



SCOTT COUNTY, INDIANA

Master Drainage Study

for

Stucker Fork

INAFSM Annual Conference
September 7, 2016



Overview

- **Project Background**
- **Existing Conditions**
- **Hydrologic Conditions**
- **Hydraulic Conditions**
- **Proposed Alternatives**



Project Background

Flooding



Log Jams



Siltation



Stucker Fork Conservancy District

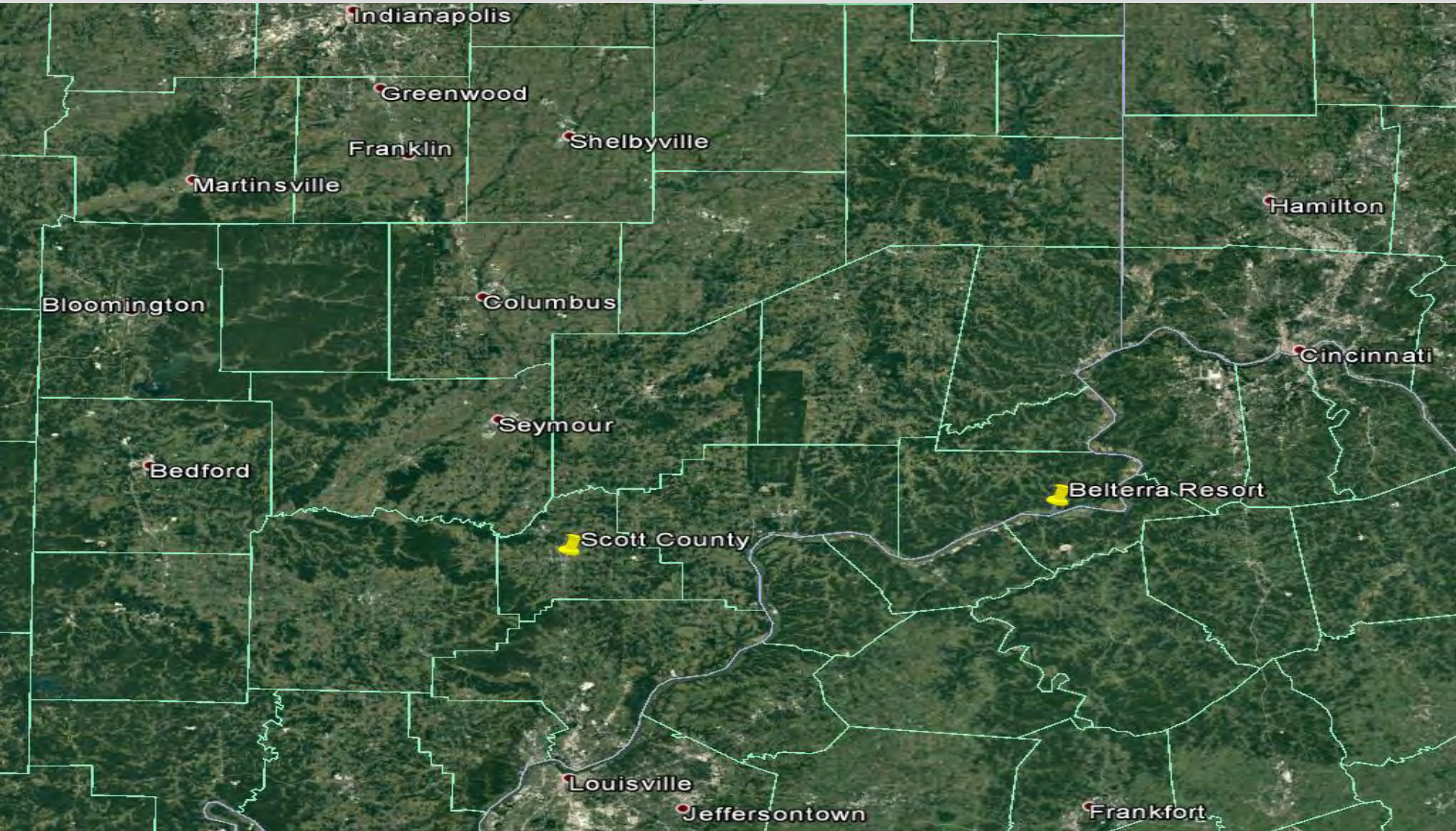


Stucker Fork Water Utility

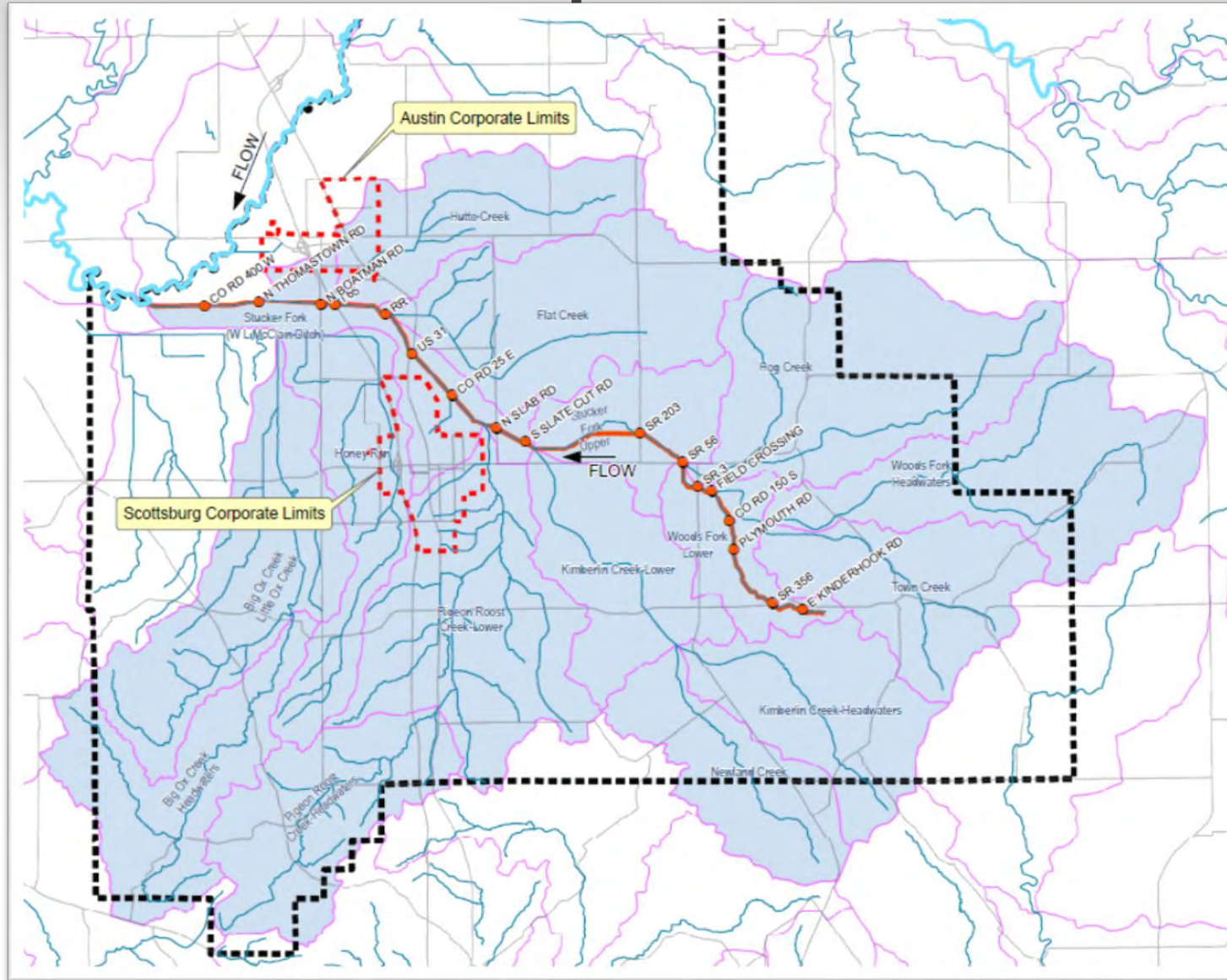








Existing Conditions

Vicinity Map



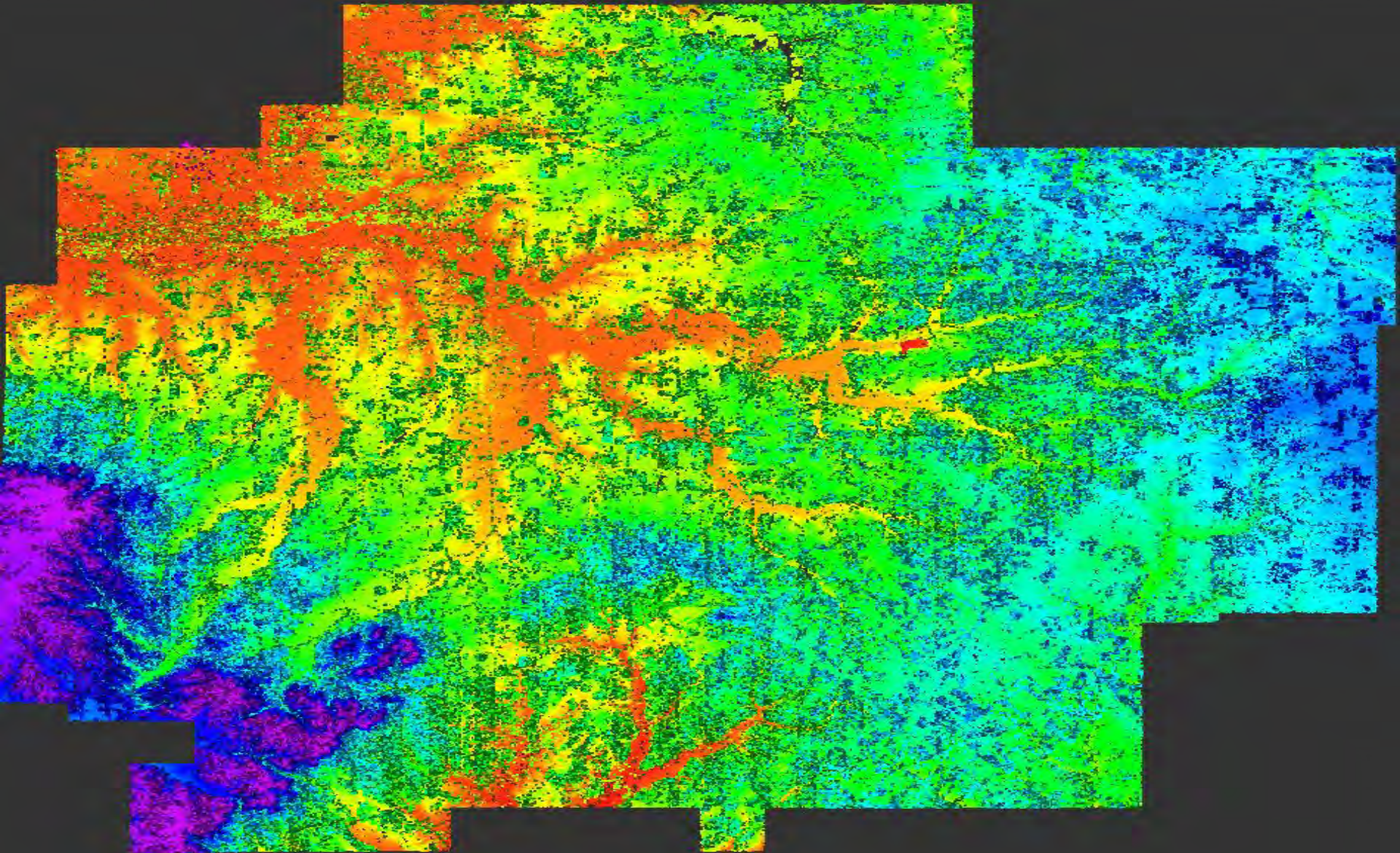
Watershed Map



-  Scott County Boundary
-  Watersheds
-  Stucker Fork
-  Stucker Fork Crossings
-  Muscatatuck River
-  Creek/Stream



