



Illinois Department of Transportation

Memorandum

To: Carl Puzey Attn: Brad Hessing
From: Michael A. Short ^{MKS} By: Jeremy Brown
Subject: Structure Geotechnical Report Disposition *
Date: May 10, 2021

* SN: 053-2040
 Route: FAP 649 (IL 17)
 Section: (108BR-4)ES
 County: Livingston
 Contract No.: 66F92

Attached is the Revised Structure Geotechnical Report for the subject project. This disposition is to provide a revised SGR and responses to the comments from the Bureau of Bridges and Structures that were provided for the SGR submitted by Jeremy Brown (IDOT D3 Geotechnical Engineer) for SN: 053-2040. The responses below are direct responses to the speed letter that was provided from the Bureau of Bridges and Structures.

1. The 2:1 slopes shown on the TS&L are evaluated in the fill section of the revised SGR. Slope stability is not a concern due to the short height and the stability provided at the toe of the slopes by the concrete headwalls at the ends of the proposed concrete box culvert.
2. A cast-in-place concrete box culvert is recommended in the foundation section of the revised SGR due to the existing soil conditions as described in the report.
3. A 1 foot undercut below the base of the entire box culvert and two-way cantilever L-type wingwalls is recommended in the foundation section of the revised SGR per request from the Bureau of Bridges and Structures.

If you have any questions, please contact Jeremy Brown at 815-433-7098.



Original Report Date: <u>12/7/2020</u>	Proposed SN: <u>053-2040</u>	Route: <u>FAP 649 (IL 17)</u>
Revised Date: <u>5/10/2021</u>	Existing SN: <u>053-0029</u>	Section: <u>(108BR-4)ES</u>
Geotechnical Engineer: <u>Jeremy Brown, P.E. (IDOT D3)</u>		County: <u>Livingston</u>
Structural Engineer: <u>T.B.D.</u>		Contract: <u>66F92</u>

Indicate the proposed structure type, substructure types, and foundation locations (attach plan and elevation drawing): The proposed structure is a triple 10 ft by 10 ft cast in place concrete box culvert with a 15 degree right forward skew.

Discuss the existing boring data, existing plans foundation information, new subsurface exploration and need for any additional exploration to be provided with SGR Technical Memo (attach all data and subsurface profile plot): The existing structure is a single span bridge with reinforced concrete T beams supported by closed abutments on untreated timber piles. Two soil borings were performed by IDOT in 2018. The soil boring logs are attached.

Provide the location and maximum height of any new soil fill or magnitude of footing bearing pressure. Estimate the amount and time of the expected settlement. Indicate if further testing, analysis, and/or ground improvement/treatment is necessary: The profile of the roadway is expected to increase by approximately 1 foot. This is not a significant increase and will not result in a significant increase in loading. A site visit found no signs of settlement at the existing structure. No further settlement analysis is warranted.

Identify any new cuts or fill slope angles and heights. Estimate the factor of safety against slope failure. Indicate if further testing, analysis or ground improvement/treatment is necessary: The proposed side slopes and the embankment heights along the roadway portions are unknown at this time. The proposed box culvert will be wider than the existing structure, which will allow for flatter side slopes. A site visit found no signs of slope stability problems. No further analysis for slope stability is required as long as the proposed slopes are 3H:1V or flatter and less than 10 feet high.

The fill over the top of the proposed box culvert will be approximately 3 feet high from the top of the culvert and 2 feet high from the top of the concrete headwalls and is shown to have side slopes of approximately 2H:1V on the approved TS&L. The slopes will be constructed according to section 205 of the Standard Spec Book utilizing approved materials. The slopes are relatively short in height and will also be supported at the toe by the 9 inch concrete headwalls at the ends of the box culvert. Slope stability is not a concern and no further analysis is warranted.

Indicate at each substructure, the 100-year and 200-year total scour depths in the Hydraulics report, the non-granular scour depth reduction, the proposed ground surface, and the recommended foundation design scour elevations: Not required for closed bottom culverts.

Determining the seismic soil site class, the seismic performance zone, the 0.2 and 1.0 second design spectral accelerations and indicate if that the soils are liquefiable: Not required for closed bottom culverts.

Confirm feasibility of the proposed foundation or wall type and provide design parameters. Attach a pile design table indicating feasible pile types, various nominal required bearings, factored resistances available and corresponding estimated lengths at locations where piles will be used. Provide factored bearing resistance and unit sliding resistance at various elevations and confirm no ground improvement/treatment is necessary where spread footings are proposed. Estimated top of rock elevations as well as preliminary factored unit side and tip resistance values shall be indicated when drilled shafts are proposed: Based on Figure 4.1.3.1-2 of the culvert manual, horizontal cantilever wingwalls are feasible for the proposed 14 foot wingwalls. Two-way cantilever L-type wingwalls are feasible for the proposed 18 foot wingwalls.

Based on the invert elevations from the approved TS&L, the base of the proposed concrete box culvert is to be constructed on a stiff silty layer which has adequate strength to support the structure. Boring 02 shows a layer of loose sand below the stiff silt layer which is not present on boring 01. Being the existing stream bed, there may be some inconsistencies in the soils where the proposed structure is to be constructed. A cast-in-place concrete box culvert is recommended as it will bridge over any weaker areas should any be encountered and minimize the potential for settlement after construction is complete.

It is recommended by the Bureau of Bridges and Structures to remove 1 foot of material below the entire box culvert and the two-way cantilever L-type wingwalls due to the location of the existing bridge footings. The horizontal limits of this treatment shall be extended 2 feet beyond the footprint of the proposed structure. It is recommended to place 1 foot of porous granular material under the proposed box culvert as it will provide added stability and an adequate working platform for the construction process.

Calculate the estimated water surface elevation and determine the need for cofferdams (type 1 or 2), and seal coat: The structure can be constructed using standard methods of water diversion determined by the contractor.

Assess the need for sheeting or soil retention or temporary construction slope and provide recommendation for other construction concerns: The new structure will be constructed using staged construction. The soils do not show a Q_u greater than 4.5 tsf or blow counts greater than 45 bpf, therefore, temporary sheet piling is feasible.

