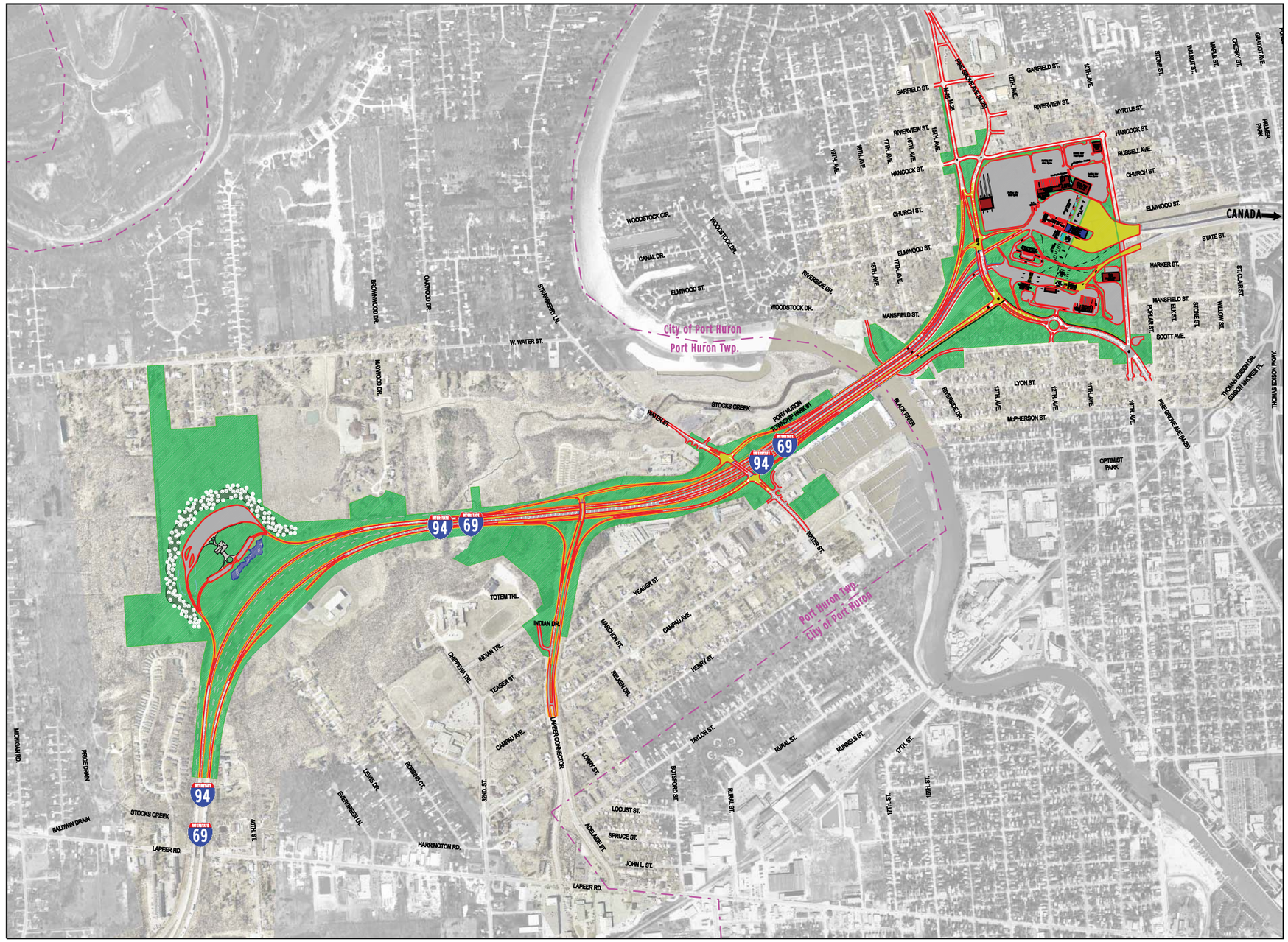


City West (Preferred) Alternative

Blue Water Bridge Plaza Study

Figure E.4 City West (Preferred) Alternative