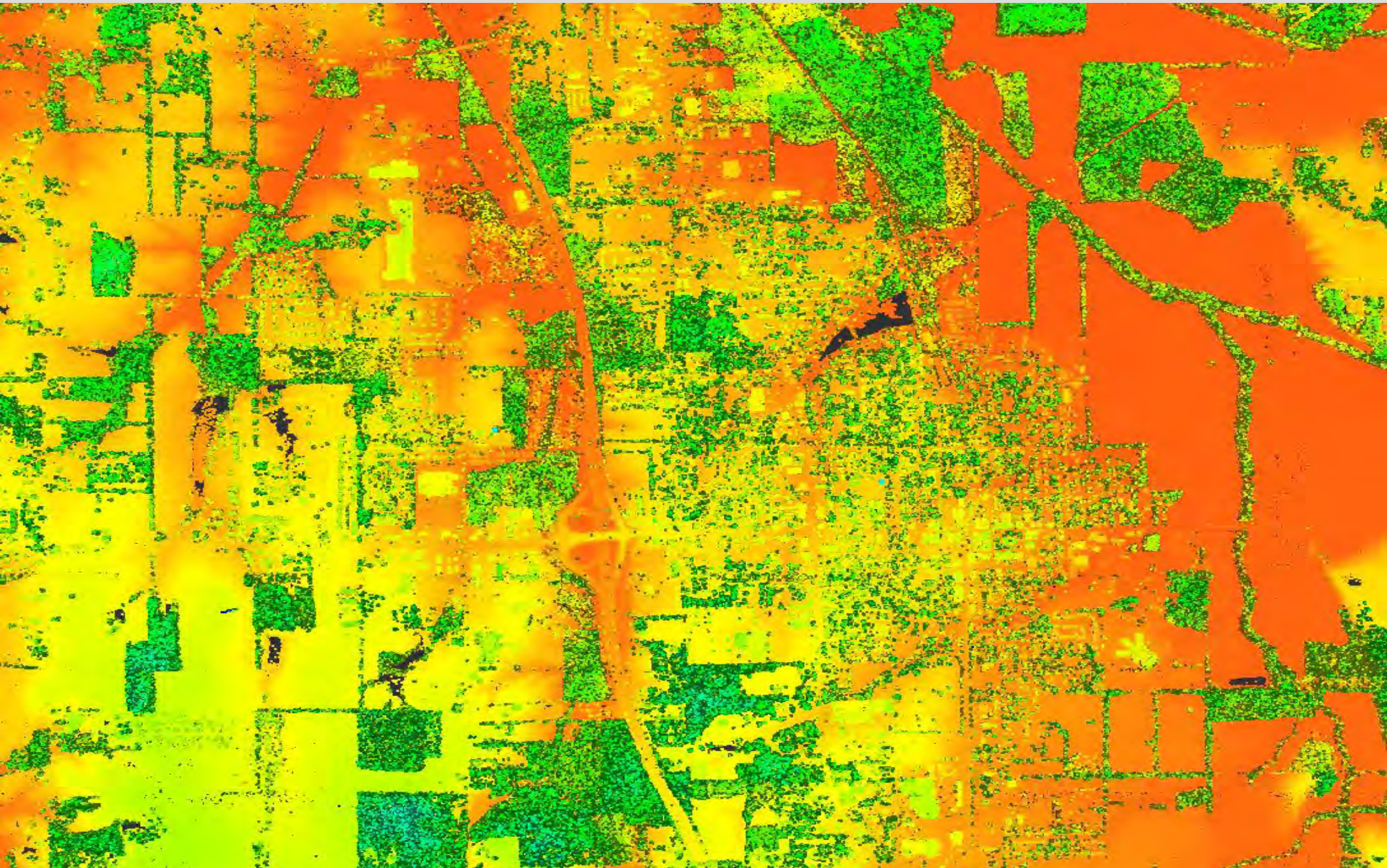
Topographic Data



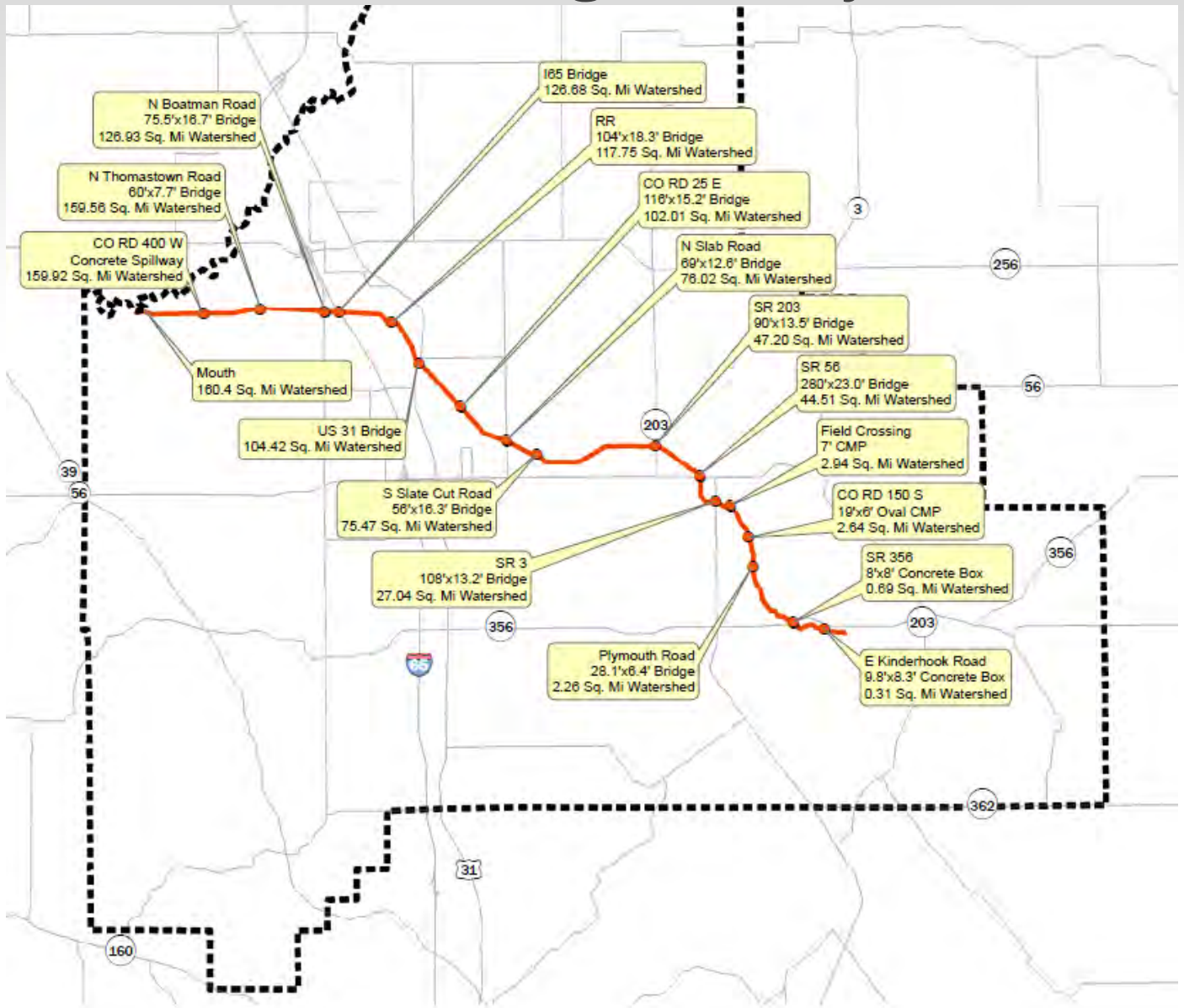
Topographic Data

82 GB of Data used to Create LiDAR Surface
1.4 MB ReCap File used to Manage LiDAR Data
75 MB AutoCAD Surface File Created

Topographic Data



Stucker Fork Crossing Inventory



-  Scott County Boundary
-  Stucker Ditch
-  Stucker Ditch Crossings

- 12 Bridges
- 4 Culverts
- 1 Spillway



Spillway

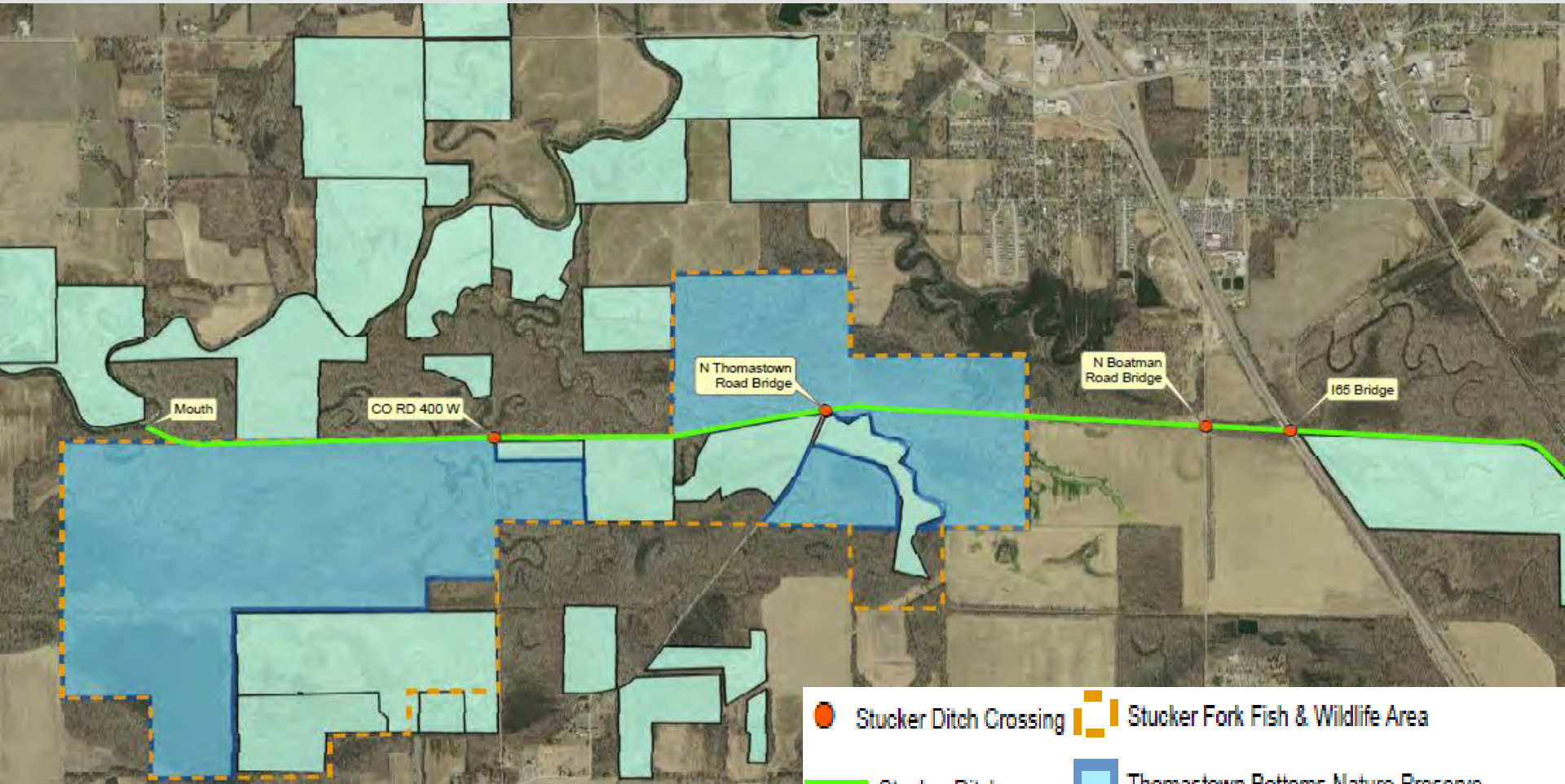


Bridge Sufficiency - NBI

Crossing/Location	Sufficiency Rating
Plymouth Road	69.2
SR 3	92.2
SR 56	92.5
SR 203	68.1
Slate Cut Road	43.8
Slab Road	73.9
CR 25	54.6
US 31	87.0
I-65	96.4
Boatman Road	67.4
Thomastown Road	69.7