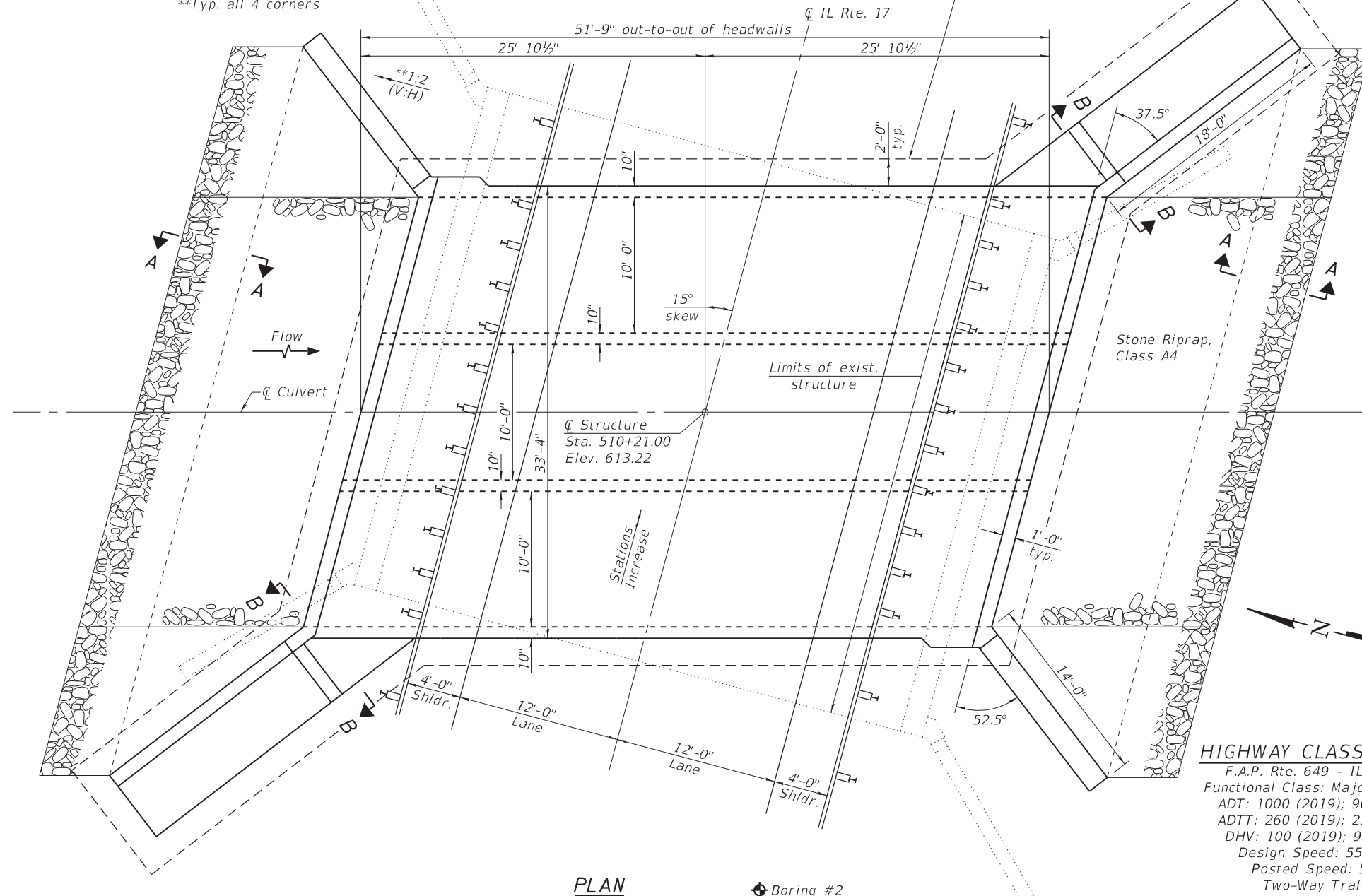
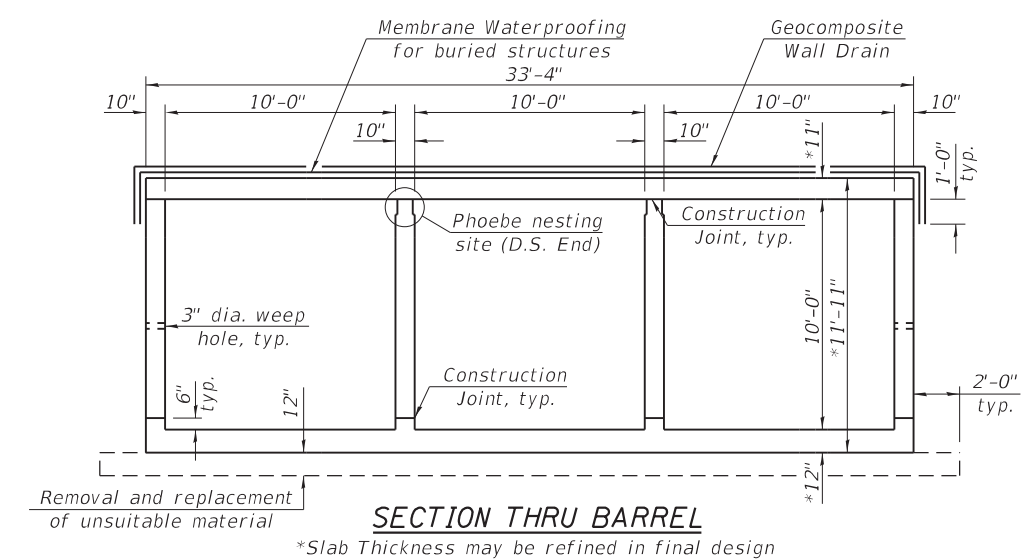
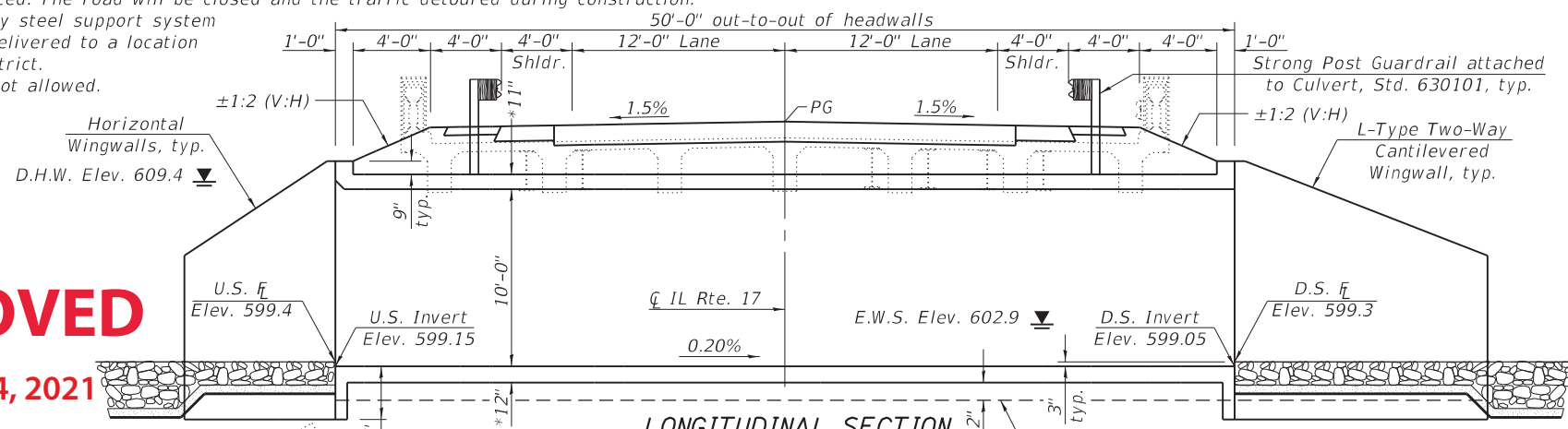
Benchmark: Chiseled square on top of southwest wingwall, Sta. 510+02.48, 23.12' Rt., Elev. 612.03.
 Existing Structure: SN 053-0029 built in 1937 as a single span reinforced concrete T-Beam bridge with a length of 38'-0" back to back of abutments and a width of 43'-4" out-to-out of deck. The superstructure is supported on closed abutments and has no skew. Existing Structure to be removed and replaced. The road will be closed and the traffic detoured during construction. The existing temporary steel support system is to be salvaged & delivered to a location designated by the District. Precast alternate is not allowed.

