To

Patrick Laux, PE

From

Jerry Shadewald
Mark Mathu

Date

September 18, 2013

Subject

B-44-126 (WIS 441 over Fox River and CN Railway)

HNTB Job Number

44386

Technical Memorandum

This memorandum summarizes the concepts considered for expanding the WIS 441 bridges over the Fox River in eastern Appleton to four lanes in each direction and to three lanes in each direction plus an additional northbound auxiliary lane north of the WIS 96 overpass. This expansion is being considered as part of the US 41/WIS 441 Operational Needs Study being conducted for the Wisconsin Department of Transportation.

All options for the WIS 441 bridges include redecking. This memorandum assumes that the deck has reached the end of its useful life at the time of structure widening; redecking also allows relocating the crown point of the bridge deck to match the new roadway section. Span lengths of new bridges or widened portions of existing bridges will match the span lengths of the existing bridge, in order to keep piers in line to assist river navigation.

New lines of girders will be the same depth as the existing lines of girders, and hinge and expansion joint locations on the existing bridge deck will be replicated on the widened bridge deck. The foundations will match the existing foundation system – steel piles for the abutments and the six piers on the river bank, and spread footings for the four piers in the river bed.

All of the options considered can be constructed in stages and maintain at least one lane of traffic in each direction at all times.

B-44-126 TYPICAL SECTION - EXISTING STRUCTURE

Figure shows the existing bridge over the Fox River and Canadian National (CN) Railroad. The bridge is 1629'-4" long, 11 spans, and has two (2) 12'-0" lanes, a 10'-0" exterior shoulder and a 6'-0" interior shoulder in each direction. The abutments and the six piers on both sides of the river bank (one on the south side and six on the north) are founded on steel piles; the four piers in the river are spread footings on cofferdam seal slabs. The two bridge decks are supported on steel plate girders spaced at 11'-8" with depths varying from 72" to 48" along the length of the bridge.

Span 3 has clearance for a 100'-0" wide navigation channel in the Fox River.

The vertical clearance over the CN Railway tracks is shown as 23'-6" in the existing plans; 23'-0” minimum vertical clearance is required by Facilities Development Manual (FDM) 11-35. The horizontal clearance at the CN tracks is 20'-11"; 9'-0" minimum horizontal clearance is required per the AREMA Manual for Railway Engineering Chapter 28.

The vertical clearance over STH 96 is shown as 28'-0” in the existing plans; 16'-4” minimum vertical clearance is required by FDM 11-35.