Sheet A

City West (Preferred) Alternative
Blue Water Bridge Plaza Study

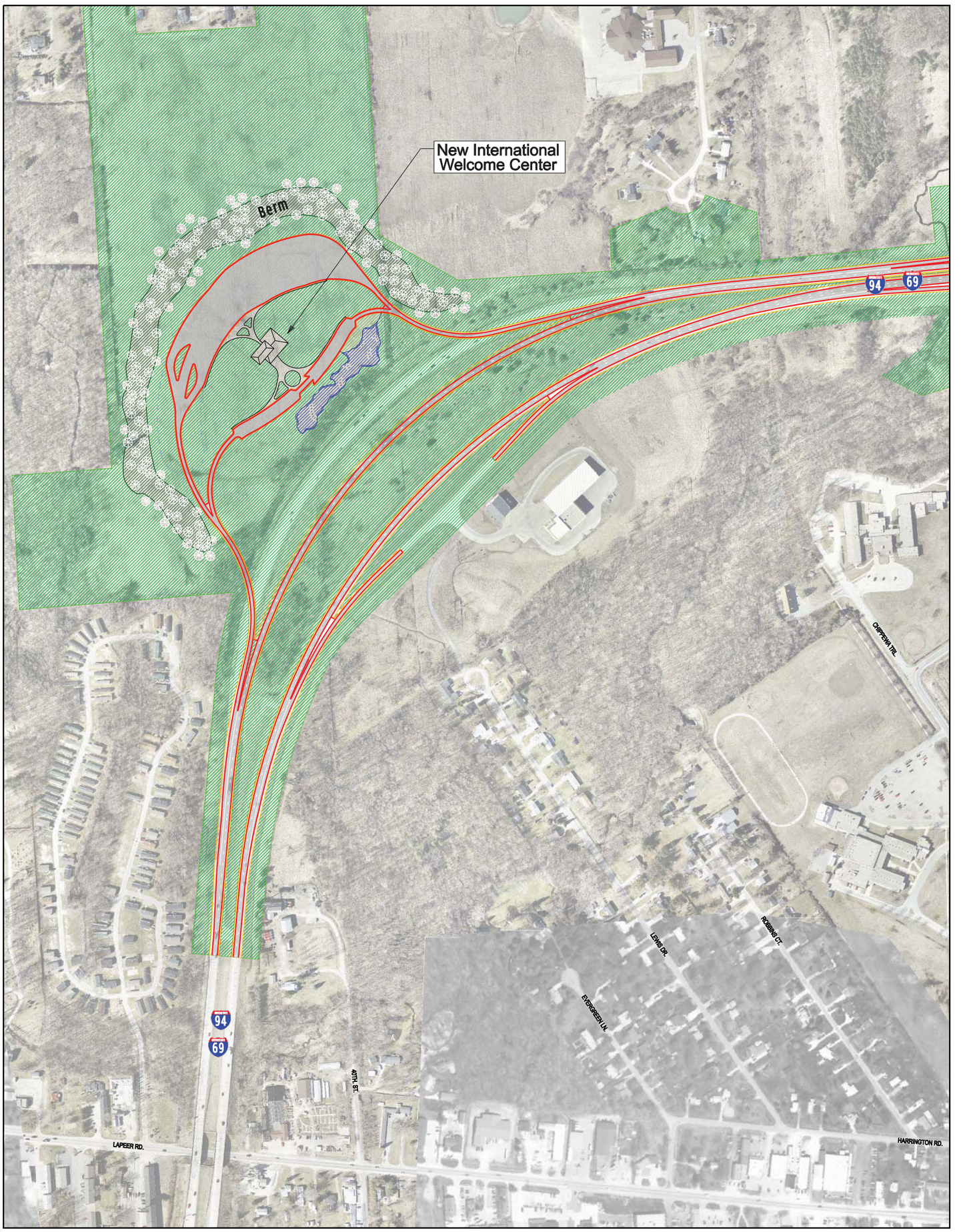
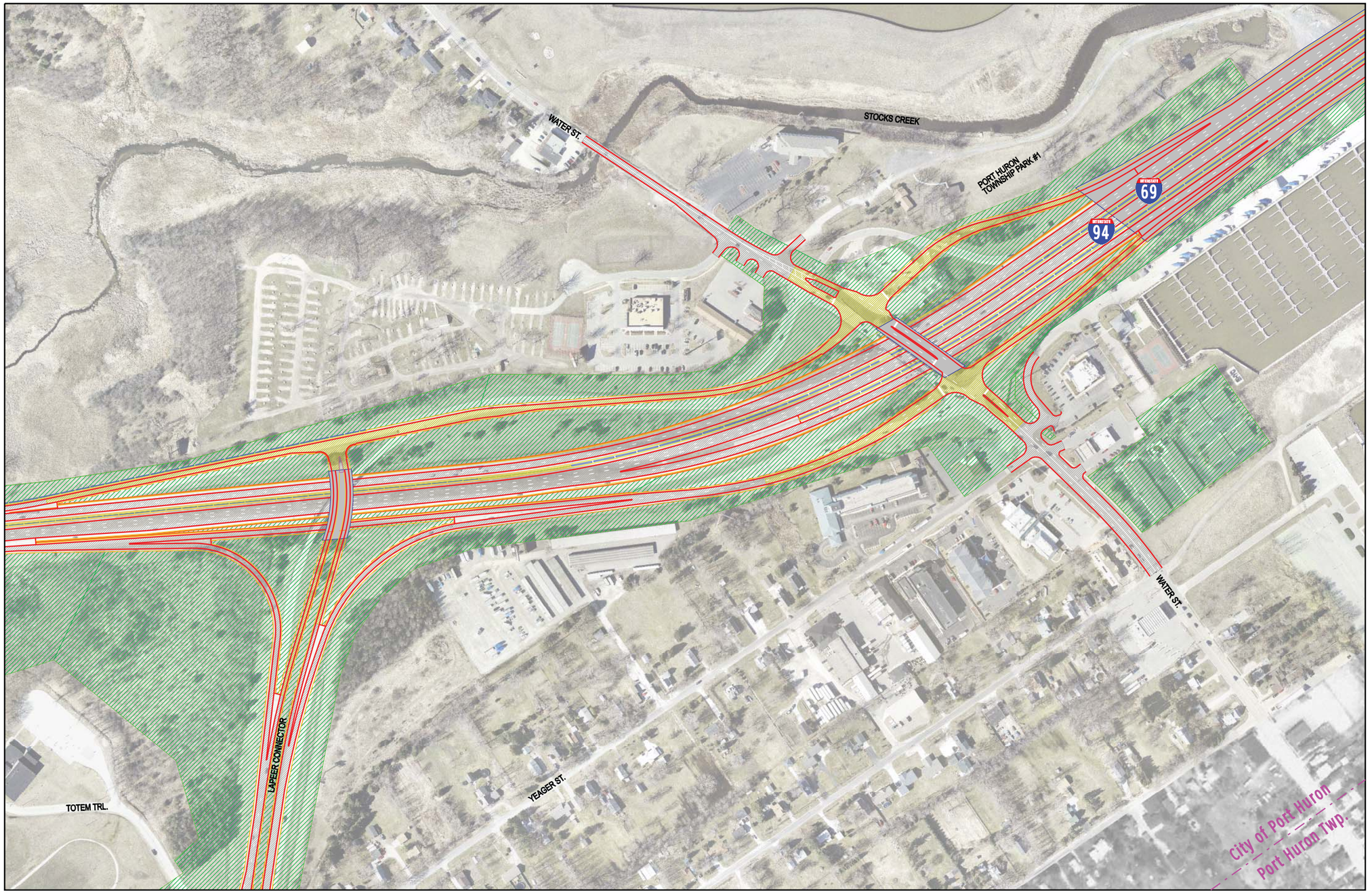