APPROVED

MARCH 24, 2021

AS A BASIS FOR PREPARATION OF DETAILED PLANS

**Typ. all 4 corners

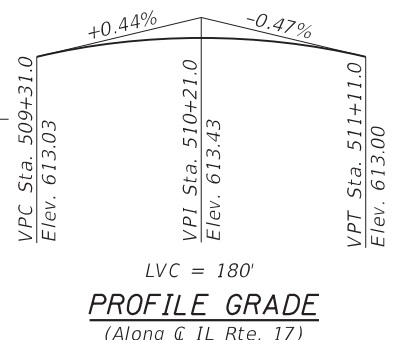
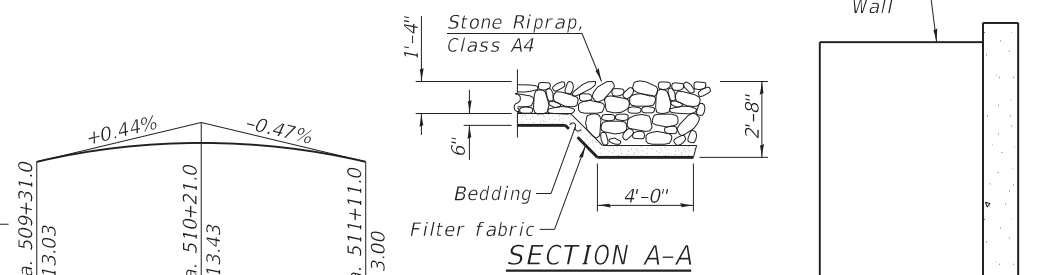


WATERWAY INFORMATION

Existing Overtopping Elev.=611.8 @ Sta. 510+21
 Proposed Overtopping Elev.=612.8 @ Sta. 510+21
 Drainage Area=5.0 sq.mi.

Flood	Freq. Yr.	Q C.F.S.	Opening Ft ²		Nat. H.W.E.	Head - Ft.		Headwater El.	
			Exist.	Prop.		Exist.	Prop.	Exist.	Prop.
Ten-Year	10	1110	282	263	608.2	0	0	608.2	608.1
Design	50	1820	296	300	609.4	0.3	0	609.7	609.4
Base	100	2140	296	300	609.8	0.5	0.1	610.4	609.9
Scour Check	200	2477	296	300	610.2	0.9	0.2	611.1	610.5
Overtop Proposed	275	2620	296	300	610.4	1.4	0.3	611.8	610.7
Max. Calc.	500	2930	296	300	610.7	1.7	0.5	612.4	611.2

10 Year velocity through existing structure = 3.9 ft./sec.
 10 Year velocity through proposed structure = 4.2 ft./sec.

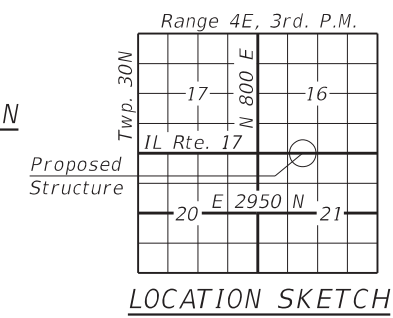


DESIGN STRESSES
 FIELD UNITS
 $f'_c = 3,500$ psi
 $f_y = 60,000$ psi (Reinforcement)