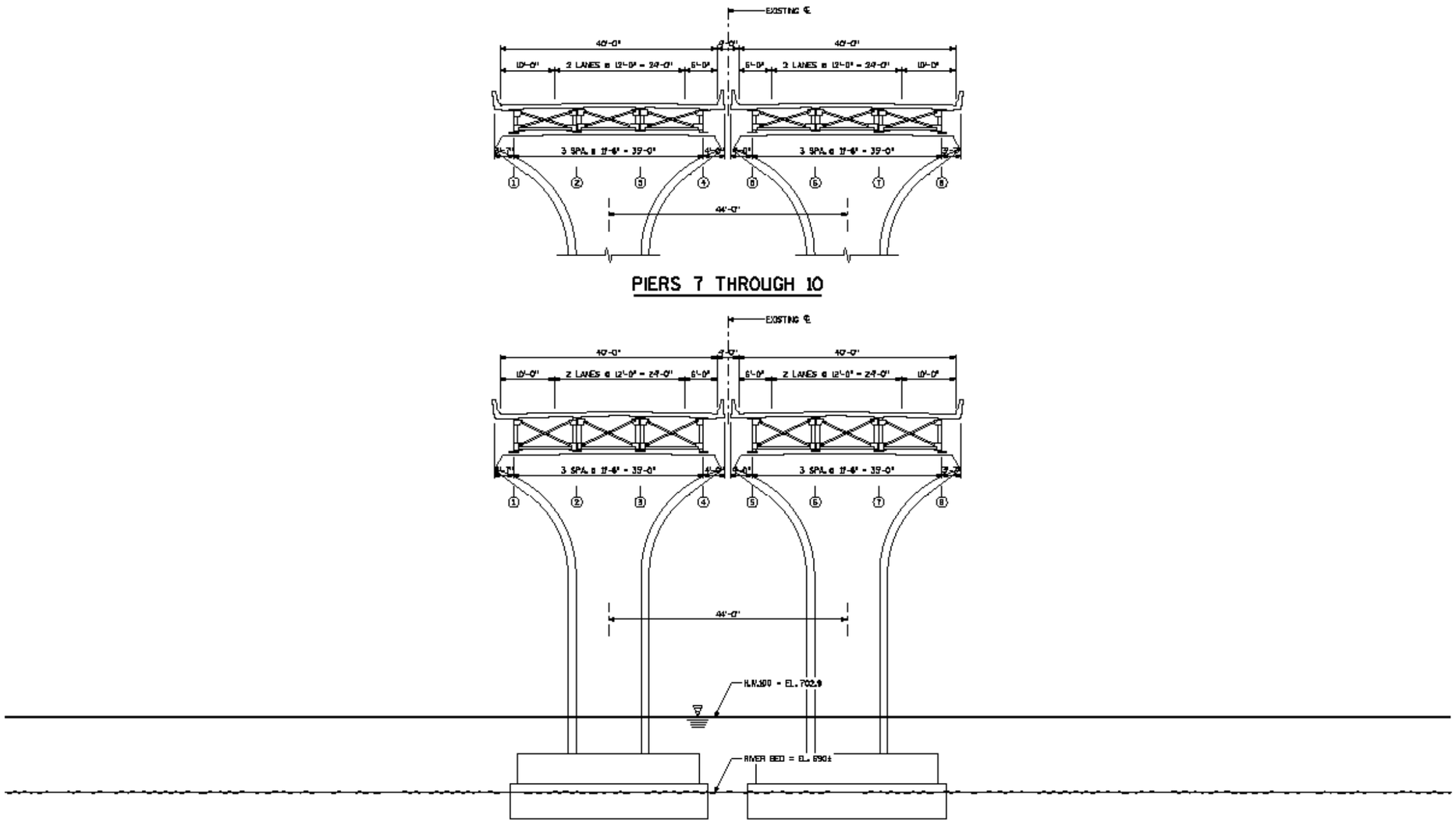

EXISTING ℄
40'-0"
2'-0"
40'-0"
10'-0"
2 LANES @ 12'-0" = 24'-0"
6'-0"
6'-0"
2 LANES @ 12'-0" = 24'-0"
10'-0"
3 SPA. @ 17'-6" = 39'-0"
3 SPA. @ 17'-6" = 39'-0"
1
2
3
4
5
6
7
8
44'-0"
PIERS 7 THROUGH 10
EXISTING ℄
40'-0"
2'-0"
40'-0"
10'-0"
2 LANES @ 12'-0" = 24'-0"
6'-0"
6'-0"
2 LANES @ 12'-0" = 24'-0"
10'-0"
3 SPA. @ 17'-6" = 39'-0"
3 SPA. @ 17'-6" = 39'-0"
1
2
3
4
5
6
7
8
44'-0"
H.W.100 = EL. 702.9
RIVER BED = EL. 690±
PIERS 1 THROUGH 6
B-44-126 TYPICAL SECTION - EXISTING BRIDGE (LOOKING NORTH)

Figure 1

B-44-126 TYPICAL SECTION – CONCEPT 1

This concept, Figure 2, widens WIS 441 on the west side of the existing bridge. The centerline of the new roadway is shifted 45'-5" west of the existing centerline.

The southbound lanes are located on an entirely new bridge. The northbound lanes are located on the existing bridge girders and piers. New cross frames are added between existing girders 4 and 5. Existing girder 8 is removed for the entire length of the bridge and girder 7 is removed south of the WIS 96 overpass. A new exterior girder, spliced into the existing girder lines, is required for the tapered lane transition at WIS 96.

There is adequate horizontal clearance in span 3 to maintain the 100'-0" wide navigation channel; however the channel will need to be shifted 7' south to clear the new piers on the southbound bridge.

Vertical clearance over the CN tracks and WIS 96 will be controlled by the existing girders and will remain unchanged. Horizontal clearance to the CN tracks is reduced to 17'-1". A railroad crash wall is not required for solid single shaft piers per Bridge Manual 13.2.4.

Figure 3 shows the plan view of the roadway transition to the new location of B-44-126. Slope intercept lines are also shown in Figure 9 to show approximate impacts. The geometry of the roadway is shifted to the west from B-44-125 to the Fox River.

There is existing storm sewer in the northwest quadrant of B-44-126. For more detailed information the on the existing storm sewer see section “Existing Storm Sewer”on page 24.