Figure E.4 City West (Preferred) Alternative
Sheet B
Page E-8



MDOT
Michigan Department of Transportation

SCALE
(IN FEET)
0 100 200 300 400 500

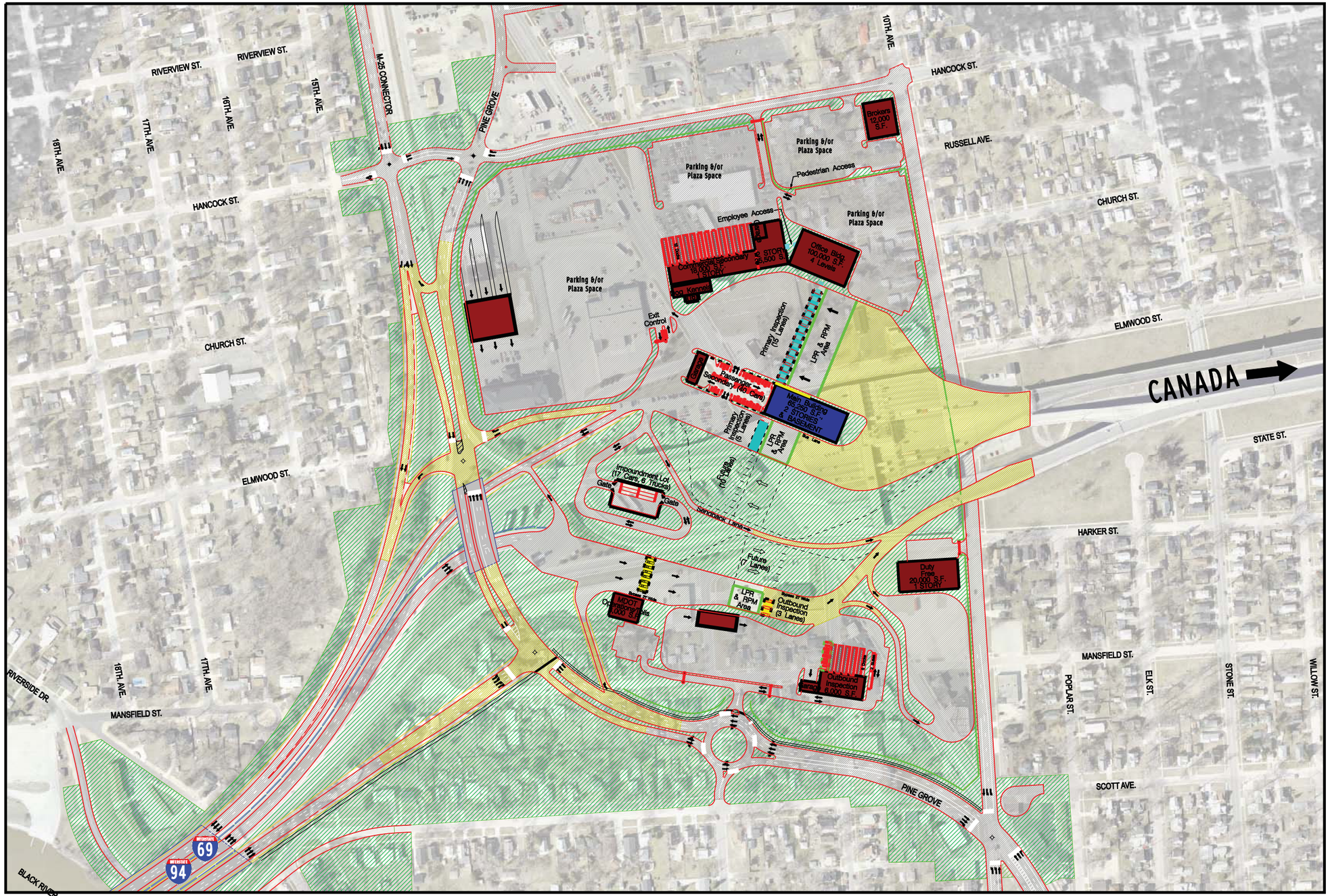
City West (Preferred) Alternative

Blue Water Bridge Plaza Study

LEGEND
- Rising or Elevated Sections
- At Grade
- Impacted Parcels

N
W E
S

Figure E.4 City West (Preferred) Alternative
Sheet C



SCALE (IN FEET)
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City West (Preferred) Alternative