LOADING HL-93
 Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS
 2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

HIGHWAY CLASSIFICATION
 F.A.P. Rte. 649 - IL Rte. 17
 Functional Class: Major Collector
 ADT: 1000 (2019); 963 (2032)
 ADTT: 260 (2019); 250 (2032)
 DHV: 100 (2019); 96 (2032)
 Design Speed: 55 m.p.h.
 Posted Speed: 55 m.p.h.
 Two-Way Traffic
 Directional Distribution: 50:50



GENERAL PLAN AND ELEVATION
 ILLINOIS ROUTE 17 OVER DRAINAGE DITCH
 F.A.P. RTE. 649 - SEC. (108BR-4)ES
 LIVINGSTON COUNTY
 STATION 510+21.00
 STRUCTURE NO. 053-2040

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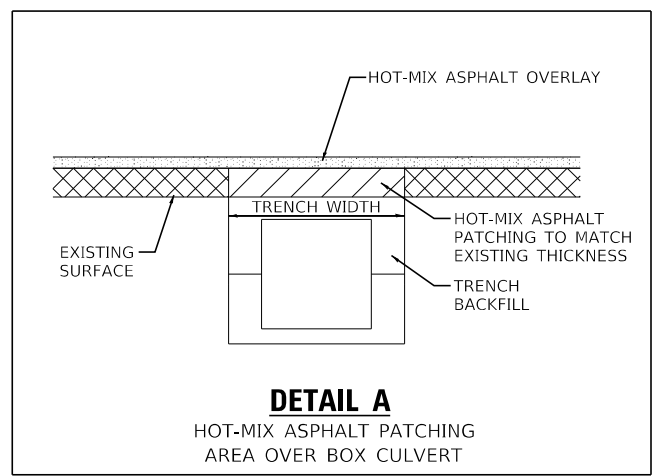
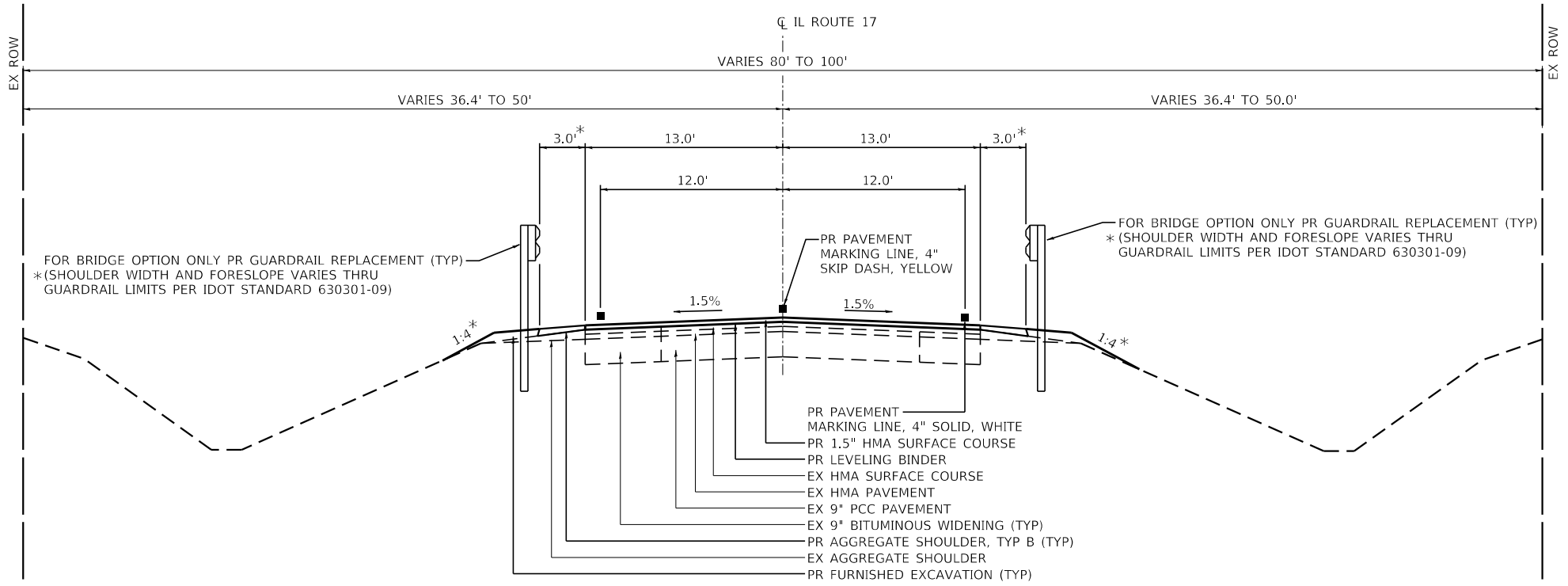
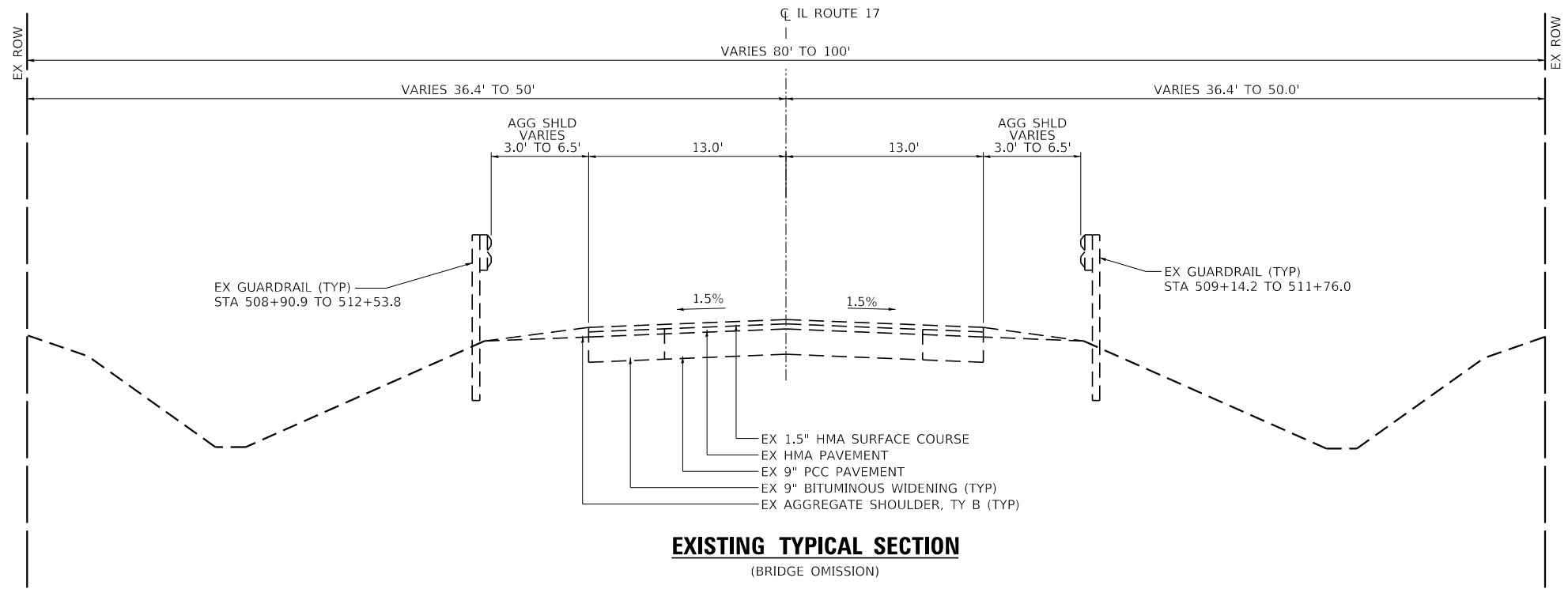