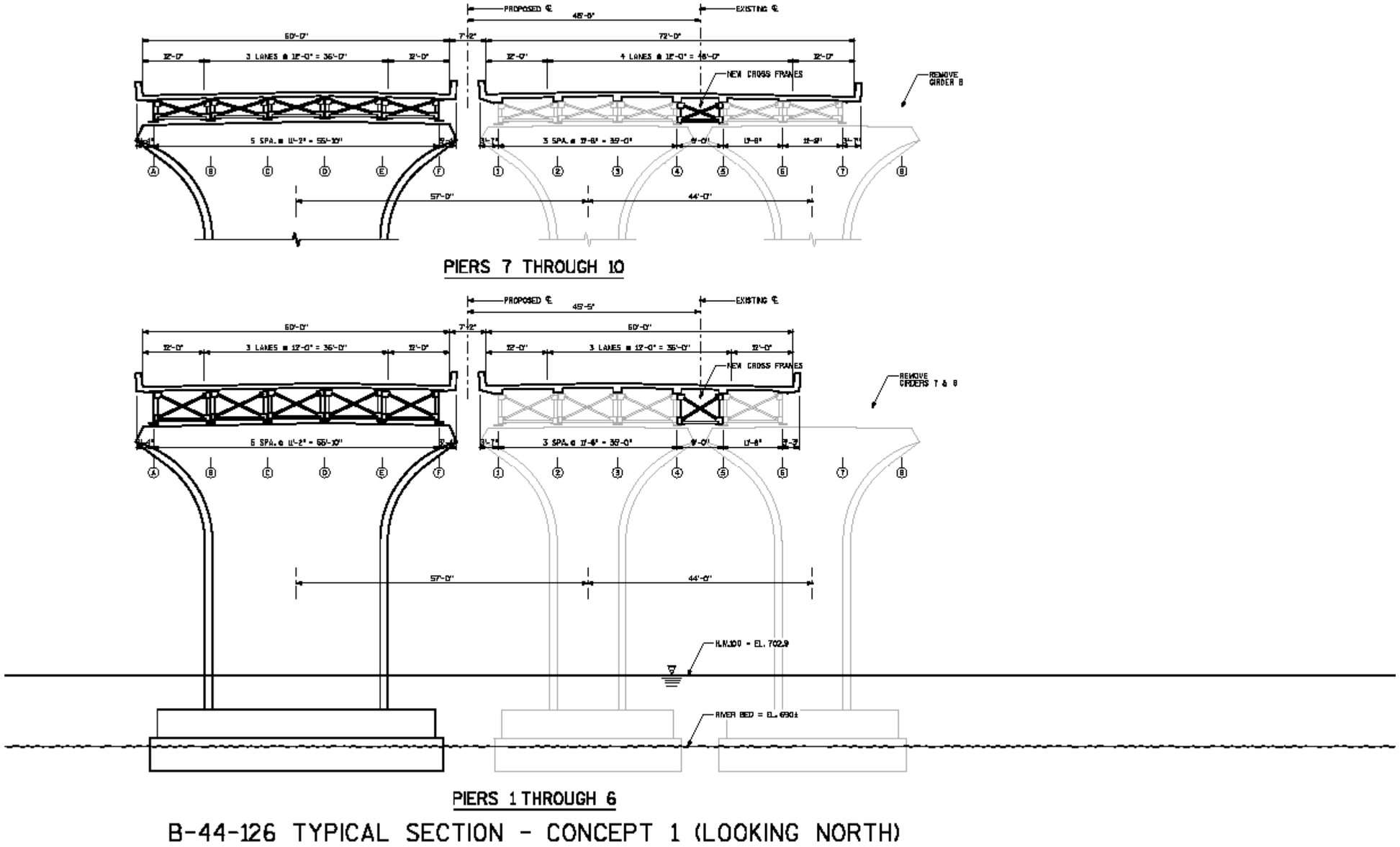

PROPOSED ℄
EXISTING ℄
45'-5"
60'-0"
7'-2"
72'-0"
12'-0"
3 LANES @ 12'-0" = 36'-0"
4 LANES @ 12'-0" = 48'-0"
NEW CROSS FRAMES
REMOVE GIRDER 8
5 SPA. @ 11'-2" = 55'-10"
3 SPA. @ 17'-8" = 53'-0"
9'-0"
17'-8"
11'-9"
57'-0"
44'-0"
PIERS 7 THROUGH 10
45'-5"
60'-0"
REMOVE GIRDERS 7 & 8
6 SPA. @ 11'-2" = 66'-10"
H.W.1100 = EL. 702.9
RIVER BED = EL. 690±
PIERS 1 THROUGH 6
B-44-126 TYPICAL SECTION - CONCEPT 1 (LOOKING NORTH)

