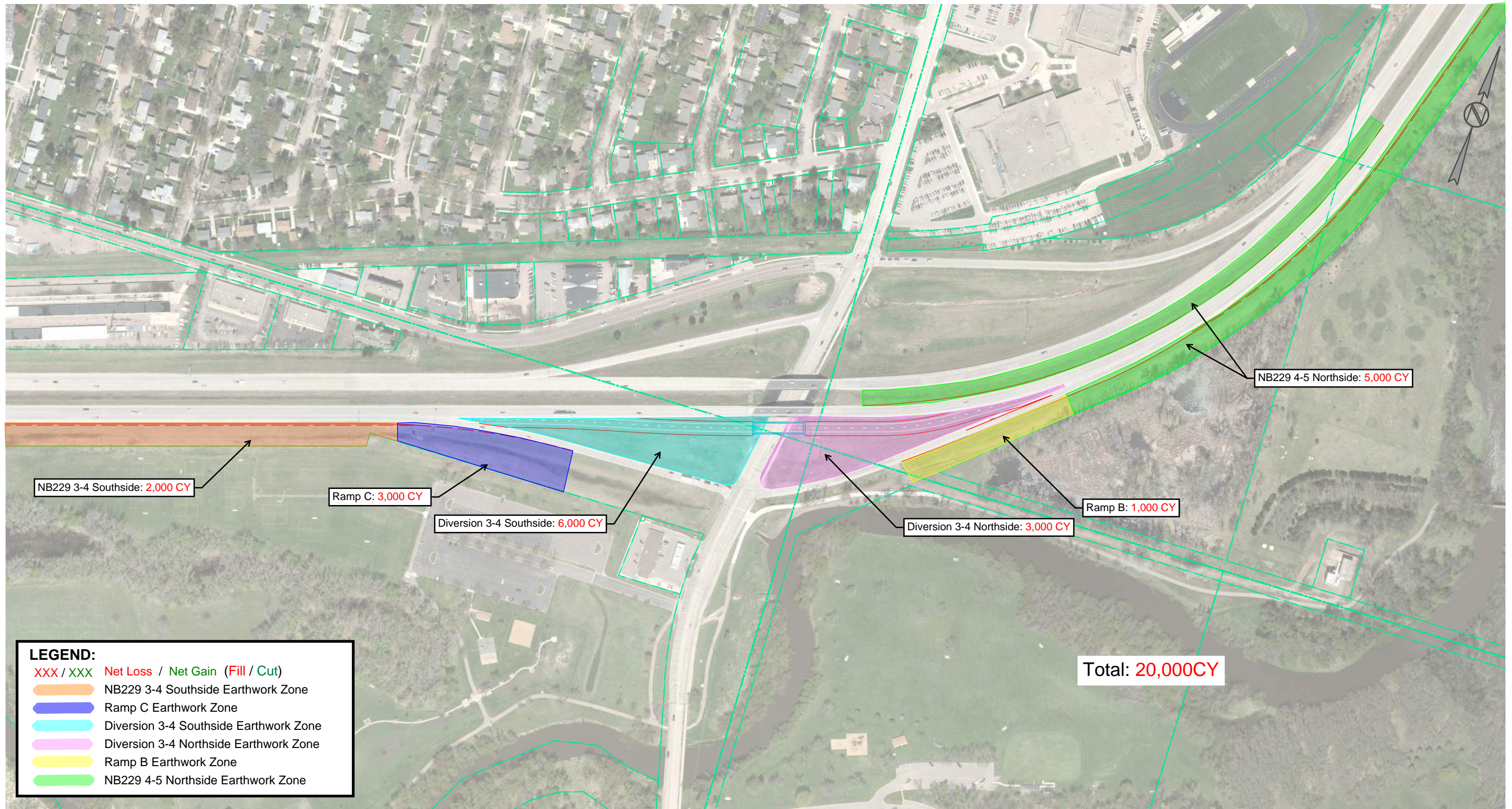
SECTION SHEET

Plotting Date: 2/20/2023



Exit 4: Floodplain Boundaries

I229 EXIT 4 FEMA BOUNDARY



LEGEND:

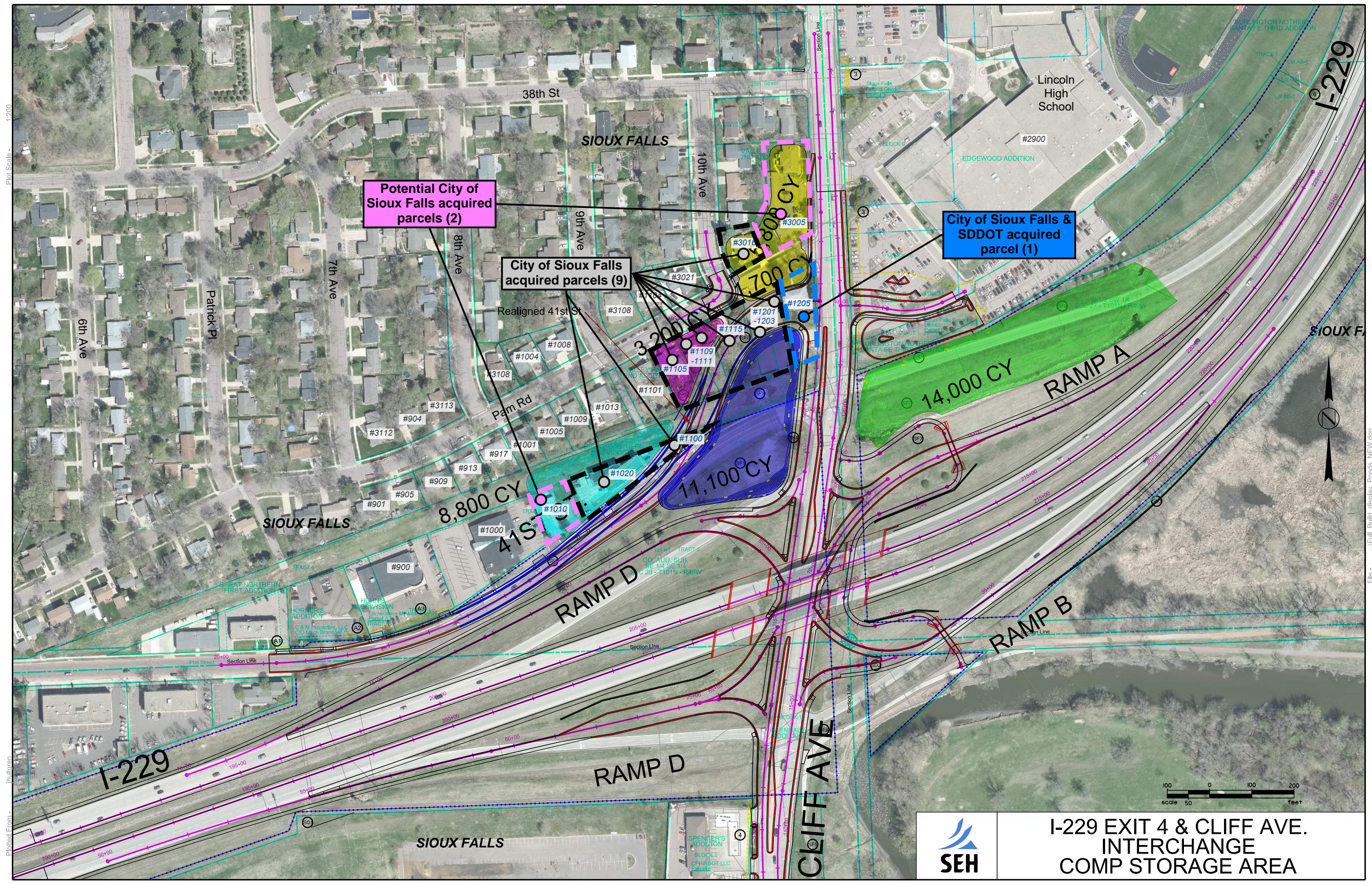
XXX / XXX Net Loss / Net Gain (Fill / Cut)

- █ NB229 3-4 Southside Earthwork Zone
- █ Ramp C Earthwork Zone
- █ Diversion 3-4 Southside Earthwork Zone
- █ Diversion 3-4 Northside Earthwork Zone
- █ Ramp B Earthwork Zone
- █ NB229 4-5 Northside Earthwork Zone

Exit 4: Cross-over Cut/Fill

Plot Scale - 1:200

Plotted From - ihultgren



Potential City of Sioux Falls acquired parcels (2)

City of Sioux Falls acquired parcels (9)

City of Sioux Falls & SDDOT acquired parcel (1)

8,800 CY

11,100 CY

14,000 CY

RAMP A

RAMP D

RAMP B

RAMP D



I-229 EXIT 4 & CLIFF AVE.
INTERCHANGE
COMP STORAGE AREA

File - ...Full_Build_display_Ponds_NEW.dgn