- Structural Sufficiency
- Functional Sufficiency
- Essentiality to the Public
- 100 = Entirely Sufficient
- 0 = Entirely Insufficient
- <80 = Eligible for Federal Repair Funding
- <50 = Eligible for Federal Replacement Funding

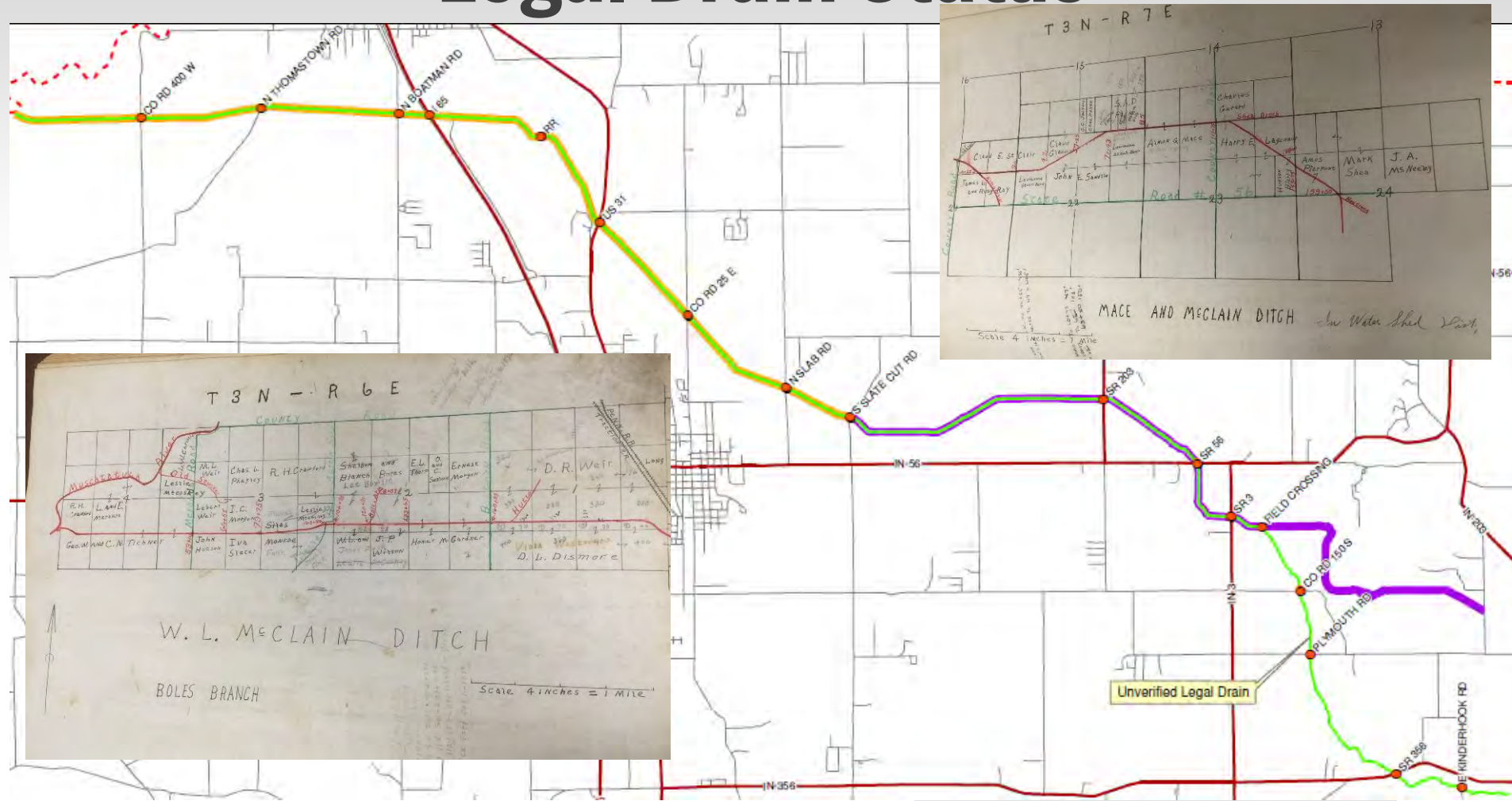
Protected Lands



- Stucker Ditch Crossing
- Stucker Fork Fish & Wildlife Area
- Stucker Ditch
- Thomastown Bottoms Nature Preserve
- Wetlands Reserve Program (WRP) Easements



Legal Drain Status



- Stucker Fork
- W. L. McClain Legal Drain
- Mace and McClain Legal Drain
- Highways
- Scott County Boundary