Figure 2

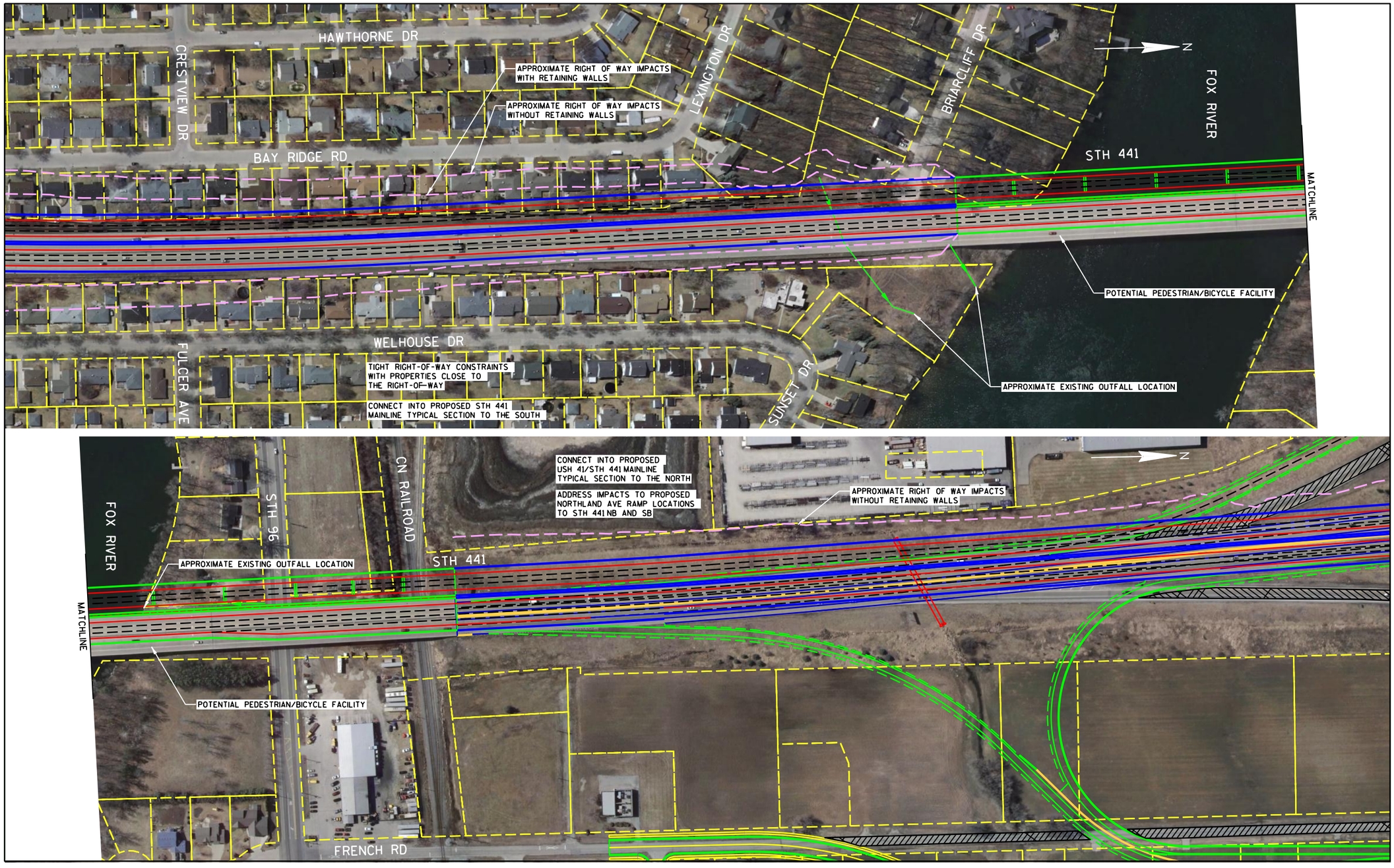

HAWTHORNE DR
CRESTVIEW DR
APPROXIMATE RIGHT OF WAY IMPACTS WITH RETAINING WALLS
APPROXIMATE RIGHT OF WAY IMPACTS WITHOUT RETAINING WALLS
LEXINGTON DR
BRIARCLIFF DR
N
FOX RIVER
BAY RIDGE RD
STH 441
MATCHLINE
POTENTIAL PEDESTRIAN/BICYCLE FACILITY
WELHOUSE DR
FULCER AVE
TIGHT RIGHT-OF-WAY CONSTRAINTS WITH PROPERTIES CLOSE TO THE RIGHT-OF-WAY
CONNECT INTO PROPOSED STH 441 MAINLINE TYPICAL SECTION TO THE SOUTH
SUNSET DR
APPROXIMATE EXISTING OUTFALL LOCATION
CONNECT INTO PROPOSED USH 41/STH 441 MAINLINE TYPICAL SECTION TO THE NORTH
ADDRESS IMPACTS TO PROPOSED NORTHLAND AVE RAMP LOCATIONS TO STH 441 NB AND SB
APPROXIMATE RIGHT OF WAY IMPACTS WITHOUT RETAINING WALLS
FOX RIVER
STH 96
CN RAILROAD
STH 441
APPROXIMATE EXISTING OUTFALL LOCATION
MATCHLINE
POTENTIAL PEDESTRIAN/BICYCLE FACILITY
FRENCH RD