Blue Water Bridge Plaza Study

LEGEND
- Rising or Elevated Sections
- At Grade
- Impacted Parcels

N W E S

Figure E.4 City West (Preferred) Alternative
Sheet D
Page E-10

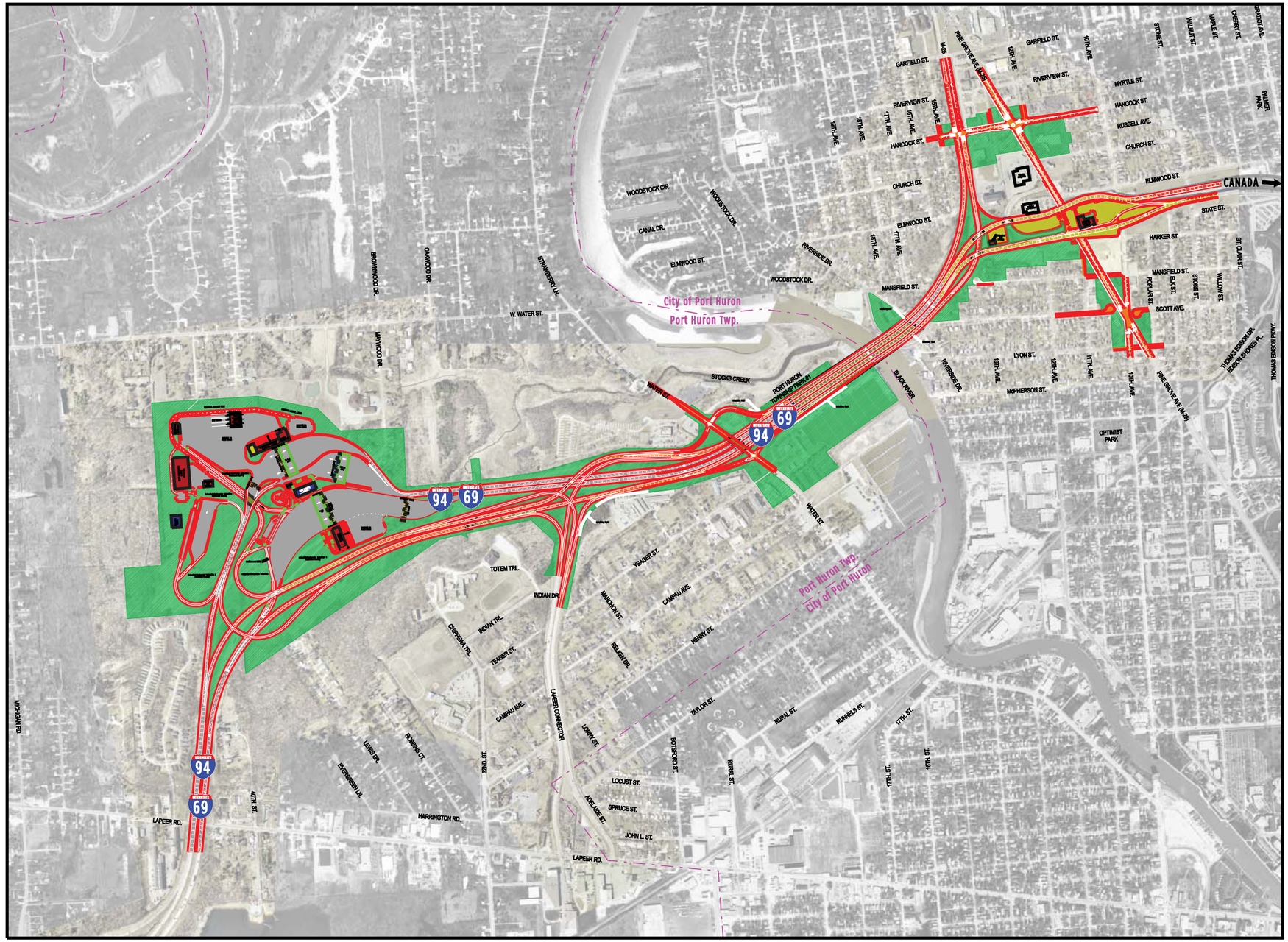
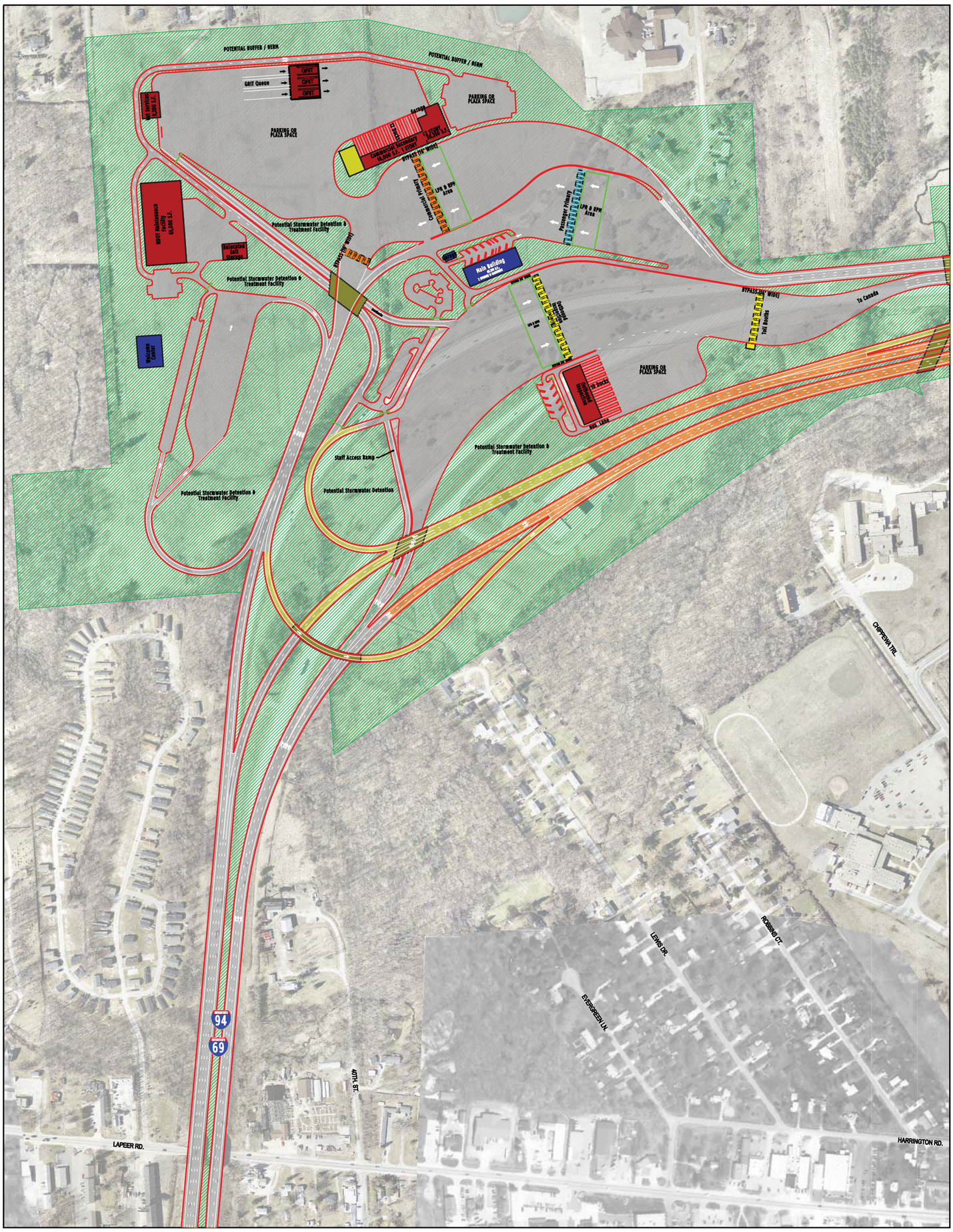