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PLOT SCALE =	CHECKED - D. Greifzu	REVISED -
PLOT DATE =	DRAWN - B. Vegrzyn	REVISED -
	CHECKED - D. Greifzu	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

F.A.P. RTE. 649	SECTION (108BR-4)ES	COUNTY LIVINGSTON	TOTAL SHEETS	SHEET NO.
CONTRACT NO. 66F92				
ILLINOIS FED. AID PROJECT				

SHEET 1 OF 1 SHEETS



PROPOSED TYPICAL SECTION
 STA 508+20 TO STA 512+80 (CULVERT OPTION)
 SEE DETAIL A FOR FULL DEPTH PAVEMENT OVER BOX CULVERT
 STA 505+80 TO STA 514+50 (BRIDGE OPTION)
 BRIDGE OMISSION STA 509+85.62 TO STA 510+56.38

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PLOT DATE = 5/15/2020	CHECKED - KLM	REVISED - _____
	DATE - 04/07/2020	REVISED - _____

**STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION**

EXISTING & PROPOSED TYPICAL SECTIONS			
IL ROUTE 17			
SCALE: NONE	SHEET 1	OF 1 SHEETS	STA. TO STA.

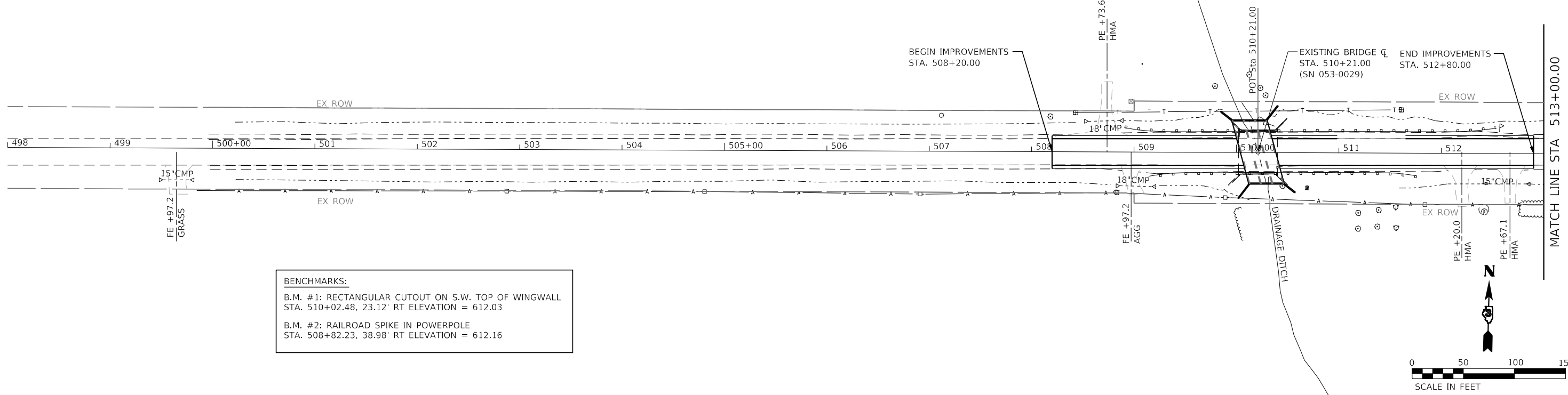
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CONTRACT NO. 66F92				
ILLINOIS FED. AID PROJECT				