Figure 3

B-44-126 TYPICAL SECTION – CONCEPT 2

This concept, Figure 4, widens WIS 441 on the east side of the existing bridge. The centerline of the new roadway is shifted 21'-11" east of the existing centerline.

The southbound lanes are located on the existing bridge girders and piers. The northbound lanes are located on a combination of existing and new girders and piers. New cross frames are added between existing girders 4 and 5. The new pier designs will need to adequately control settlement to limit differential deflections between existing girder 8 and new girder A.

There is adequate horizontal clearance in span 3 to maintain the 100'-0" wide navigation channel; however the channel will need to be shifted 2' north to clear the new piers on the northbound bridge.

Vertical clearance over the railroad is 23'-2½". Vertical clearance over WIS 96 is 27-8½". Horizontal clearance to the tracks is controlled by the existing pier and will remain unchanged.

Figure 5 shows the plan view of the roadway transition to the new location of B-44-126. Slope intercept lines are also shown in Figure 5 to show approximate impacts. The geometry of the roadway is shifted the alignment to the east from B-44-125 to the Fox River.

There is existing storm sewer in the southeast quadrant of B-44-126. For more detailed information the on the existing storm sewer see section "Existing Storm Sewer"on page 24.

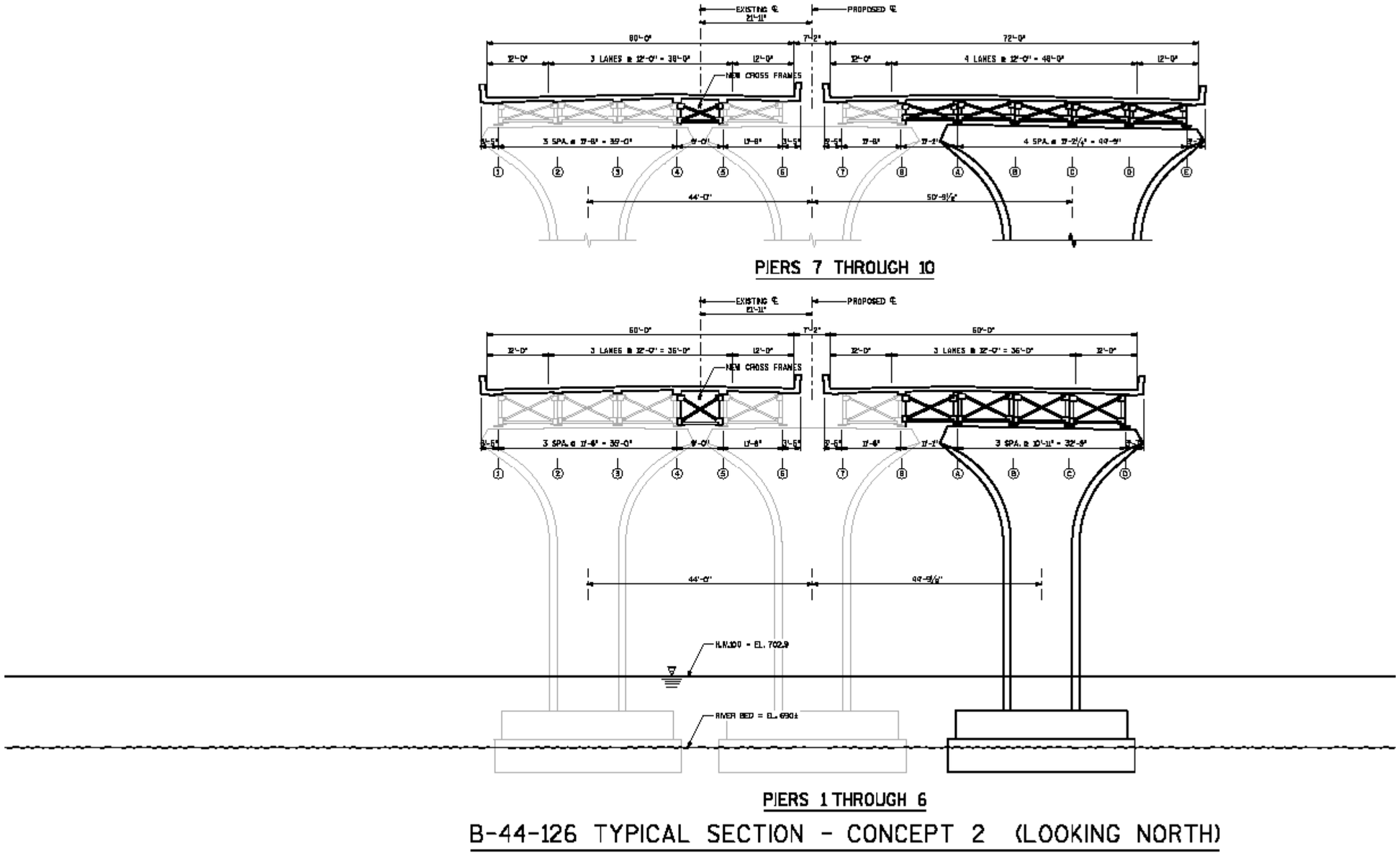

EXISTING ℄
PROPOSED ℄
80'-0"
72'-0"
12'-0"
3 LANES @ 12'-0" = 36'-0"
12'-0"
NEW CROSS FRAMES
4 LANES @ 12'-0" = 48'-0"
3 SPA. @ 17'-6" = 52'-6"
4 SPA. @ 17'-2 1/4" = 68'-9"
44'-0"
50'-9 1/2"
PIERS 7 THROUGH 10
60'-0"
3 SPA. @ 17'-6" = 52'-6"
3 SPA. @ 10'-11" = 32'-9"
H.W.100 = EL. 702.9
RIVER BED = EL. 690±
PIERS 1 THROUGH 6
B-44-126 TYPICAL SECTION - CONCEPT 2 (LOOKING NORTH)