Figure E.5 Township Alternative
Sheet A

Township Alternative
Blue Water Bridge Plaza Study



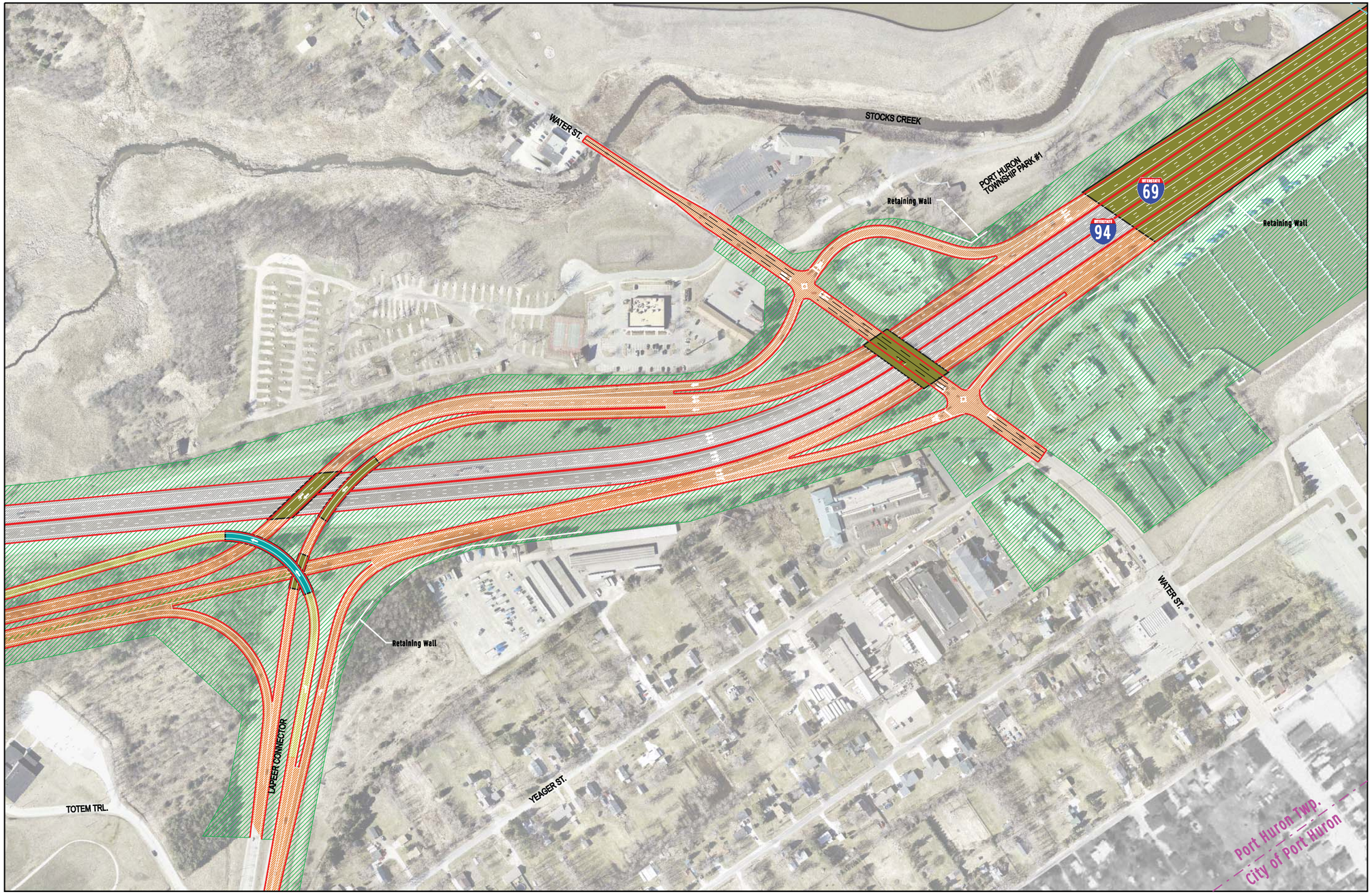
MDOT Michigan Department of Transportation

SCALE
1 IN FEET
0 100 200 300 400 500

LEGEND
- Rising or Elevated Sections
- At Grade
- Impacted Parcels
- New Connector Road

N W E S

Figure E.5 Township Alternative
Sheet B



MDOT
Michigan Department of Transportation

SCALE
(IN FEET)
0 100 200 300 400 500

Township Alternative

Blue Water Bridge Plaza Study

LEGEND
- Rising or Elevated Sections
- At Grade
- Impacted Parcels
- New Connector Road

N
W E
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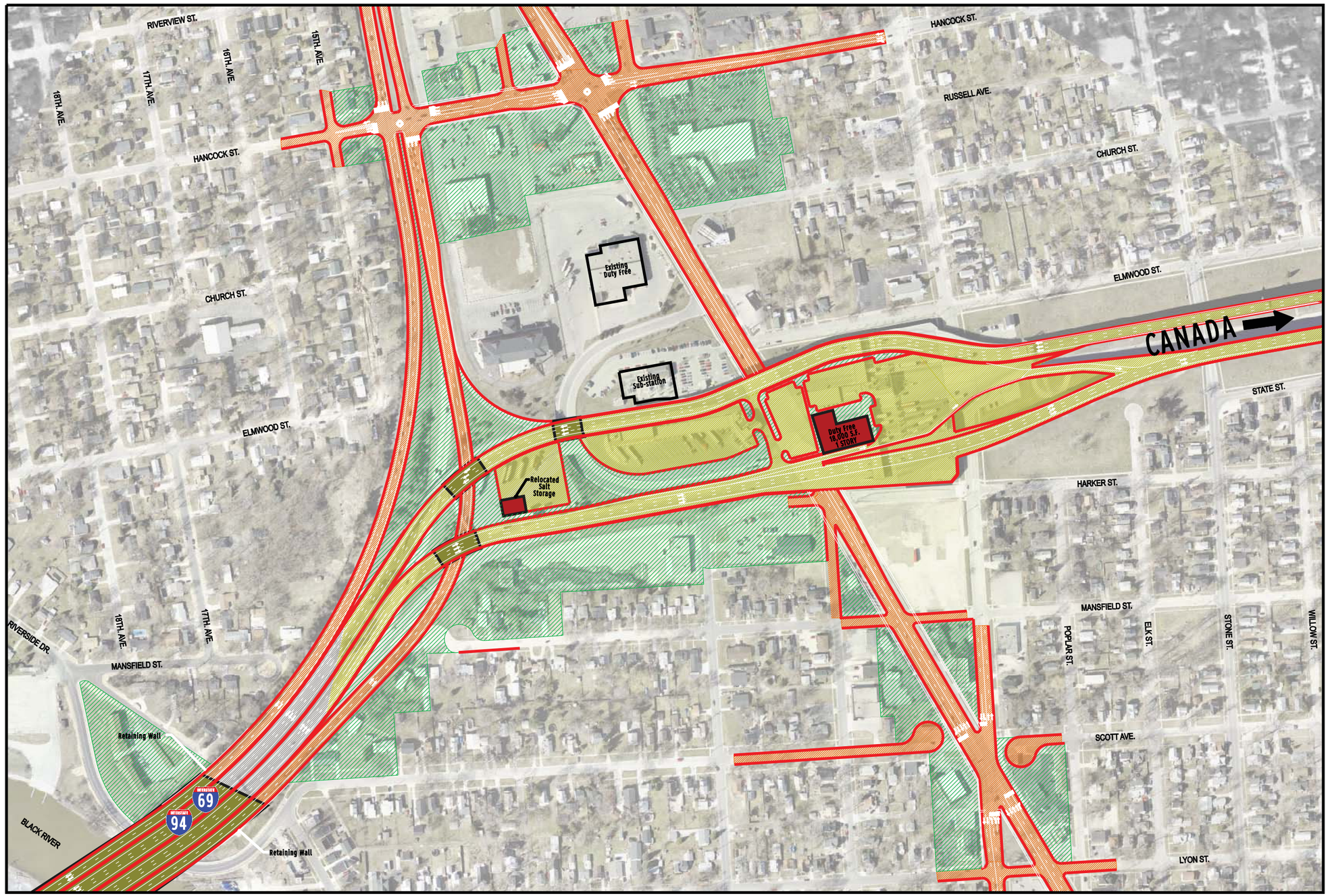
Figure E.5 Township Alternative
Sheet C