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	PLOTTED	BY
	ALIGNMENT CHECKED	
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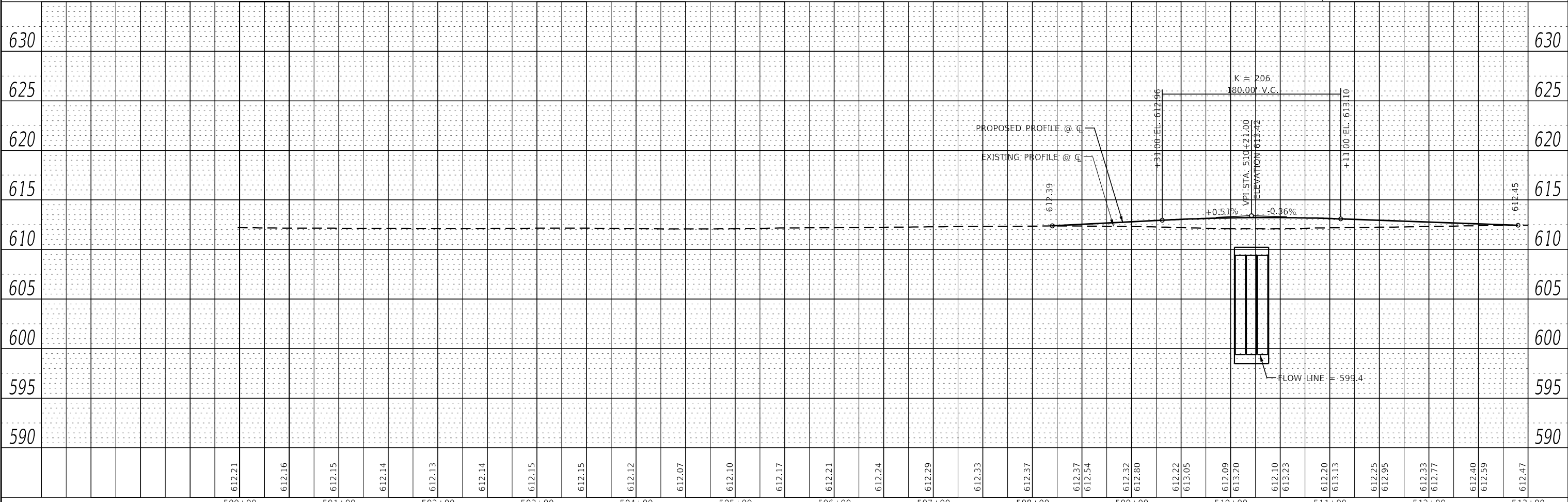
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APPARENT EXISTING RIGHT OF WAY SHOWN IS TAKEN FROM PLAN SET S.B.I. ROUTE 118-A LIVINGSTON COUNTY REG. F.A. PROJECT 229-B DATED 1938.



BENCHMARKS:
 B.M. #1: RECTANGULAR CUTOUT ON S.W. TOP OF WINGWALL
 STA. 510+02.48, 23.12' RT ELEVATION = 612.03
 B.M. #2: RAILROAD SPIKE IN POWERPOLE
 STA. 508+82.23, 38.98' RT ELEVATION = 612.16



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	DATE -	REVISED -

**STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION**

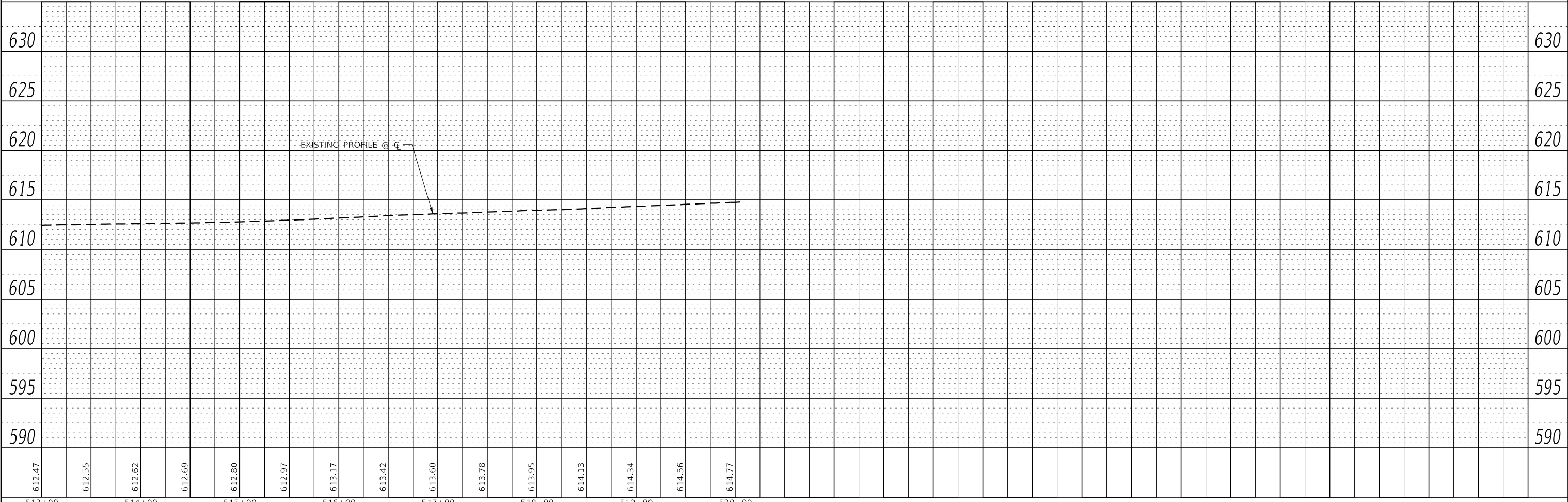
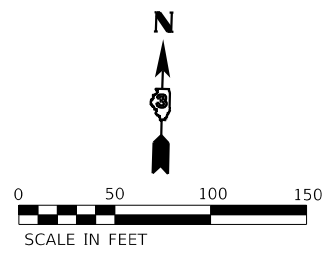
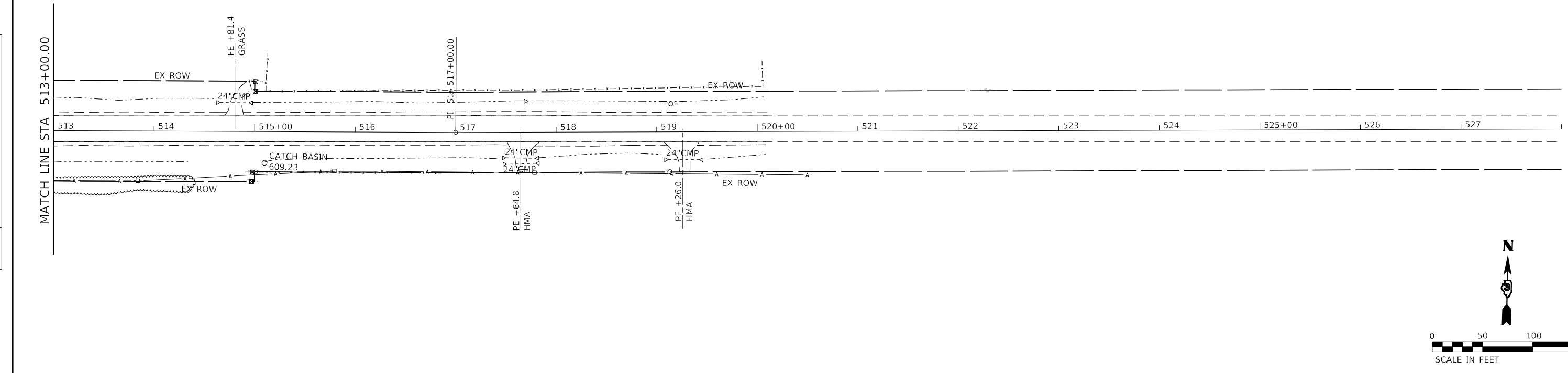
**ILLINOIS ROUTE 17 OVER DRAINAGE DITCH
 PLAN AND PROFILE**
 SCALE: H=50, V=5 SHEET 1 OF 2 SHEETS STA. 498+00.00 TO STA. 513+00.00