Figure 4

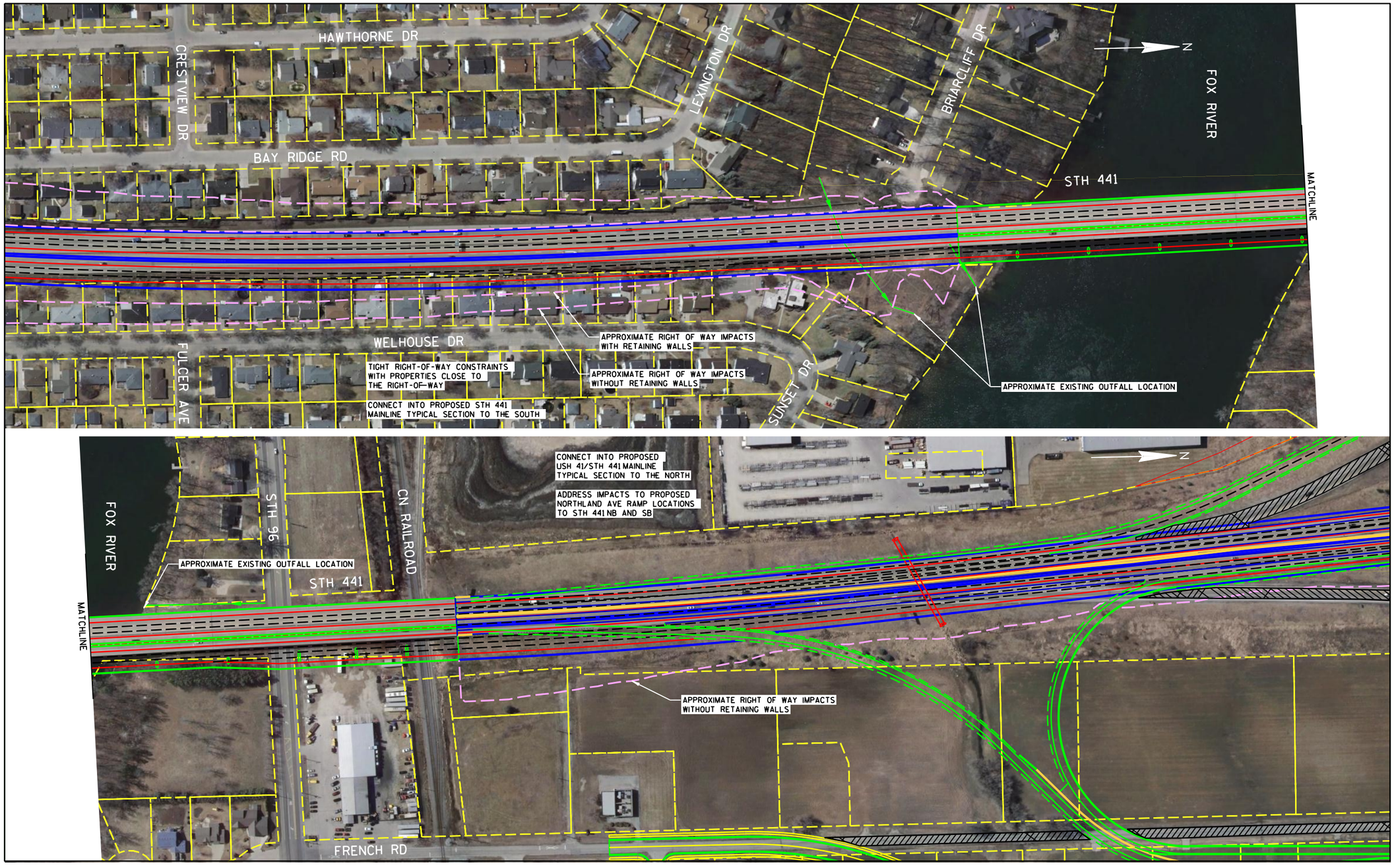

HAWTHORNE DR
CRESTVIEW DR
LEXINGTON DR
BRIARCLIFF DR
N
FOX RIVER
BAY RIDGE RD
STH 441
MATCHLINE
WELHOUSE DR
FULCER AVE
APPROXIMATE RIGHT OF WAY IMPACTS WITH RETAINING WALLS
TIGHT RIGHT-OF-WAY CONSTRAINTS WITH PROPERTIES CLOSE TO THE RIGHT-OF-WAY
APPROXIMATE RIGHT OF WAY IMPACTS WITHOUT RETAINING WALLS
SUNSET DR
APPROXIMATE EXISTING OUTFALL LOCATION
CONNECT INTO PROPOSED STH 441 MAINLINE TYPICAL SECTION TO THE SOUTH
CONNECT INTO PROPOSED USH 41/STH 441 MAINLINE TYPICAL SECTION TO THE NORTH
ADDRESS IMPACTS TO PROPOSED NORTHLAND AVE RAMP LOCATIONS TO STH 441 NB AND SB
FOX RIVER
STH 96
CN RAILROAD
APPROXIMATE EXISTING OUTFALL LOCATION
STH 441
MATCHLINE
APPROXIMATE RIGHT OF WAY IMPACTS WITHOUT RETAINING WALLS
FRENCH RD

Figure 5

B-44-126 TYPICAL SECTION – CONCEPT 3

This concept, Figure 6, widens WIS 441 on both sides of the existing bridge. The centerline of the new roadway matches the centerline of the existing roadway.