Township Alternative

Blue Water Bridge Plaza Study

Figure E.5 Township Alternative
Sheet D

Preliminary Road Design Criteria (English Units)

ITEM	I-94/I-69	I-94/I-69	M-25 Connector	Lapeer Connector	Pine Grove	Hancock	Water	Ramps		Plaza
								16' Ramps	24' Ramps	
ROADWAY CLASSIFICATION										
Roadway Classification	Rural Freeway	Urban Freeway	Local Arterial	Local Arterial	Local Arterial	Local Arterial	Local Arterial	Rural Freeway	Rural Freeway	N/A
Terrain	Level	Level	Level	Level	Level	Level	Level	Level	Level	Level
Existing AADT's (2003)	16,000	16,000	33,600	12,400	23,800	12,700	15,800	To Be Determined	To Be Determined	to be determined
Proposed AADT's (Projected to Year 2030-Peak Hour)	N/A	30,400	43,300	14,800	26,400	16,100	16,800	See Traffic Report	See Traffic Report	to be determined
Level of Service	D or better	D or better	D or better	D or better	D or better	D or better	D or better	D or better	D or better	D or better
Posted Speed	70 MPH	55 MPH	40 MPH	40 MPH	35 MPH	35 MPH	35 MPH	Not Applicable	Not Applicable	Not Applicable
Design Speed	75 MPH	60 MPH	45 MPH	45 MPH	40 MPH	40 MPH	40 MPH	15 MPH Below Mainline	15 MPH Below Mainline	25 MPH
Design Vehicle	WB-62	WB-62	WB-62	WB-62	WB-62	WB-62	WB-62	WB-62	WB-62	WB-109D
Design Year	2030	2030	2030	2030	2030	2030	2030	2030	2030	2030
CROSS-SECTION ELEMENTS										
Median Shoulder Width (Adj. To Conc. Median Barrier)	13 ft. (12 ft. paved)	8 ft. Shoulder + 4 ft. Valley Gutter (12 ft. Clear Width) (includes valley gutter)	8 ft. (includes valley gutter)	8 ft. (includes valley gutter)	N/A	N/A	N/A	6 ft. (4 ft. Paved)	6 ft. (4 ft. Paved)	6 ft. (4 ft. Paved)
Outside Shoulder Width (Curb Section)	N/A	12 ft. Clear Width	6 ft. Shoulder + 4 ft. Valley Gutter (10 ft. Clear Width)	6 ft. Shoulder + 4 ft. Valley Gutter (10 ft. Clear Width)	N/A	N/A	N/A	8 ft. (7 ft/ paved)	8 ft. (7 ft/ paved)	8 ft. (7 ft/ paved)
Outside Shoulder Width (Ditch Section)	13 ft. (12 ft. paved)	N/A	9ft (8 ft paved)	9ft (8 ft paved)	N/A	N/A	N/A	8 ft. (7 ft/ paved)	8 ft. (7 ft/ paved)	8 ft. (7 ft/ paved)
Curb Type	N/A	Type G	B2	B2	F4	F4	F4	B2	B2	F4
Lane Width	12 ft.	12 ft.	12 ft.	12 ft.	12 ft.	12 ft.	12 ft.	16 ft.	2 Lanes at 12 ft. Each	12 ft. / 16 ft. Loop Ramps
Number of Lanes (Practical Alternative 2)	4 Lanes (2 each Direction)	4 Lanes (2 each Direction)	4 Lanes (2 each Direction)	4 Lanes (2 each Direction)	5 Lanes	5 Lanes	5 Lanes	To Be Determined	To Be Determined	To Be Determined
Number of Lanes (Practical Alternative 3)	6 Lanes (3 each Direction)	6 Lanes (3 each Direction)	4 Lanes (2 each Direction)	4 Lanes (2 each Direction)	5 Lanes	5 Lanes	5 Lanes	1 Lane	2 Lanes	To Be Determined
Roadway Cross Slopes	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Crown Rollover	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Crown Point	left edge of inside lane	left edge of inside lane	left edge of inside lane	left edge of inside lane	left edge of inside lane	left edge of inside lane	left edge of inside lane	Either Edge of Outside Land as Needed	Middle 12 ft. From an Edge	Left Edge of Inside Lane
Point of Rotation	left edge of inside lane	left edge of inside lane	left edge of inside lane	left edge of inside lane	determined by site conditions	determined by site conditions	determined by site conditions	Alignment Edge	Alignment Edge	Alignment Edge
Shoulder Cross Slopes	4%	4%	4%	4%	N/A	N/A	N/A	4%	4%	4%
Sidewalk Width	N/A	N/A	N/A	N/A	4 ft. Min. (5 ft. Des.)	4 ft. Min. (5 ft. Des.)	4 ft. Min. (5 ft. Des.)	N/A	N/A	N/A
Outside Ditch Foreslope	1:6 Des./ 1:4 Max.	1:6 Des./ 1:4 Max.	1:6 Des./ 1:4 Max.	1:6 Des./ 1:4 Max.	N/A	N/A	N/A	1:6 Des./ 1:4 Max.	1:6 Des./ 1:4 Max.	1:6 Des./ 1:4 Max.
Outside Ditch Backslope	1:4 Des./ 1:2 Max.	1:4 Des./ 1:2 Max.	1:4 Des./ 1:2 Max.	1:4 Des./ 1:2 Max.	N/A	N/A	N/A	1:4 Des./ 1:2 Max.	1:4 Des./ 1:2 Max.	1:4 Des./ 1:2 Max.
Ditch Width	6' Des./4' Min.	6' Des./4' Min.	6' Des./4' Min.	6' Des./4' Min.	N/A	N/A	N/A	6' Des./4' Min.	6' Des./4' Min.	6' Des./4' Min.
Ditch Depth	4' Below Plan Grade and Below Subbase Outlet	4' Below Plan Grade and Below Subbase Outlet	4' Below Plan Grade and Below Subbase Outlet	4' Below Plan Grade and Below Subbase Outlet	N/A	N/A	N/A	4' Below Plan Grade and Below Subbase Outlet	4' Below Plan Grade and Below Subbase Outlet	4' Below Plan Grade and Below Subbase Outlet
Min. Percent Ditch Grade	Des. 0.3%/ Min: 0.1%	Des. 0.3%/ Min: 0.1%	Des. 0.3%/ Min: 0.1%	Des. 0.3%/ Min: 0.1%	N/A	N/A	N/A	Des. 0.3%/ Min: 0.1%	Des. 0.3%/ Min: 0.1%	Des. 0.3%/ Min: 0.1%
HORIZONTAL ALIGNMENT										
Minimum Curve Length	1125 ft. Min (2250 Desired)	900 ft. Min (1800 Desired)	675 ft. Min (1350 Desired)	675 ft. Min (1350 Desired)	600 ft. Min (1200 Desired)	600 ft. Min (1200 Desired)	600 ft. Min (1200 Desired)	675 ft. Min (1350 Desired)	675 ft. Min (1350 Desired)	Dependent on Radius