F.A.P. RTE. 649	SECTION 108(BR-4)ES	COUNTY LIVINGSTON	TOTAL SHEETS 2	SHEET NO. 1
CONTRACT NO. 66F92			ILLINOIS FED. AID PROJECT	

APPARENT EXISTING RIGHT OF WAY SHOWN IS
 TAKEN FROM PLAN SET S.B.I. ROUTE 118-A
 LIVINGSTON COUNTY REG. F.A. PROJECT 229-B
 DATED 1938.

PLAN	SURVEYED	DATE
	PLOTTED	
	ALIGNMENT CHECKED	
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	DATE -	REVISED -

**STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION**

**ILLINOIS ROUTE 17 OVER DRAINAGE DITCH
 PLAN AND PROFILE**
 SCALE: H=50, V=5 SHEET 2 OF 2 SHEETS STA. 513+00.00 TO STA. 520+00.00

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
649	108(BR-4)ES	LIVINGSTON	2	2
CONTRACT NO. 66F92				
ILLINOIS FED. AID PROJECT				



SOIL BORING LOG

ROUTE SBI-118 (IL 17) DESCRIPTION IL 17 over a Drainage Ditch, 3.4 miles East of IL 17 & IL 23 LOGGED BY Larry Myers

SECTION 108-B-1 LOCATION SW 1/4, SEC. 16, TWP. 30N, RNG. 4E, 3rd PM, Latitude 41.062177, Longitude -88.768173

COUNTY Livingston DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO.	Station	BORING NO.	Station	Offset	Ground Surface Elev.	D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)	Surface Water Elev.	Stream Bed Elev.	Groundwater Elev.:	First Encounter	Upon Completion	After	Hrs.	D E P T H (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)			
053-0029	510+21	01 (N.E. Quad.)	510+53	14.0 ft Lt.	611.86					600.89 ft	599.52 ft												
Augered Shoulder Gravel, Black Silty Clay Loam Fill										Medium Gray Fine to Coarse Sand - Free Water (continued)						6							
										589.86						8						19	
						609.36										12							
Stiff Black Silty Clay Loam Fill							2			Dense Gray Fine to Coarse Sand with some Fine to Coarse Gravel Washed Sample 22.5' to 24.0'							11						
							3	1.5	22								17						13
WH = Weight of Hammer							3	P									21						
						-5																	
							WH										10						
							1	1.0	23								18						10
							2	P									21						
							2										15						
							2	1.0	20								18						13
							3	P									22						
602.36																							
Stiff to Very Stiff Black Loam and Gray Silt										Washed Sample 30.0' to 31.5'													
						-10																	
							2										14						
							3	1.0	32								19						12
							6	P									21						
599.86																							
Very Stiff Gray Silt with Minor Silty Loam Till Layers																							
							3										5						
							5	2.1	17								12					16	
							8	B									18						
						-15																	
							5										10						
							8	2.5	23								12						13
							7	P									18						
594.36																							
Medium Gray Fine to Coarse Sand - Free Water																							
							5										12						
							8		15								13						12
							11										17						
						-20																	

SOIL BORING 053-0029.GPJ IL_DOT_GDT 10/26/18

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)



Illinois Department of Transportation

Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/4/18

ROUTE SBI-118 (IL 17) DESCRIPTION IL 17 over a Drainage Ditch, 3.4 miles East of IL 17 & IL 23 LOGGED BY Larry Myers

SECTION 108-B-1 LOCATION SW 1/4, SEC. 16, TWP. 30N, RNG. 4E, 3rd PM,
Latitude 41.062177, Longitude -88.768173

COUNTY Livingston DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 053-0029
Station 510+21

BORING NO. 01 (N.E. Quad.)
Station 510+53
Offset 14.0 ft Lt.
Ground Surface Elev. 611.86 ft

DEPTH (ft)	B L O W S (/6")	U C S Qu (tsf)	M O I S T (%)
---------------	--------------------------------	----------------------------	------------------------------

Surface Water Elev.	<u>600.89</u>	ft
Stream Bed Elev.	<u>599.52</u>	ft
Groundwater Elev.:		
First Encounter	<u>594.4</u>	ft ▼
Upon Completion	<u>594.9</u>	ft ▽
After _____ Hrs.		ft

Dense Gray Fine to Coarse Sand
with some Fine to Coarse Gravel
(continued)

	13		
	13		15
	18		

Washed Sample 42.5' to 44.0'