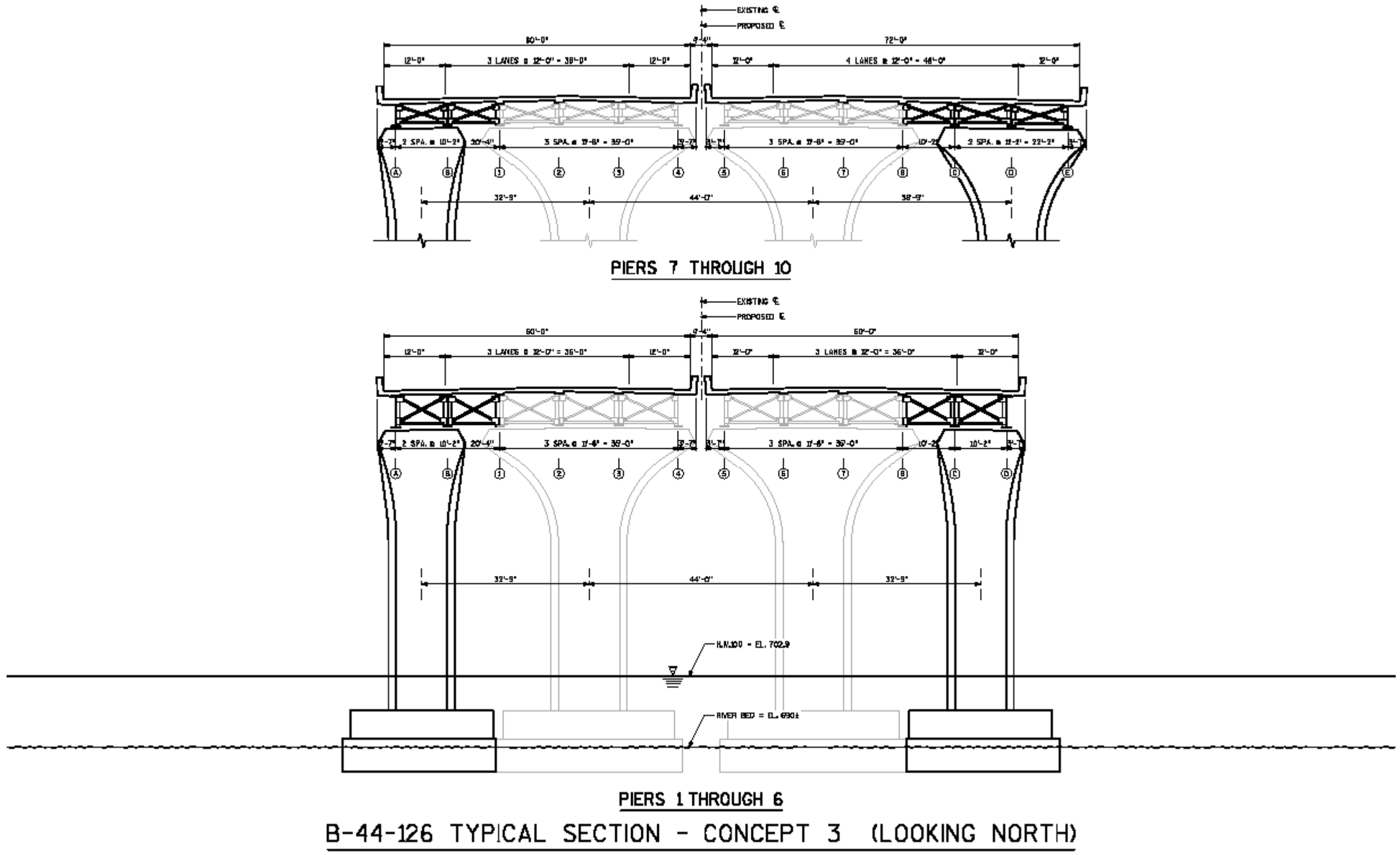
The southbound and northbound lanes are each located on a combination of existing and new girders and piers. The new pier designs will need to adequately control settlement to limit differential deflections between existing girder 1 and new girder B, and existing girder 8 and new girder C.

There is adequate horizontal clearance in span 3 to maintain the 100'-0" wide navigation channel in its current location.

Vertical clearance over the railroad is 23'-1¼". Vertical clearance over WIS 96 is 27-7¼". Horizontal clearance to the CN tracks is reduced to 19'-0". A railroad crash wall is not required for solid single shaft piers per Bridge Manual 13.2.4.

Figure 7 shows the plan view of the roadway connection to B-44-126. Slope intercept lines are also shown in Figure 7 to show approximate impacts. The geometry of the roadway is centered along the existing alignment.

There is existing storm sewer in the northwest and southeast quadrants of B-44-126. For more detailed information the on the existing storm sewer see section "Existing Storm Sewer"on page 24.