Minimum Curve Radii	2344 ft. Min (2700 Des.)	1412 ft. Min (2700 Des.)	614 ft.	614 ft.	464 ft.	464 ft.	464 ft.	222 ft. Min, 250 Des. for Loop Ramps	222 ft. Min, 250 Des. for Loop Ramps	**139 ft. for Truck Turning Radius (260 ft. Desired for Loop Ramps)
Minimum radius of Curve for Spiral	Table (Pg. 2)	Table (Pg. 2)	Table (Pg. 2)	Table (Pg. 2)	N/A	N/A	N/A	Table (Pg. 2)	Table (Pg. 2)	N/A
Spiral Length	Dependent on Super Transition Length	Dependent on Super Transition Length	Dependent on Super Transition Length	Dependent on Super Transition Length	Dependent on Super Transition Length	Dependent on Super Transition Length	Dependent on Super Transition Length	Dependent on Super Transition Length	Dependent on Super Transition Length	Dependent on Super Transition Length
Compound Circular Curve Ratio (Flatter to Sharper Radii)	Max. 1.5:1	Max. 1.5:1	Max. 1.5:1	Max. 1.5:1	Max. 1.5:1	Max. 1.5:1	Max. 1.5:1	Max. 1.5:1	Max. 1.5:1	Max. 1.5:1
Acceleration / Deceleration Lane Lengths (Tapered)	Dependent on Ramp Radius	Dependent on Ramp Radius	Dependent on Ramp Radius	Dependent on Ramp Radius	N/A	N/A	N/A	See Roadway	See Roadway	See Roadway
Acceleration / Deceleration Lane Lengths (Parallel)	Dependent on Ramp Radius	Dependent on Ramp Radius	Dependent on Ramp Radius	Dependent on Ramp Radius	N/A	N/A	N/A	See Roadway	See Roadway	See Roadway
Stopping Sight Distance (based on 0% Grade)	570 ft.	570 ft.	360 ft.	360 ft.	305 ft.	305 ft.	305 ft.	Dependent on Design Speed	Dependent on Design Speed	Dependent on Design Speed
Clear Vision Area	Dependent on Design	Dependent on Design	Dependent on Design	Dependent on Design	Dependent on Design	Dependent on Design	Dependent on Design	Dependent on Design	Dependent on Design	Dependent on Design
Superelevation	7% Max.	5% Max.	7% Max.	7% Max.	7% Max.	7% Max.	7% Max.	7% Max.	7% Max.	7% Max.
Superelevation Split Inside Curve	33% (40% Max. & 10% Min.)	33% (40% Max. & 10% Min.)	33% (40% Max. & 10% Min.)	33% (40% Max. & 10% Min.)	33% (40% Max. & 10% Min.)	33% (40% Max. & 10% Min.)	33% (40% Max. & 10% Min.)	33% (40% Max. & 10% Min.)	33% (40% Max. & 10% Min.)	33% (40% Max. & 10% Min.)
Superelevation Split Outside Curve	66% (90% Max & 60% Min.)	66% (90% Max & 60% Min.)	66% (90% Max & 60% Min.)	66% (90% Max & 60% Min.)	66% (90% Max & 60% Min.)	66% (90% Max & 60% Min.)	66% (90% Max & 60% Min.)	66% (90% Max & 60% Min.)	66% (90% Max & 60% Min.)	66% (90% Max & 60% Min.)
Maximum Rollover	8% (AASHTO Max), 6% (MDOT Max)	8% (AASHTO Max), 6% (MDOT Max)	8% (AASHTO Max), 6% (MDOT Max)	8% (AASHTO Max), 6% (MDOT Max)	8% (AASHTO Max), 6% (MDOT Max)	8% (AASHTO Max), 6% (MDOT Max)	8% (AASHTO Max), 6% (MDOT Max)	8% (AASHTO Max), 6% (MDOT Max)	8% (AASHTO Max), 6% (MDOT Max)	8% (AASHTO Max), 6% (MDOT Max)
Max. Algebraic Difference at Gore	5% Max.	5% Max.	5% Max.	5% Max.	5% Max.	5% Max.	5% Max.	5% Max.	5% Max.	5% Max.
Delta	0.38 Max.	0.45 Max.	0.54 Max.	0.54 Max.	0.58 Max.	0.58 Max.	0.58 Max.	Dependent on Design Speed	Dependent on Design Speed	0.66 Max.
Security Wall Height	To be Determined	To be Determined	To be Determined	To be Determined	To be Determined	To be Determined	To be Determined	To be Determined	To be Determined	To be Determined
Clear Zone Distances	30- 46 ft.	30-44 ft.	20-28 ft.	20-28 ft.	14-18 ft.	14-18 ft.	14-18 ft.	14-18 ft.	14-18 ft.	14-18 ft.
Curve Correction Factors	Dependent on Radius	Dependent on Radius	Dependent on Radius	Dependent on Radius	Dependent on Radius	Dependent on Radius	Dependent on Radius	Dependent on Radius	Dependent on Radius	Dependent on Radius
VERTICAL ALIGNMENT										
Maximum Grade	4% Maximum	4% Maximum	4% Maximum	4% Maximum	4% Maximum	4% Maximum	4% Maximum	5% Maximum	5% Maximum	5% Maximum
Minimum Grade (Curb and Gutter Sections)	0.3% Min. (0.5% Des.)	0.3% Min. (0.5% Des.)	0.3% Min. (0.5% Des.)	0.3% Min. (0.5% Des.)	0.3% Min. (0.5% Des.)	0.3% Min. (0.5% Des.)	0.3% Min. (0.5% Des.)	0.3% Min. (0.5% Des.)	0.3% Min. (0.5% Des.)	0.3% Min. (0.5% Des.)
Minimum Ditch Grade	0.1% Min. (0.3% Des.)	0.1% Min. (0.3% Des.)	0.1% Min. (0.3% Des.)	0.1% Min. (0.3% Des.)	0.1% Min. (0.3% Des.)	0.1% Min. (0.3% Des.)	0.1% Min. (0.3% Des.)	0.1% Min. (0.3% Des.)	0.1% Min. (0.3% Des.)	0.1% Min. (0.3% Des.)
K-Value (Crest)	312	151	61	61	44	44	44	* 61 (19 Loops)	* 61 (19 Loops)	12
K-Value (Sag)	206	136	79	79	64	64	64	Dependent on Ramp Design Speed	Dependent on Ramp Design Speed	26
Vertical Clearance	16 ft. Min. (16'-3" Des.)	16 ft. Min. (16'-3" Des.)	16 ft. Min. (16'-3" Des.)	16 ft. Min. (16'-3" Des.)	14'-6" Min.	14'-6" Min.	14'-6" Min.	16 ft. Min.	16 ft. Min.	16 ft. Min.
Minimum Vertical Curve Length	180 ft.	180 ft.	135 ft.	135 ft.	120 ft.	120 ft.	120 ft.	* 135 ft./90 ft. Loops	* 135 ft./90 ft. Loops	* 135 ft./90 ft. Loops