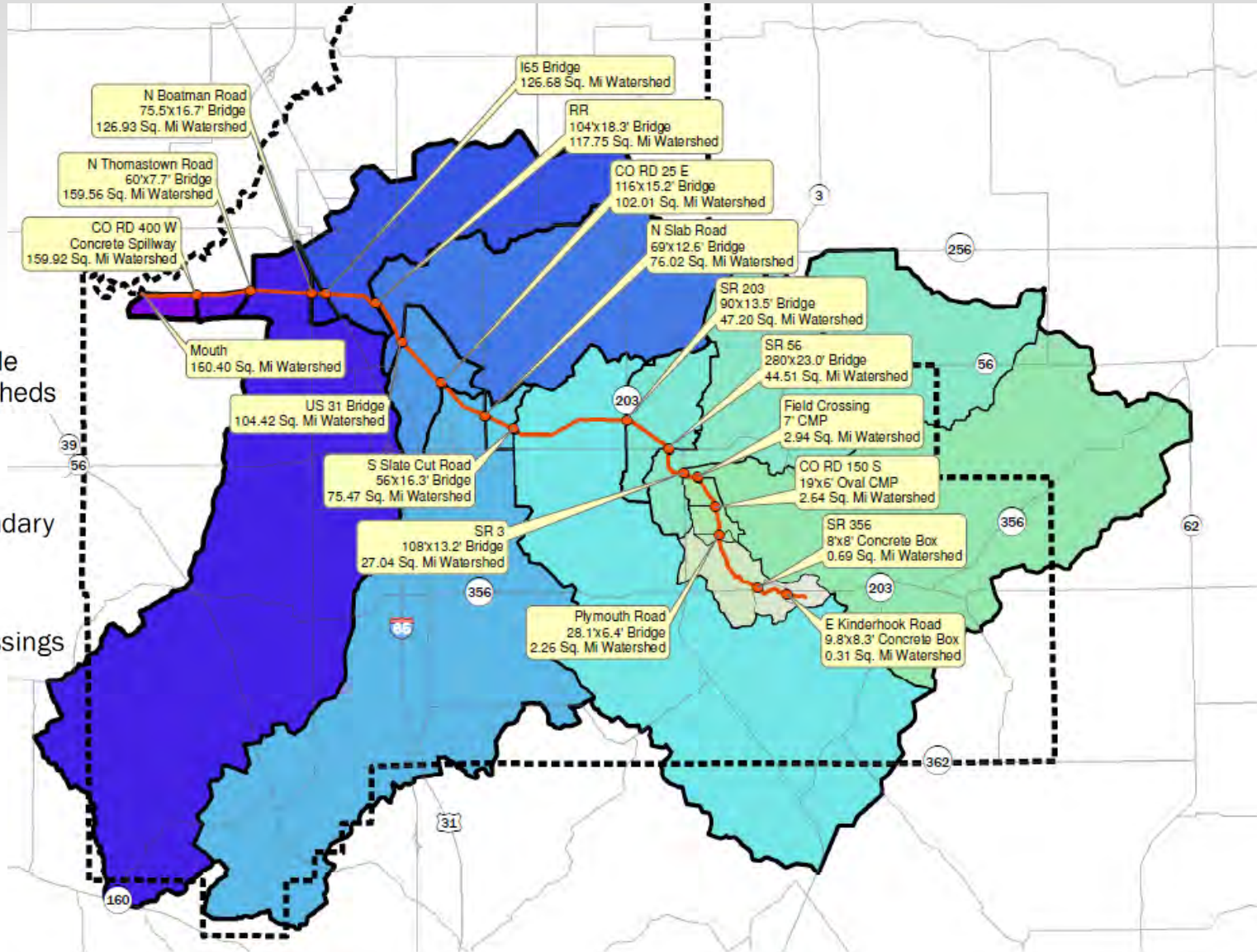


Hydrologic Conditions

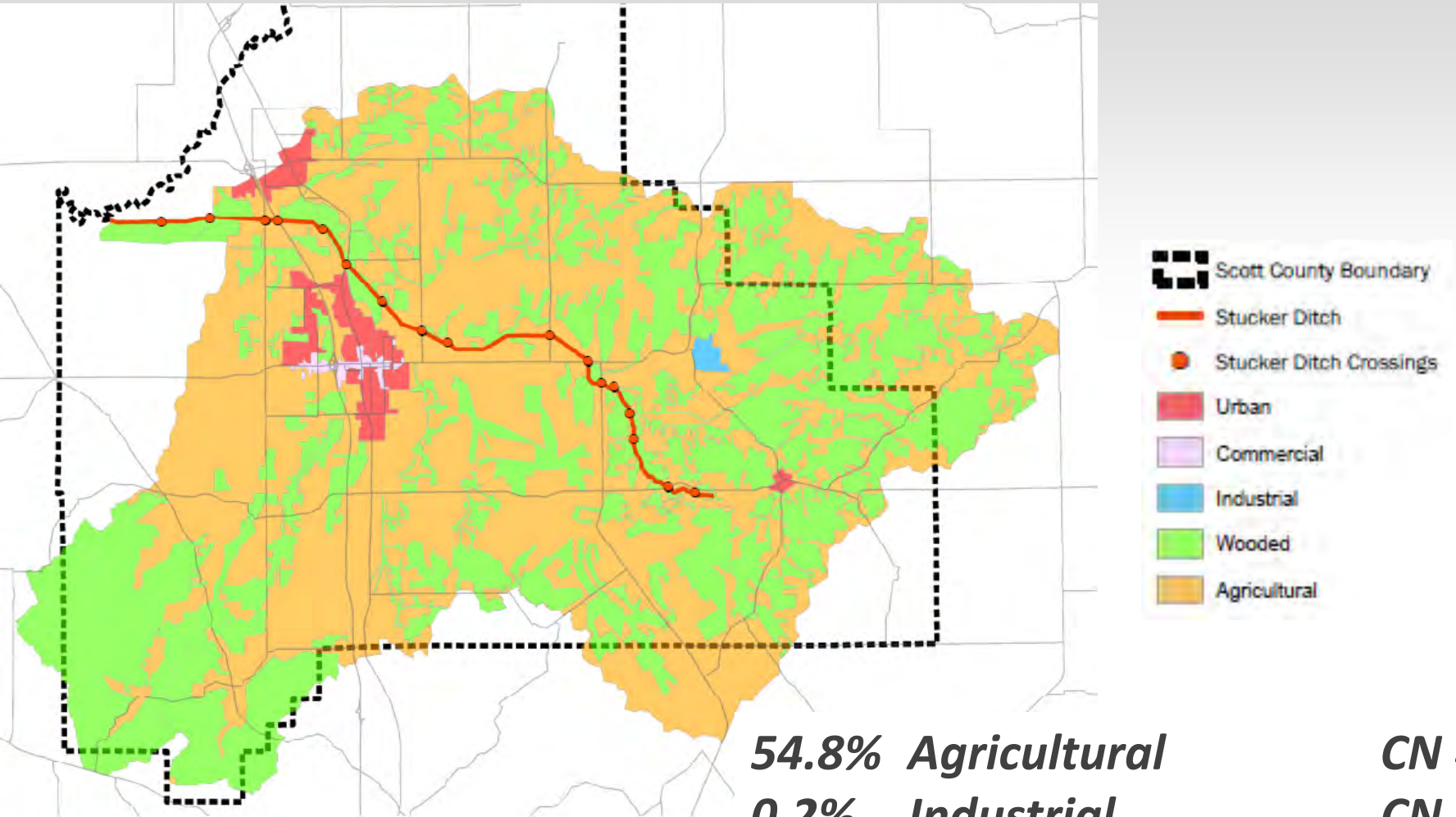
Watershed Delineation

Darker Watersheds Include Upstream, Lighter Watersheds

-  Scott County Boundary
-  Stucker Ditch
-  Stucker Ditch Crossings

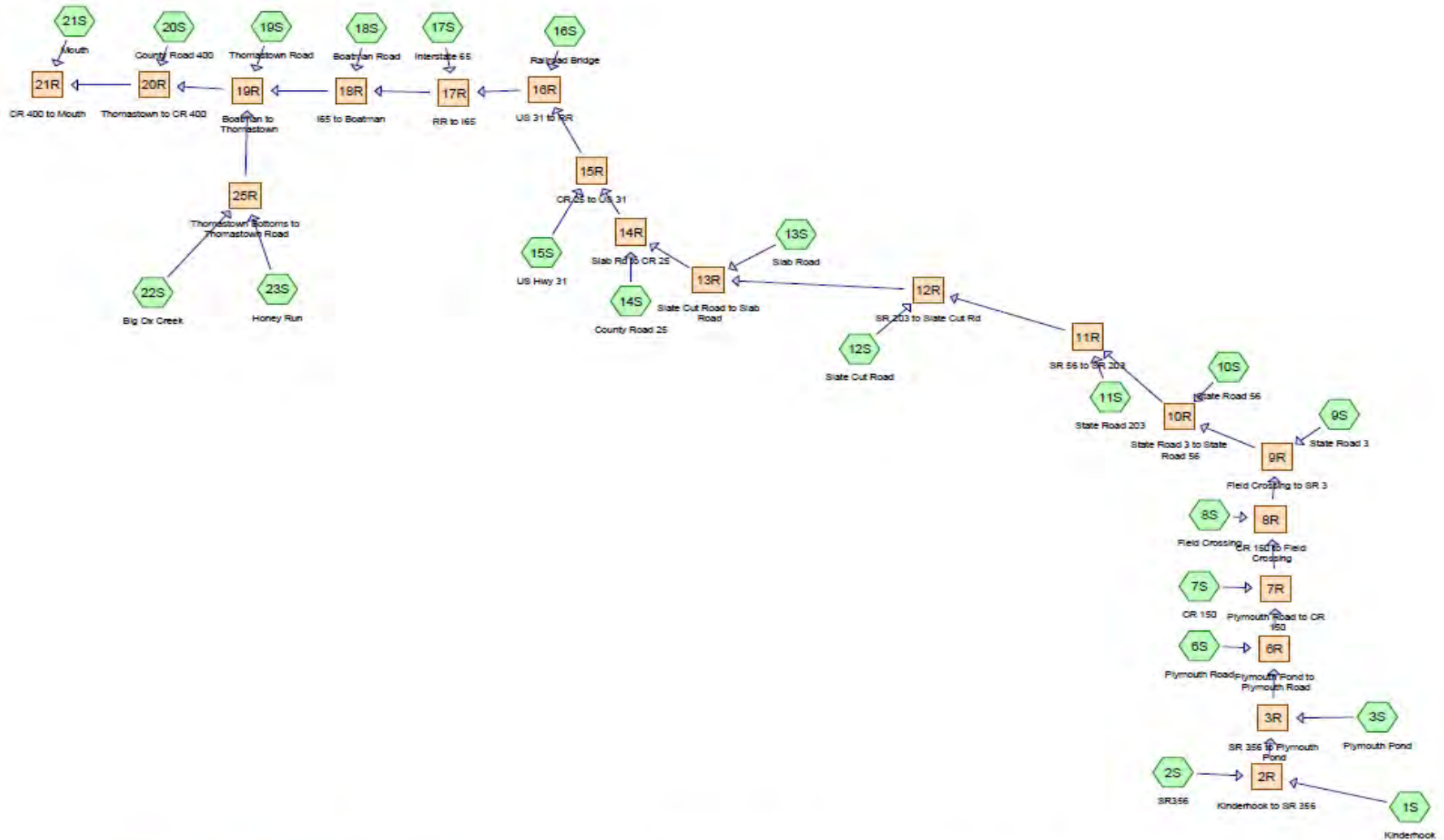


Existing Land Use



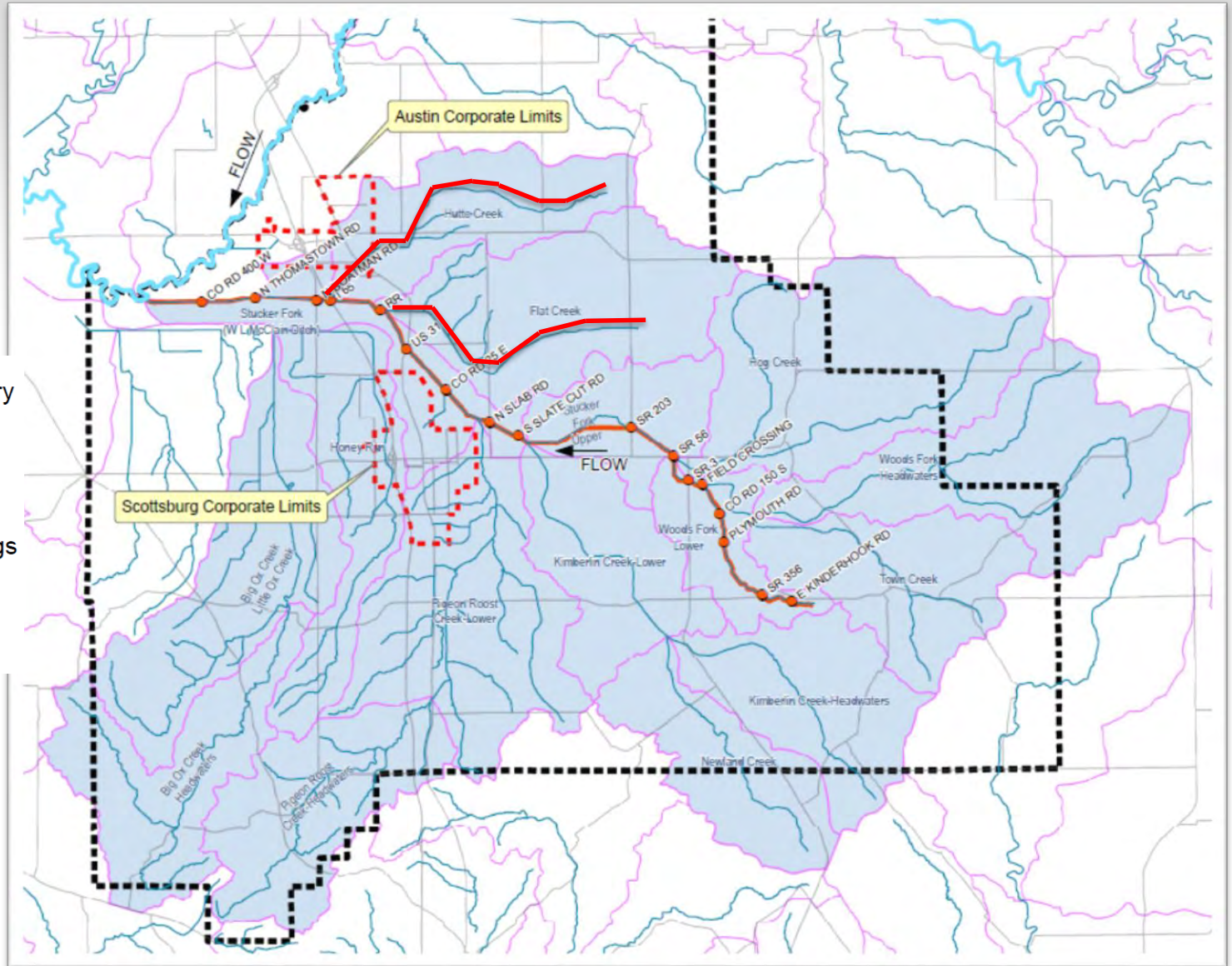
54.8%	<i>Agricultural</i>	<i>CN = 84</i>
0.2%	<i>Industrial</i>	<i>CN = 92</i>
2.7%	<i>Urban/Commercial</i>	<i>CN = 88</i>
42.3%	<i>Woods</i>	<i>CN = 74</i>

Hydrologic Model – HydroCAD



Drainage Diagram for Stucker Hydrologic Model
 Prepared by HWC Engineering, Printed 11/16/2015
 HydroCAD® 9.00 s/n 04805 © 2009 HydroCAD Software Solutions LLC

Tributaries to Stucker Fork



- Scott County Boundary
- Watersheds
- Stucker Fork
- Stucker Fork Crossings
- Muscatatuck River
- Creek/Stream