B-44-126 TYPICAL SECTION - CONCEPT 3 (LOOKING NORTH)

Figure 6


HAWTHORNE DR
CRESTVIEW DR
APPROXIMATE RIGHT OF WAY IMPACTS WITH RETAINING WALLS
APPROXIMATE RIGHT OF WAY IMPACTS WITHOUT RETAINING WALLS
LEXINGTON DR
BRIARCLIFF DR
N
FOX RIVER
BAY RIDGE RD
STH 441
MATCHLINE
WELHOUSE DR
FULCER AVE
APPROXIMATE RIGHT OF WAY IMPACTS WITH RETAINING WALLS
TIGHT RIGHT-OF-WAY CONSTRAINTS WITH PROPERTIES CLOSE TO THE RIGHT-OF-WAY
APPROXIMATE RIGHT OF WAY IMPACTS WITHOUT RETAINING WALLS
SUNSET DR
APPROXIMATE EXISTING OUTFALL LOCATION
CONNECT INTO PROPOSED STH 441 MAINLINE TYPICAL SECTION TO THE SOUTH
CONNECT INTO PROPOSED USH 41/STH 441 MAINLINE TYPICAL SECTION TO THE NORTH
ADDRESS IMPACTS TO PROPOSED NORTHLAND AVE RAMP LOCATIONS TO STH 441 NB AND SB
APPROXIMATE RIGHT OF WAY IMPACTS WITHOUT RETAINING WALLS
FOX RIVER
STH 96
CN RAILROAD
APPROXIMATE EXISTING OUTFALL LOCATION
STH 441
MATCHLINE
APPROXIMATE RIGHT OF WAY IMPACTS WITHOUT RETAINING WALLS
FRENCH RD

Figure 7