Sources:

1. American Association of State Highway and Transportation Officials (AASHTO) 2001
2. Michigan Department of Transportation (MDOT) Road Design Manual (RDM ** 7% used for e and emax
3. MDOT Geometric Design Guide
4. Traffic & Safety Notes
5. MDOT Drainage Design Manual
6. 2000 Highway capacity Manual
7. AASHTO- Geometric Design of Highways and Streets (GDS)
8. Traffic Control Order (TCO) Review
9. South East Michigan Council of Governments (SEMCOG)
10. Americans with Disabilities Act Accessibility Guidelines (ADAAG)
11. Average Annual Daily Traffic (AADT) Report
12. MDOT Road Design Manual (RDM)
13. MDOT Special Detail (SP)

Preliminary Bridge Design Criteria (English Units)

ITEM	Reference	Description	Criteria
Substructure Concrete:	AASHTO/ MDOT BDM	Grade S2	f'c = 3,000 psi
Superstructure Concrete:	AASHTO/ MDOT BDM	Grade D	f'c = 4,000 psi
Steel Reinforcement:	AASHTO/ MDOT BDM	Sub & Super	fy = 60,000 psi
Steel Reinforcement:	AASHTO/ MDOT BDM	Beam Stirrups	fy = 60,000 psi
Prestressed Concrete:	AASHTO/ MDOT BDM		f'c = 5,000 – 7,000 psi
Prestressing Strands:	AASHTO/ MDOT BDM		f's = 270,000 psi
Live Load:	AASHTO/ MDOT BDM		HS20-44 or HS25
Deflection Limit:	AASHTO/ MDOT BDM		(Span Length =L)/1000 or (Span Length =L)/800
Future Wearing Surface:	AASHTO/ MDOT BDM		25 Lbs/Sft Additional design load
Stay-In-Place Forms:	AASHTO/ MDOT BDM		15 Lbs/Sft Additional design load
Vertical Clearance:	AASHTO/ MDOT BDM		16'-0" Min. / 16'-3" Desirable
Bridge Clear Roadway Width (PA2/ PA3)	MDOT BDM 12.02		Traveled way + 2ft. (each side) Min./Traveled way + Shldr Max.
Clear Zone Median:	AASHTO/ MDOT BDM		MDOT BDM 6.06
Clear Zone Outside:	AASHTO/ MDOT BDM		MDOT BDM 6.06
Longitudinal Deck Grade:	AASHTO/ MDOT BDM		0.3 % Min.
Transverse Deck Grade (Cross Slope):	AASHTO/ MDOT BDM		2.00%
Structure Lane Width:	AASHTO/ MDOT BDM		12'-0"
Structure Shoulder Width:	AASHTO/ MDOT BDM		10'-0"
Shoulder Width for Ramp Sturtures			4' Left/ 8' Right
Wall Height	Under Study		Under Study
Other:	AASHTO/ MDOT BDM		Slab continuous over substructures with expansion joints off of
			the structure at the end of the bridge approach slabs.

Figure E.7 Bridge Design Criteria