Flooding Concerns on Stucker Fork, Hutto Creek, and Flat Creek

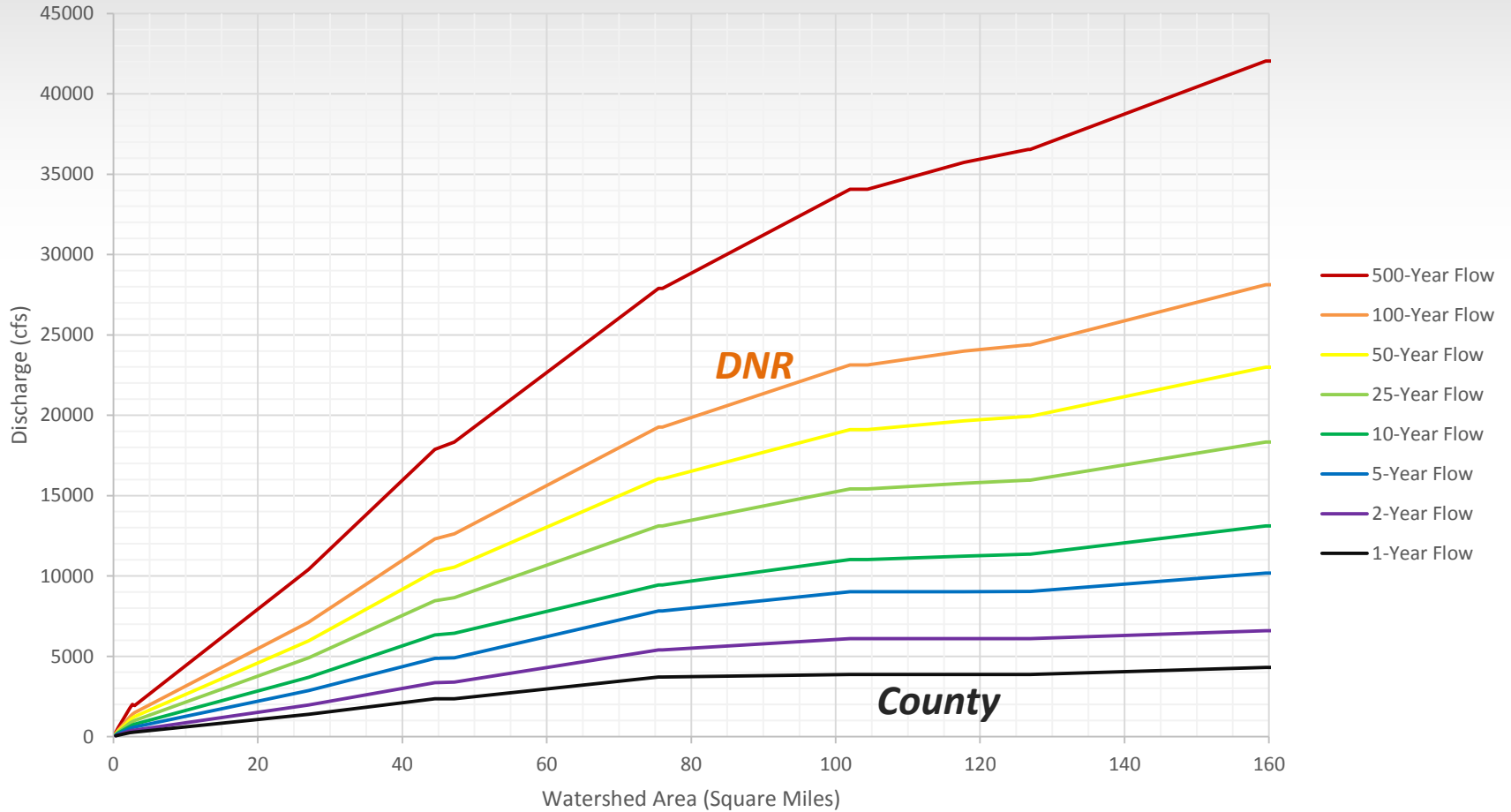


100-Year Flow Rate Comparison

Crossing/Location	Incremental Watershed Area (Ac)	100-Year Flow From StreamStats (cfs)	100-Year Flow From IDNR FARAs (cfs)	100-Year Flow From IDNR Model (cfs)	100-Year flow from HWC's Hydrologic Model (cfs)	100-Year flow used in HWC's Hydraulic Model (cfs)
Kinderhook Road	200	276		N/A	188	190
SR 356	242	489		N/A	397	400
Plymouth Road	57	1,210		1,290	1,229	1,230
CR 150	243	1,250			1,381	1,390
Field Crossing	193	1,290			1,497	1,500
SR 3	15,424	7,560	8,000	7,440	7,118	7,120
SR 56	11,180	11,300	11,000	11,250	12,298	12,300
SR 203	1721	11,200		11,290	12,613	12,620
Slate Cut Road	18,091	16,200		14,670	19,256	19,260
Slab Road	356	16,100			19,054	19,260
CR 25	16,633	20,900	15,900	16,350	23,127	23,130
US 31	1,539	23,300	18,000		23,018	23,130
Railroad	8,535	23,000		20,720	23,952	24,000
I-65	5,715	23,700	23,500	22,350	24,373	24,380
Boatman Road	162	23,600	23,500		24,358	24,380
Thomastown Road	20,880	23,300			28,127	28,130
CR 400	228	22,700			27,613	28,130
Mouth	307	22,800			27,389	28,130

Flow Rate Summary

Stucker Fork Discharge





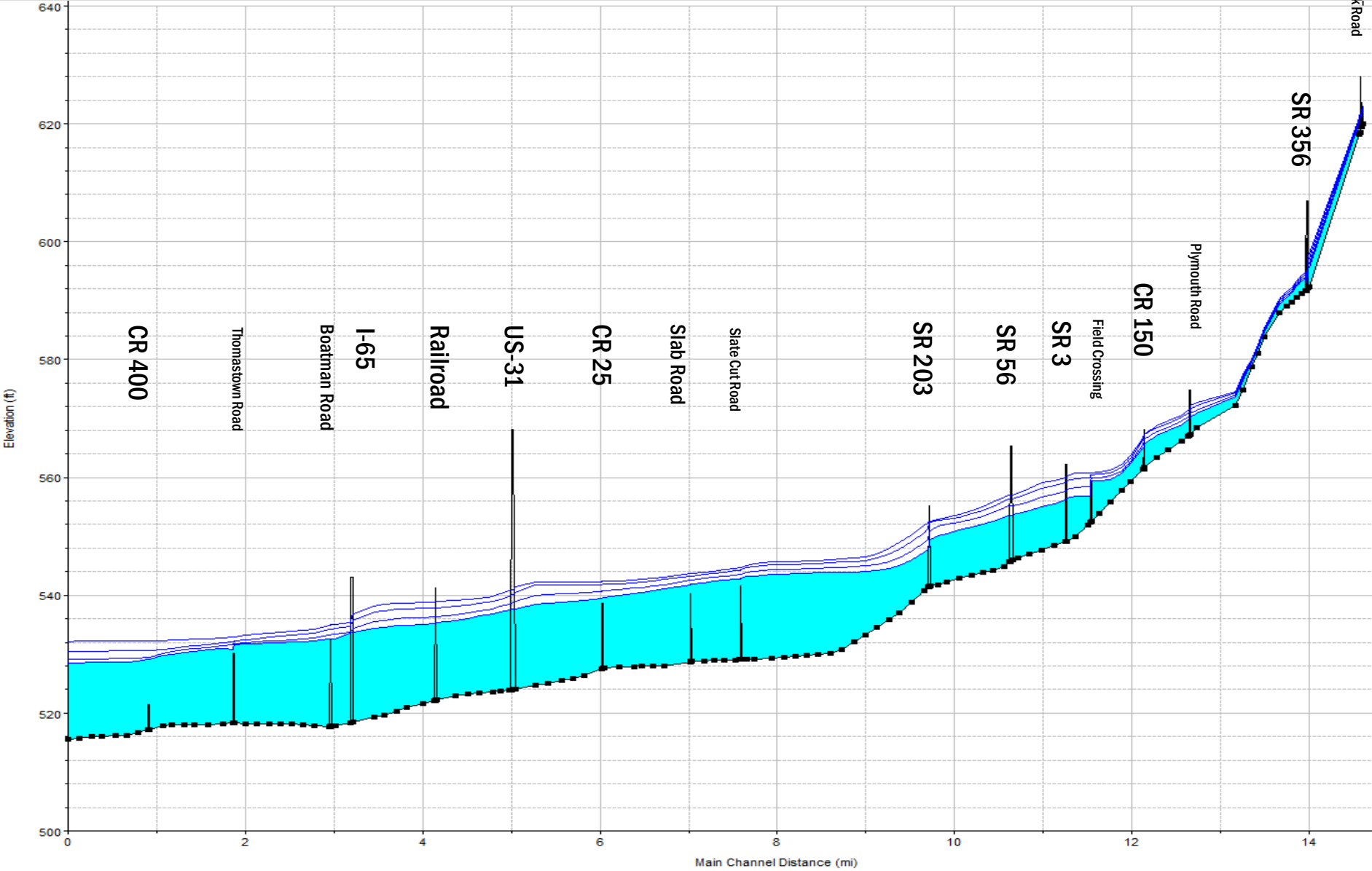
Hydraulic Conditions

Hydraulic Model – HEC-RAS



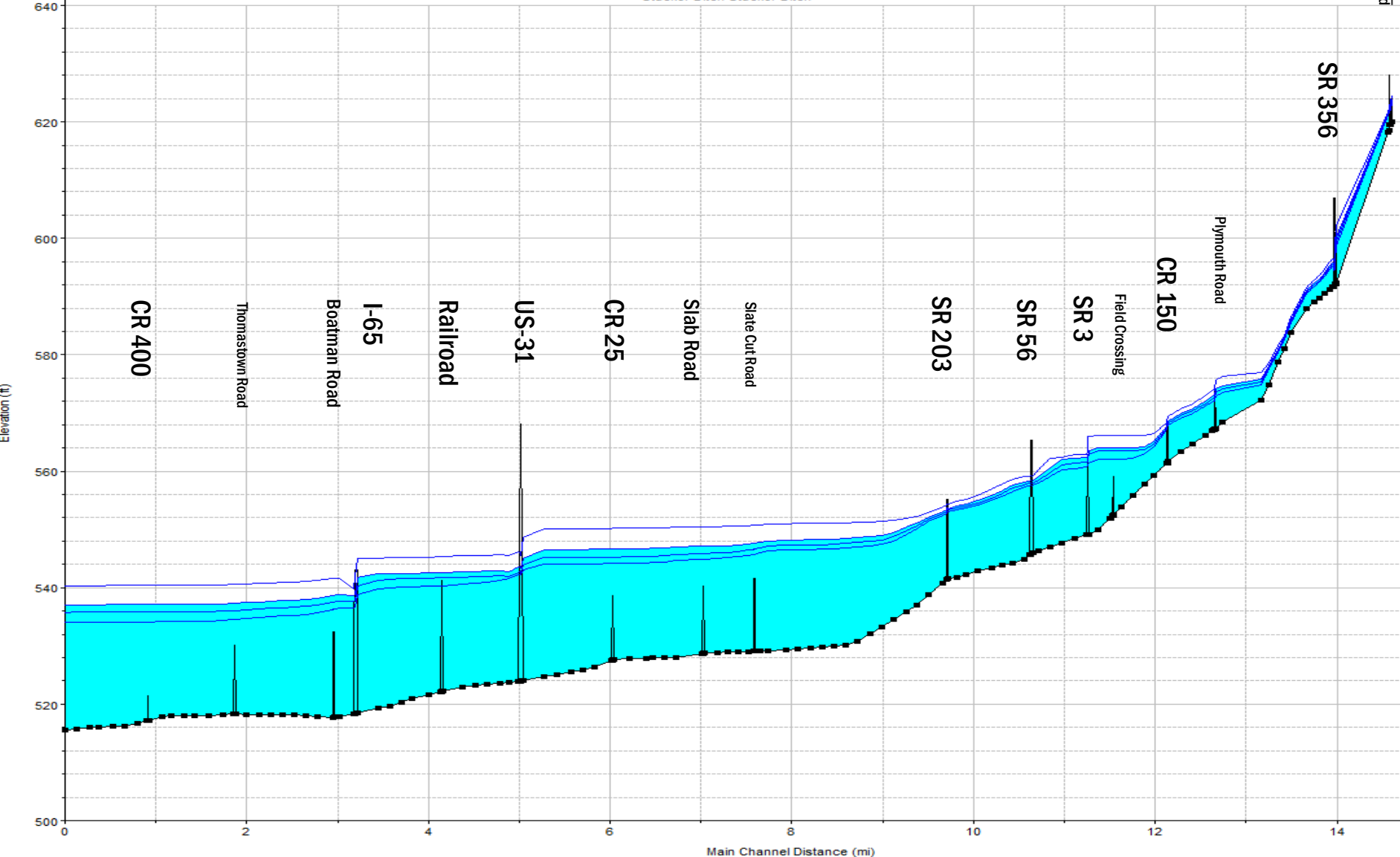
Stucker Fork Water Surface Profile 1-10 Year

Kinderhook Road



Stucker Fork Water Surface Profile 25- 500 Year

Kinderhook Road



100-Year Structure Analysis

Crossing/Location	100 YR Flow (cfs)	Overtopping? (Y/N)	Pressure Flow (Y/N)	Low Chord (ft)	Roadway Center Line Elevation (ft)	Water Surface (ft)	Low Chord – Water Surface (ft)	Roadway Centerline – Water Surface (ft)
Kinderhook Road	190	N	N	627.66	628	622.33	5.33	5.67
SR 356	400	N	N	600.99	606.91	600.09	0.90	6.82
Plymouth Road	1,230	N	N	574.12	576.61	573.10	1.02	3.51
CR 150	1,390	Y	N	567.72	570.1	568.59	-0.87	1.51
Field Crossing	1,500	Y	Y	559.04	559.79	564.07	-5.03	-4.28
SR 3	7,120	Y	N	562.25	567.09	562.25	0.00	4.84
SR 56	12,300	N	N	565.34	568.54	558.31	7.03	10.23
SR 203	12,620	N	N	555.25	557.87	553.63	1.62	4.24
Slate Cut Road	19,260	Y	Y	540.7	541.52	547.68	-6.98	-6.16
Slab Road	19,260	Y	Y	540.2	541.81	547.09	-6.89	-5.28
CR 25	23,130	Y	Y	538.68	539.91	546.64	-7.96	-6.73
US 31	23,130	N	N	568.07	572.57	543.40	24.67	29.17
Railroad	24,000	Y	Y	541.34	542.09	542.56	-1.22	-0.47
I-65	24,380	N	N	543	546.08	541.46	1.54	4.62
Boatman Road	24,380	Y	Y	532.35	536.15	538.69	-6.34	-2.54
Thomastown Road	28,130	Y	Y	530.07	532.87	537.34	-7.27	-4.47
CR 400	28,130	N/A	N/A	N/A	521.53	537.12	N/A	N/A

10 Structures with Water Surface above Low Chord
8 Structures with Water Surface above Bridge Deck
Greatest overtopping from CR25 to Slate Cut Rd.