	12		
	14		13
	17		

-45

	11		
	15		12
	16		

563.36

	12		
	15		10
	75		

Gray Weathered Limestone with
Weathered Coal & Silt Seams

561.86 -50

Limestone Surface
Auger Refusal at 50 Ft.
End of Boring

	<u>100/3'</u>		8
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SOIL BORING 053-0029.GPJ IL_DOT.GDT 10/26/18

-55
-60

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)



**Illinois Department
of Transportation**

Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 10/9/18

ROUTE SBI-118 (IL 17) DESCRIPTION IL 17 over a Drainage Ditch, 3.4 miles East of IL 17 & IL 23 LOGGED BY Larry Myers

SECTION 108-B-1 LOCATION NW 1/4, SEC. 21, TWP. 30N, RNG. 4E, 3rd PM,

Latitude 41.062094, **Longitude** -88.768407

COUNTY Livingston DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. <u>053-0029</u>	D E P T H	B L O W S	U C S	M O I S T	Surface Water Elev. <u>600.89</u> ft	D E P T H	B L O W S	U C S	M O I S T
Station <u>510+21</u>					Stream Bed Elev. <u>600.49</u> ft				
BORING NO. <u>02 (S.W. Quad.)</u>	(ft)	(/6")	(tsf)	(%)	Groundwater Elev.:	(ft)	(/6")	(tsf)	(%)
Station <u>509+88</u>					First Encounter <u>597.0</u> ft ▼				
Offset <u>13.0 ft Rt.</u>					Upon Completion <u>597.0</u> ft ▼				
Ground Surface Elev. <u>611.96</u> ft					After <u> </u> Hrs. <u> </u> ft				

Soil Description	Depth (ft)	Blow Value (/6")	UCS (tsf)	Moisture (%)	Soil Description	Depth (ft)	Blow Value (/6")	UCS (tsf)	Moisture (%)	
Augered Shoulder Stone, Black Silty Clay Loam Fill	-	-	-	-	Medium to Dense Gray Fine to Coarse Sand with Free to Coarse Gravel (continued)	6	-	-	-	
	609.46	-	-	-		12	-	-	12	-
Medium Black & Brown Silty Clay / Silty Clay Loam WH = Weight of Hammer	-	3	-	-	Washed Sample 22.5' to 24.0'	12	-	-	-	
	-	2	1.0	23		14	-	-	10	-
	-	3	P	-		16	-	-	-	-
Very Stiff Brown & Gray Silty Clay Loam Till	-5	WH	-	-	Washed Sample 25.0' to 26.5'	-25	-	-	-	
	-	WH	0.5	26		12	-	-	-	-
	-	2	P	-		16	-	-	10	-
Stiff to Very Stiff Gray Silt with some Silty Clay Layers	604.96	-	-	-	Washed Sample 32.5' to 34.0'	-	-	-	-	
	-	2	-	-		10	-	-	-	-
	-	3	2.0	23		15	-	-	10	-
	-	4	P	-		16	-	-	-	-
Loose Gray Fine to Medium Sand with Layers of Gray Silty Clay Loam WH = Weight of Hammer	-10	5	-	-	Washed Sample 35.0' to 36.5'	-30	-	-	-	
	-	7	4.0	14		11	-	-	-	-
	-	8	P	-		16	-	-	15	-
	599.96	-	-	-		12	-	-	-	-
Stiff to Very Stiff Gray Silt with some Silty Clay Layers	-	4	-	-	Washed Sample 32.5' to 34.0'	-	-	-	-	
	-	4	2.0	21		12	-	-	18	-
	-	4	P	-		17	-	-	-	-
Loose Gray Fine to Medium Sand with Layers of Gray Silty Clay Loam WH = Weight of Hammer	-15	2	-	-	Washed Sample 35.0' to 36.5'	-35	-	-	-	
	-	4	2.3	22		10	-	-	-	-
	-	6	P	-		15	-	-	14	-
Loose Gray Fine to Medium Sand with Layers of Gray Silty Clay Loam WH = Weight of Hammer	594.96	-	-	-	Washed Sample 37.5' to 39.0'	-	-	-	-	
	-	WH	-	-		10	-	-	-	-
	-	2	-	15		14	-	-	13	-
592.46	-	7	-	-	-	-	-	-	-	
-20	-	-	-	-	-	-	-	-	-	

SOIL BORING 053-0029.GPJ IL_DOT.GDT 10/26/18

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)



SOIL BORING LOG

ROUTE SBI-118 (IL 17) DESCRIPTION IL 17 over a Drainage Ditch, 3.4 miles East of IL 17 & IL 23 LOGGED BY Larry Myers

SECTION 108-B-1 LOCATION NW 1/4, SEC. 21, TWP. 30N, RNG. 4E, 3rd PM, Latitude 41.062094, Longitude -88.768407

COUNTY Livingston DRILLING METHOD Hollow Stem Auger HAMMER TYPE CME Automatic

STRUCT. NO. 053-0029
Station 510+21

BORING NO. 02 (S.W. Quad.)
Station 509+88
Offset 13.0 ft Rt.
Ground Surface Elev. 611.96 ft

DEPTH (ft)	BLOWS (/6")	UCS (tsf)	MOIST (%)
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Surface Water Elev. 600.89 ft
Stream Bed Elev. 600.49 ft

Groundwater Elev.:
First Encounter 597.0 ft ▼
Upon Completion 597.0 ft ▼
After Hrs. ft

Medium to Dense Gray Fine to Coarse Sand with Free to Coarse Gravel (<i>continued</i>) Washed Sample 40.0' to 41.5'	10 12 18		8
Washed Sample 42.5' to 44.0'	11 14 14		13
Washed Sample 45.0' to 46.5'	-45 10 12 14		16
Washed Sample 47.5' to 49.0'	9 12 16		10
Washed Sample 50.0' to 51.5'	-50 12 18 18		11
Washed Sample 52.5' to 54.0'	14 16 18		13
556.96 -55			
Limestone Surface Auger Refusal at 55 Ft. End of Boring	100/2"		
	-60		

SOIL BORING 053-0029.GPJ IL_DOT.GDT 10/26/18

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