1-Year Structure Analysis

Crossing/Location	1 Year Flow (cfs)	Overtopping? (Y/N)	Pressure Flow (Y/N)	Low Chord (ft)	Roadway Center Line Elevation (ft)	Water Surface (ft)	Low Chord – Water Surface (ft)	Roadway Centerline – Water Surface (ft)
Kinderhook Road	45	N	N	627.66	628	621.13	6.53	6.87
SR 356	90	N	N	600.99	606.91	595.63	5.36	11.28
Plymouth Road	250	N	N	574.12	576.61	570.04	4.08	6.57
CR 150	270	N	N	567.72	570.1	565.72	2.00	4.38
Field Crossing	280	Y	N	559.04	559.79	559.41	-0.37	0.38
SR 3	1380	N	N	562.25	567.09	556.38	5.87	10.71
SR 56	2360	N	N	565.34	568.54	553.62	11.72	14.92
SR 203	2360	N	N	555.25	557.87	549.13	6.12	8.74
Slate Cut Road	3710	Y	Y	540.7	541.52	542.96	-2.26	-1.44
Slab Road	3710	Y	Y	540.2	541.81	541.85	-1.65	-0.04
CR 25	3870	Y	N	538.68	539.91	539.57	-0.89	0.34
US 31	3870	N	N	568.07	572.57	537.61	30.46	34.96
Railroad	3870	N	N	541.34	542.09	535.35	5.99	6.74
I-65	3870	N	N	542.24	546.08	533.71	8.53	12.37
Boatman Road	3870	Y	N	532.35	536.15	532.58	-0.23	3.57
Thomastown Road	4300	Y	N	530.07	532.87	531.55	-1.48	1.32
CR 400	4300	N/A	N/A	N/A	521.529	529.11	N/A	N/A

7 Structures with Water Surface above Low Chord
3 Structures with Water Surface above Bridge Deck
Greatest overtopping at Slate Cut Rd.



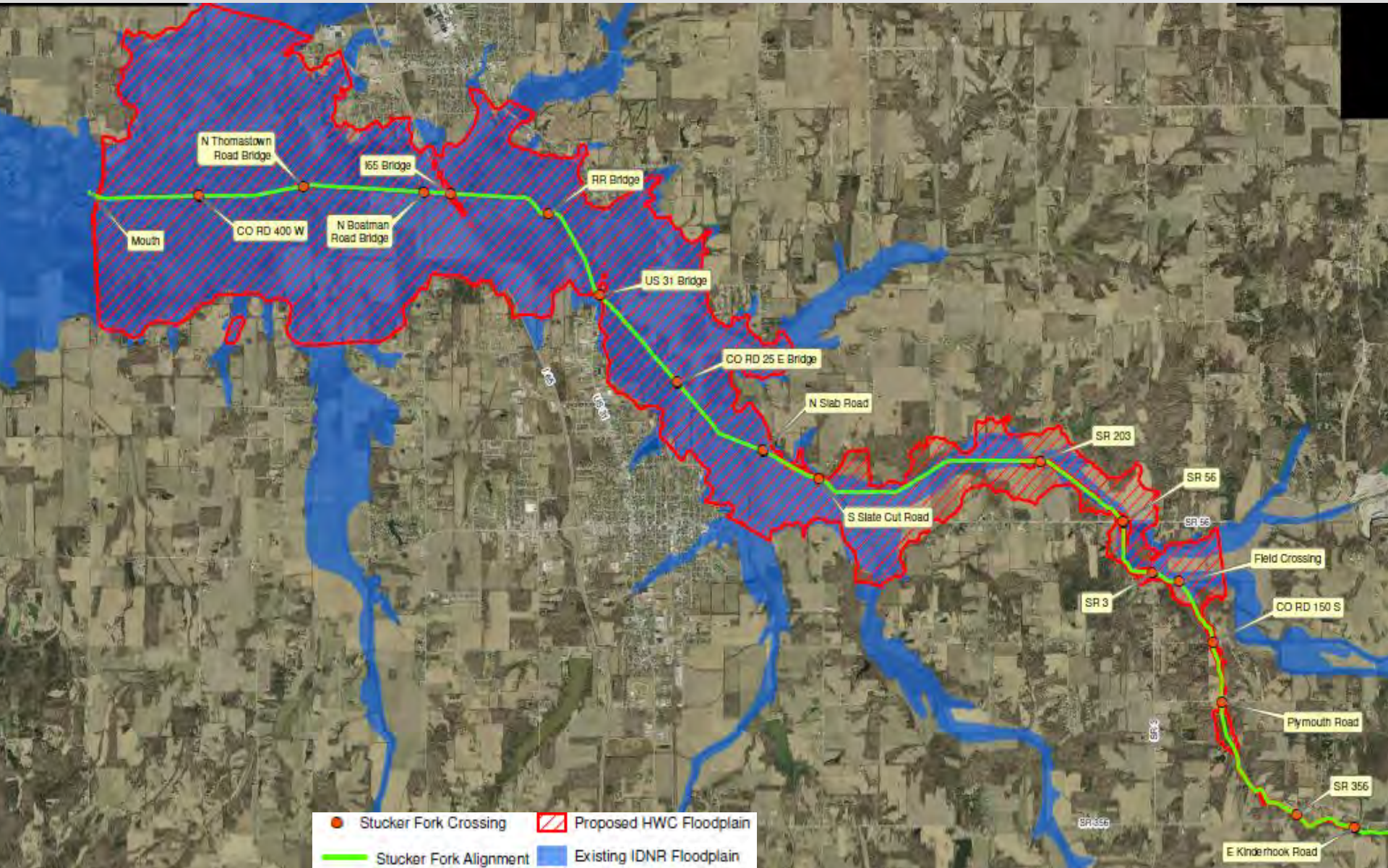
1-Year Structure Analysis

Crossing/Location	1 Year Flow (cfs)	Crossing/Location	Sufficiency Rating	Low Chord - Water Surface (ft)	Roadway Centerline - Water Surface (ft)
Kinderhook Road	45	Plymouth Road	69.2	6.53	6.87
SR 356	90			5.36	11.28
Plymouth Road	250	SR 3	92.2	4.08	6.57
CR 150	270	SR 56	92.5	2.00	4.38
Field Crossing	280			-0.37	0.38
SR 3	1380	SR 203	68.1	5.87	10.71
SR 56	2360			11.72	14.92
SR 203	2360	Slate Cut Road	43.8	6.12	8.74
Slate Cut Road	3710	Slab Road	73.9	-2.26	-1.44
Slab Road	3710			-1.65	-0.04
CR 25	3870	CR 25	54.6	-0.89	0.34
US 31	3870			30.46	34.96
Railroad	3870	US 31	87.0	5.99	6.74
I-65	3870			8.53	12.37
Boatman Road	3870	I-65	96.4	-0.23	3.57
Thomastown Road	4300			-1.48	1.32
CR 400	4300	Boatman Road	67.4	N/A	N/A
		Thomastown Road	69.7		

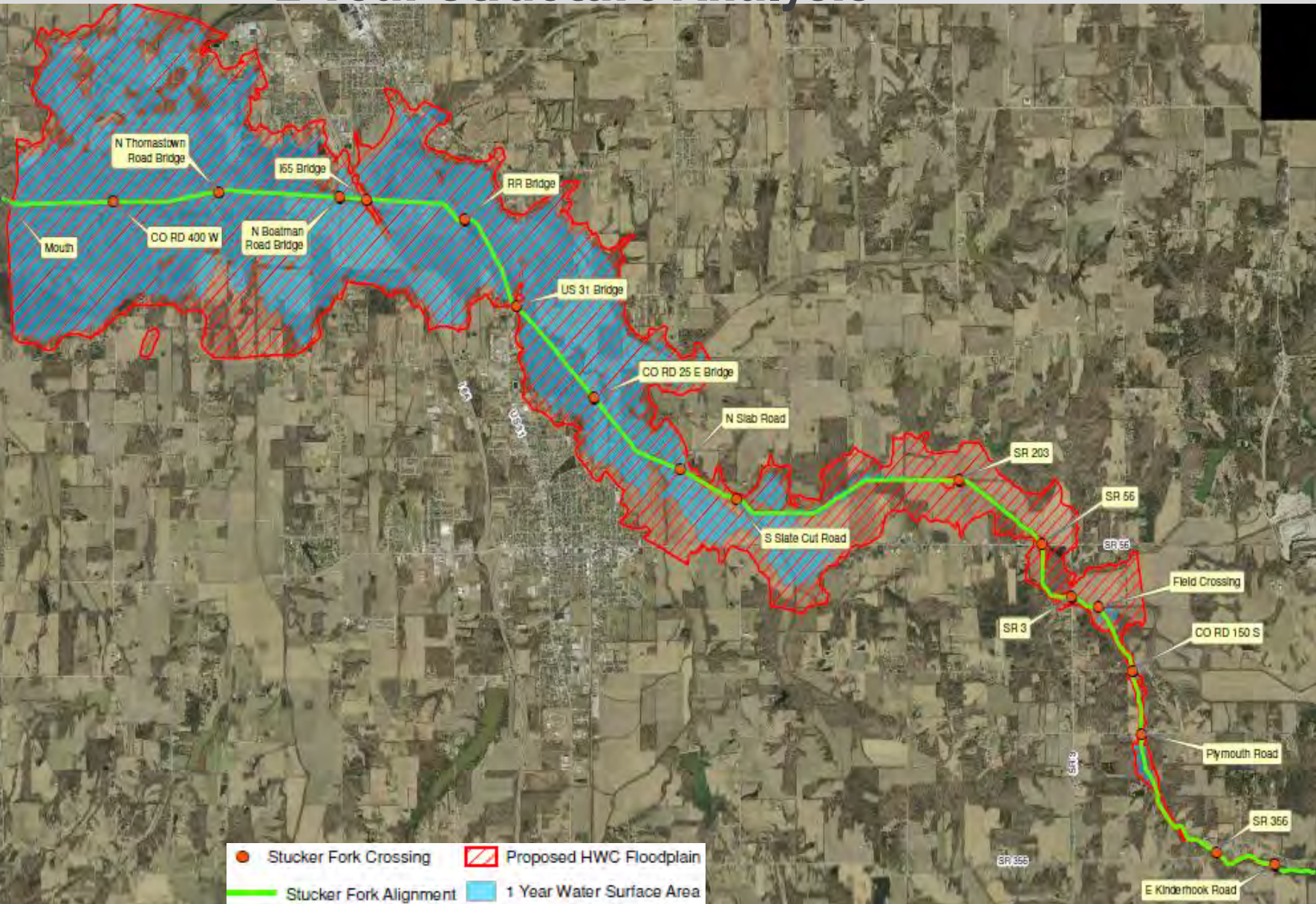
7 Structures with Water Surface above Low Chord
3 Structures with Water Surface above Bridge Deck
Greatest overtopping at Slate Cut Rd.



100-Year Structure Analysis



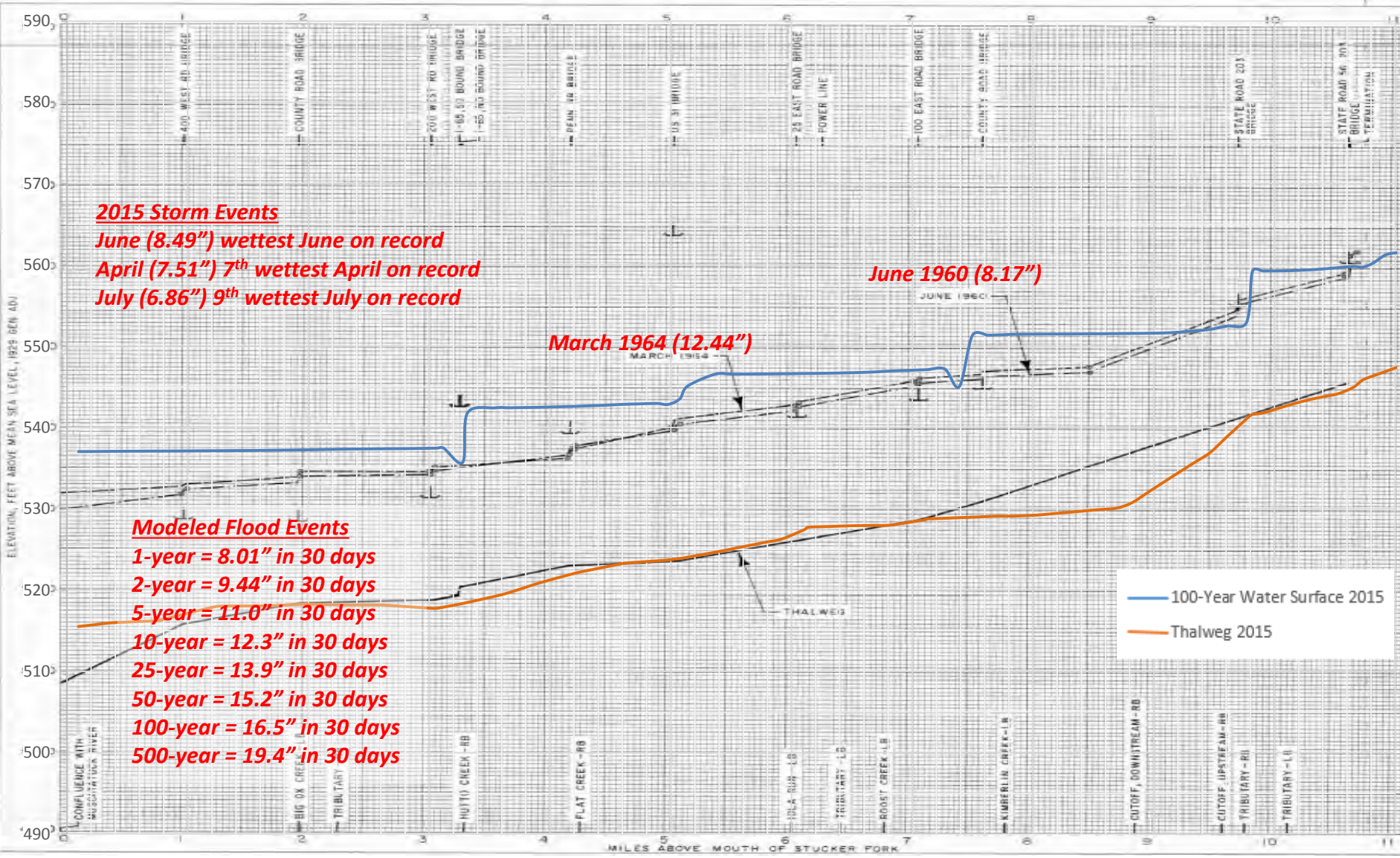
1-Year Structure Analysis



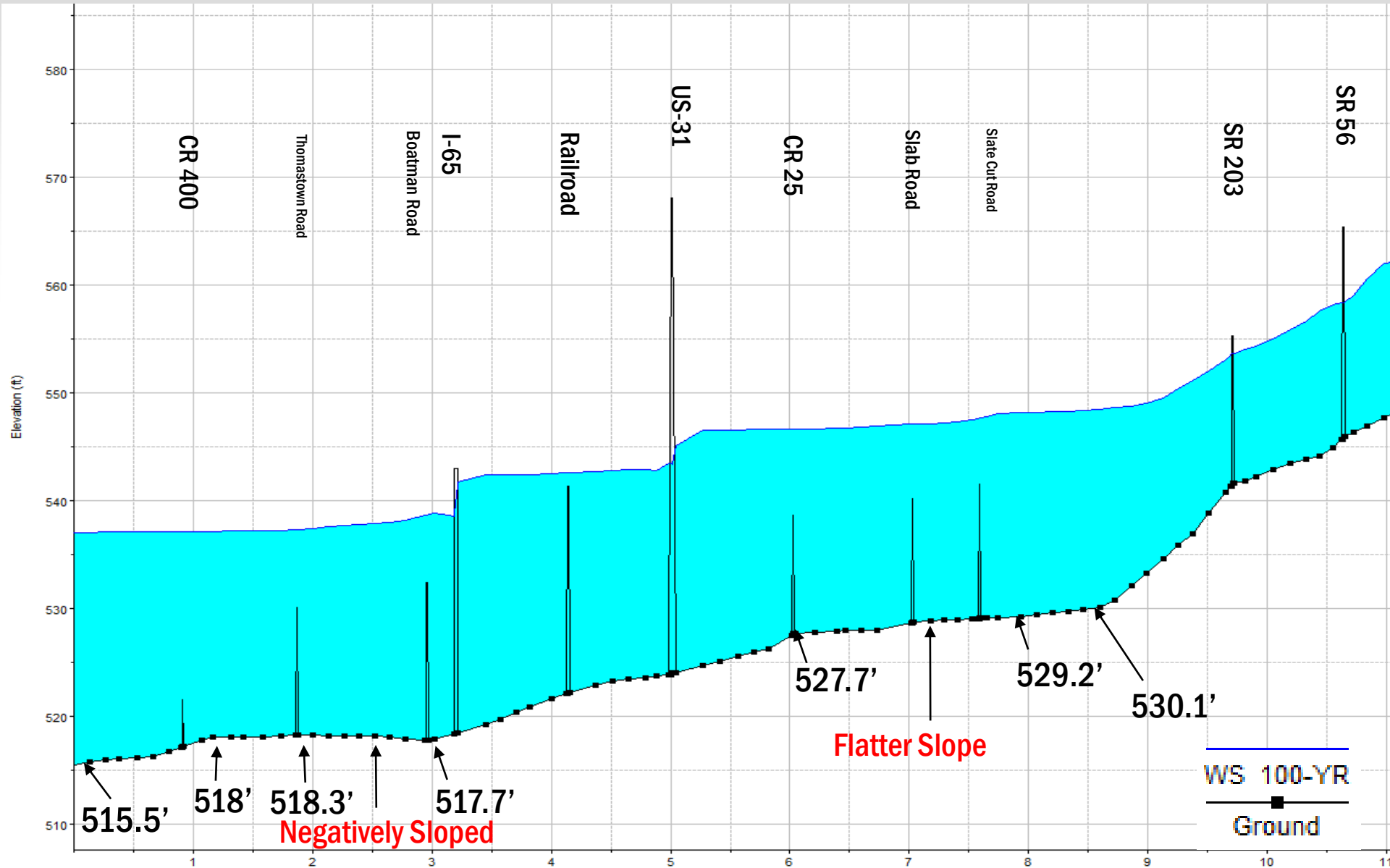


Proposed Alternatives

Stucker Fork Profile, 1975 Vs. 2015



Stucker Fork Profile, 2015



HEC-RAS Channel Design Tool

Channel Design/Modification Editor - Stucker Cross Sections Ineff Alt

File Edit View Options Help

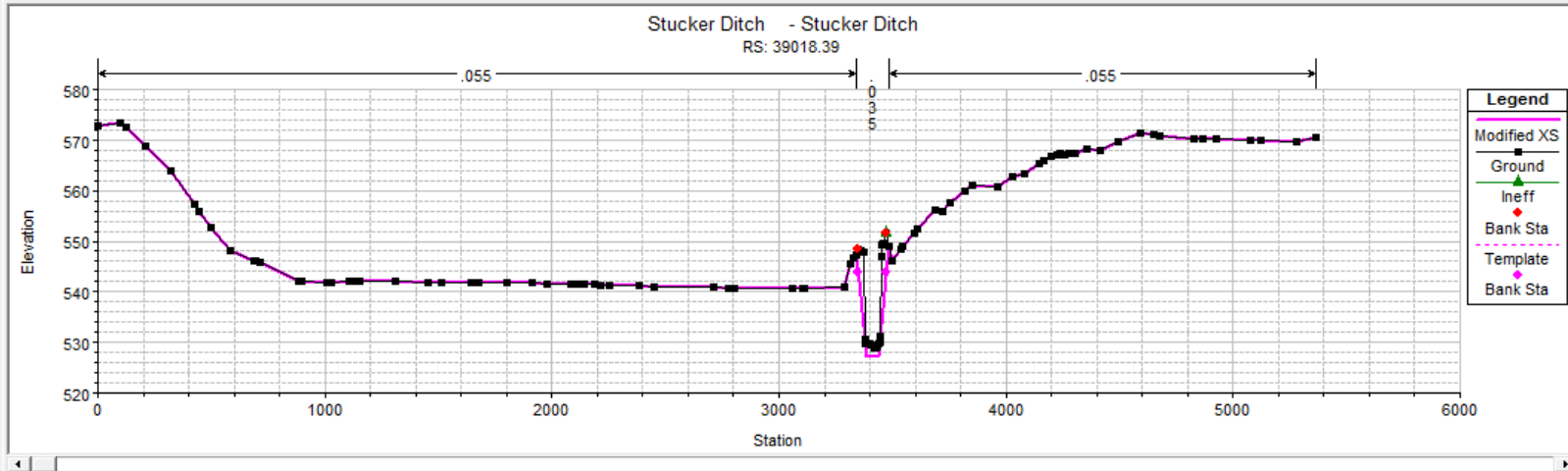
Editing Tools

Template Design ...

Modify a Range of XS ...

Profile Plot XS Plot

Plot Template



River: Stucker Ditch

Reach: Stucker Ditch

Channel Design/Modification Alternative

Selected Area Edit Options

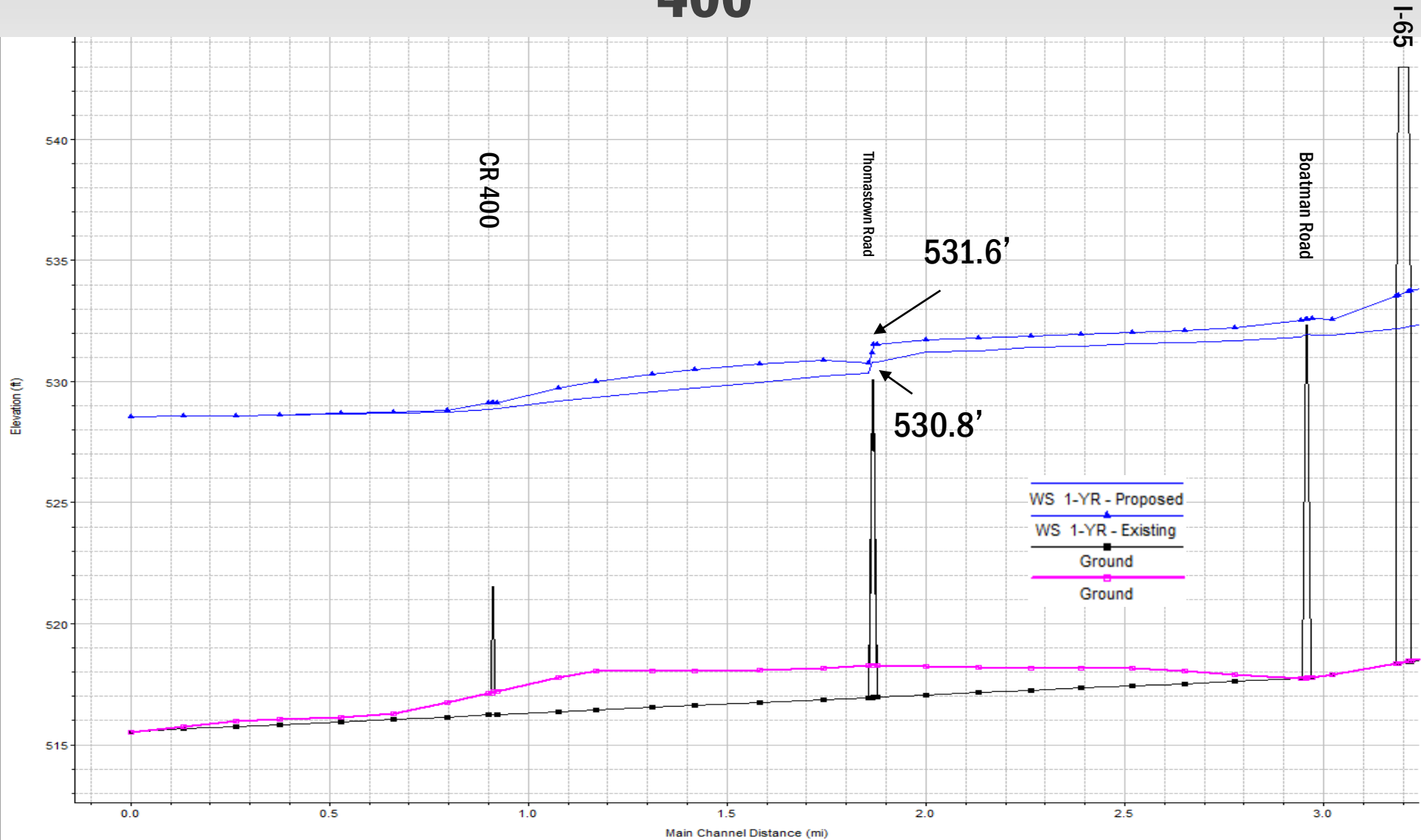
Copy of Copy of Slate to Boatman

Copy Invert Reset Lengths Reset Center Sta

	River	Reach	RS	Invert Elev.	Template Elev.	LOB Length	Channel Length	ROB Length	Center Station	Template	Fixed Elev.	Slope from US	Slope from DS	Interp. Dist.	Cut Area	Fill Area
69	Stucker Ditch	Stucker	45889.19	530.08	530.08	716.86	720.28	718.86	2919.82	Slate to US31	530.08				181	
70	Stucker Ditch	Stucker	45168.91	529.91	529.78	685.72	675.71	665.03	3171.12	Slate to US31		0.00041			166	
71	Stucker Ditch	Stucker	44493.2	529.74	529.5	708.84	689.34	678.55	2941.45	Slate to US31		0.00041			315	
72	Stucker Ditch	Stucker	43803.86	529.57	529.22	688.19	685.94	682.85	3332.05	Slate to US31		0.00041			32.3	
73	Stucker Ditch	Stucker	43117.92	529.4	528.94	698.85	697.04	693.88	3881.54	Slate to US31		0.00041			754	
74	Stucker Ditch	Stucker	42420.88	529.23	528.65	1074.3	1043.46	1013.52	5551.63	Slate to US31		0.00041			68.6	
75	Stucker Ditch	Stucker	41377.42	529.1	528.22	462.56	468.71	473.33	3166.2	Slate to US31		0.00041			123	
76	Stucker Ditch	Stucker	40908.71	529.1	528.03	283.45	295.87	312.28	3408.56	Slate to US31		0.00041			90.3	
77	Stucker Ditch	Stucker	40612.84	529.09	527.91	104.27	103.82	103.82	2953.74	Slate to US31		0.00041			259	
78	Stucker Ditch	Stucker	40563	BR												
79	Stucker Ditch	Stucker	40509.02	529.08	527.87	258.66	259.11	257.72	2961.22	Slate to US31		0.00041			366	
80	Stucker Ditch	Stucker	40249.91	529.05	527.76	666.42	661.97	651.42	3739.75	Slate to US31		0.00041			309	
81	Stucker Ditch	Stucker	39587.94	528.97	527.49	567.71	569.55	570.05	3114.34	Slate to US31		0.00041			537	
82	Stucker Ditch	Stucker	39018.39	528.91	527.26	633.23	633.42	639.47	3410.92	Slate to US31		0.00041			739	
83	Stucker Ditch	Stucker	38384.97	528.84	527	721.49	741.18	757.64	3811.11	Slate to US31		0.00041			425	
84	Stucker Ditch	Stucker	37643.79	528.75	526.7	103.02	103.94	102.54	4207.86	Slate to US31		0.00041			400	
85	Stucker Ditch	Stucker	37597	BR												

Create a Geometry File with these Modifications ... OK Cancel

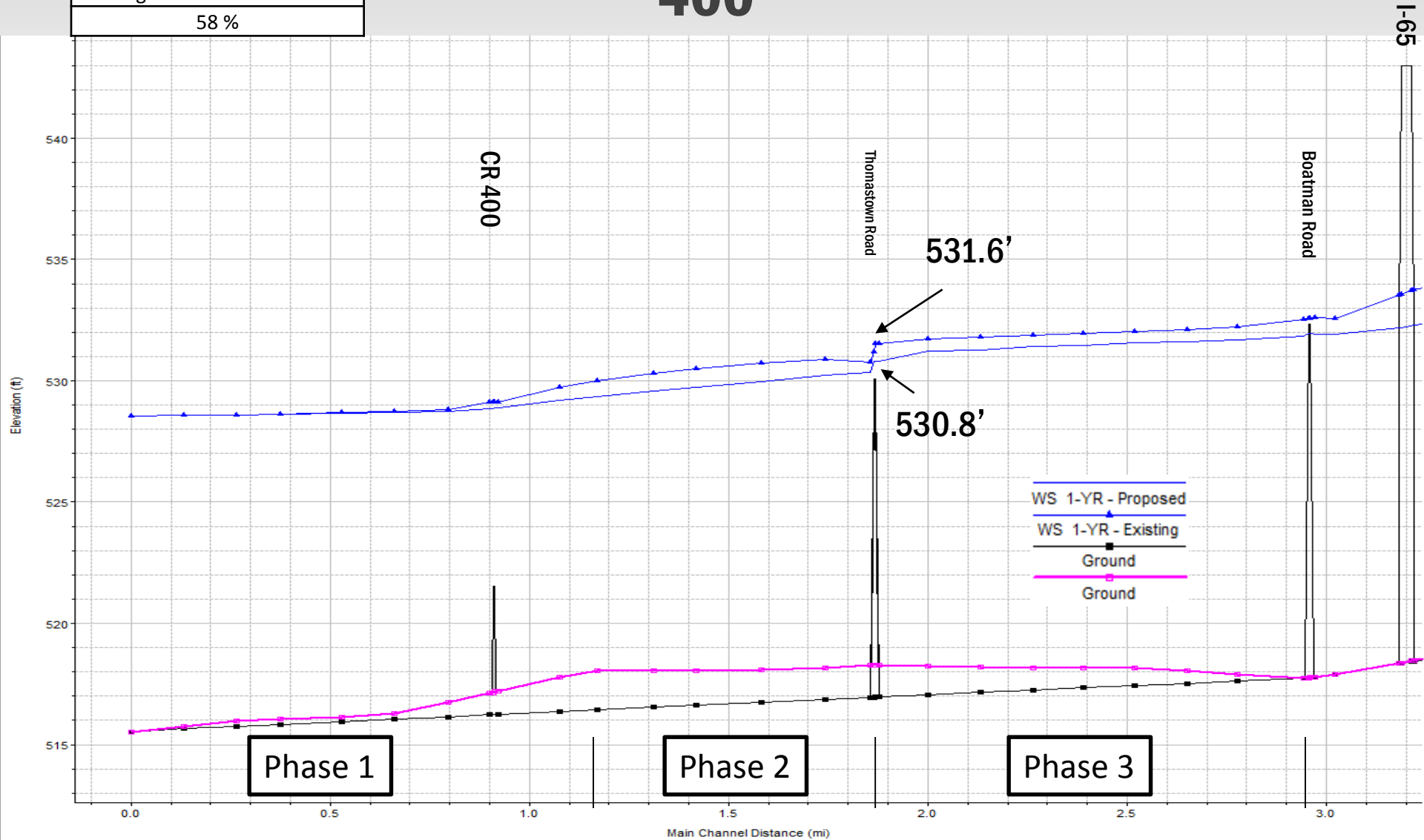
Dredge Downstream of Boatman Road and Eliminate CR 400



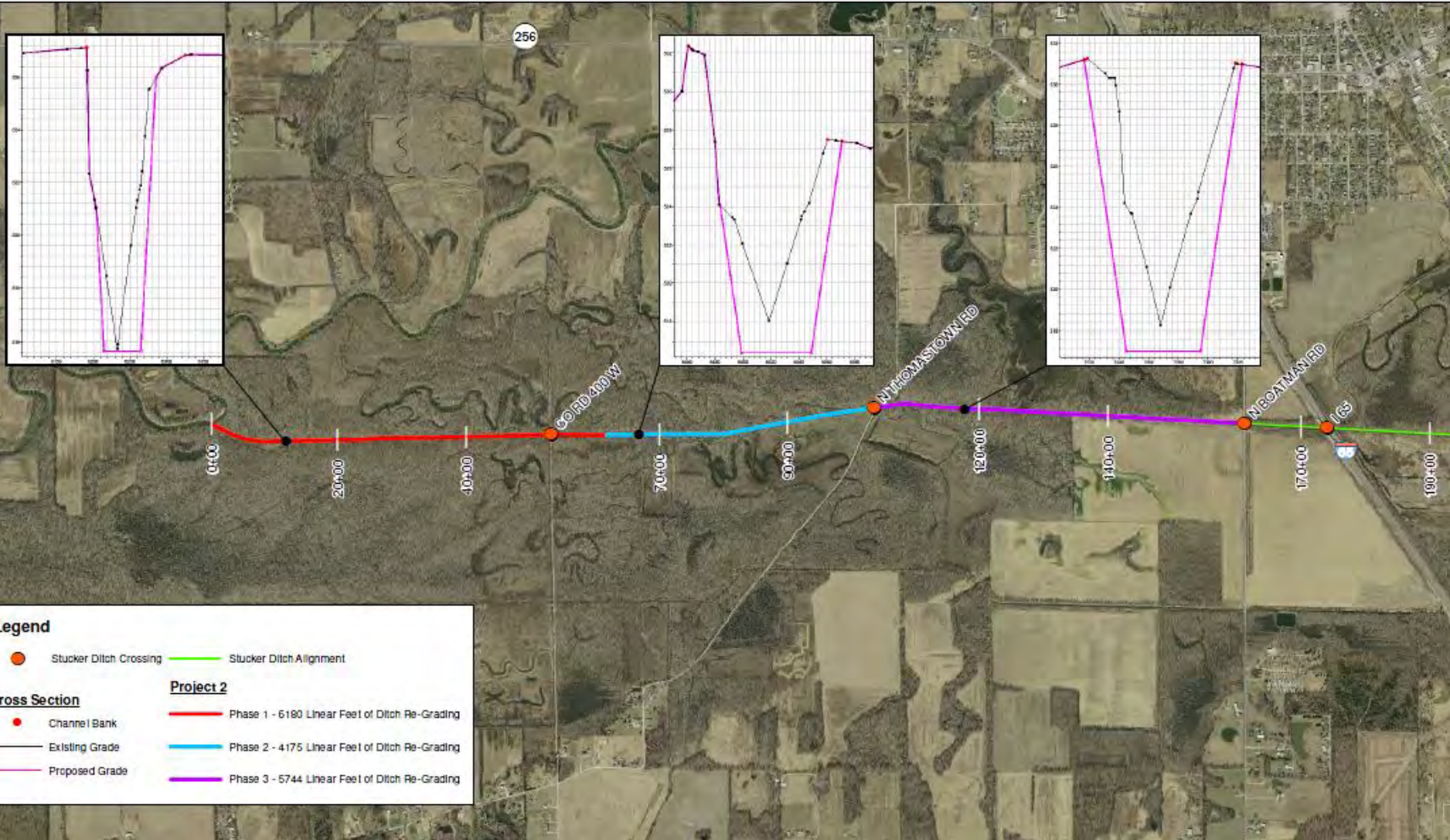
Dredge Downstream of Boatman Road and Eliminate CR 400

400

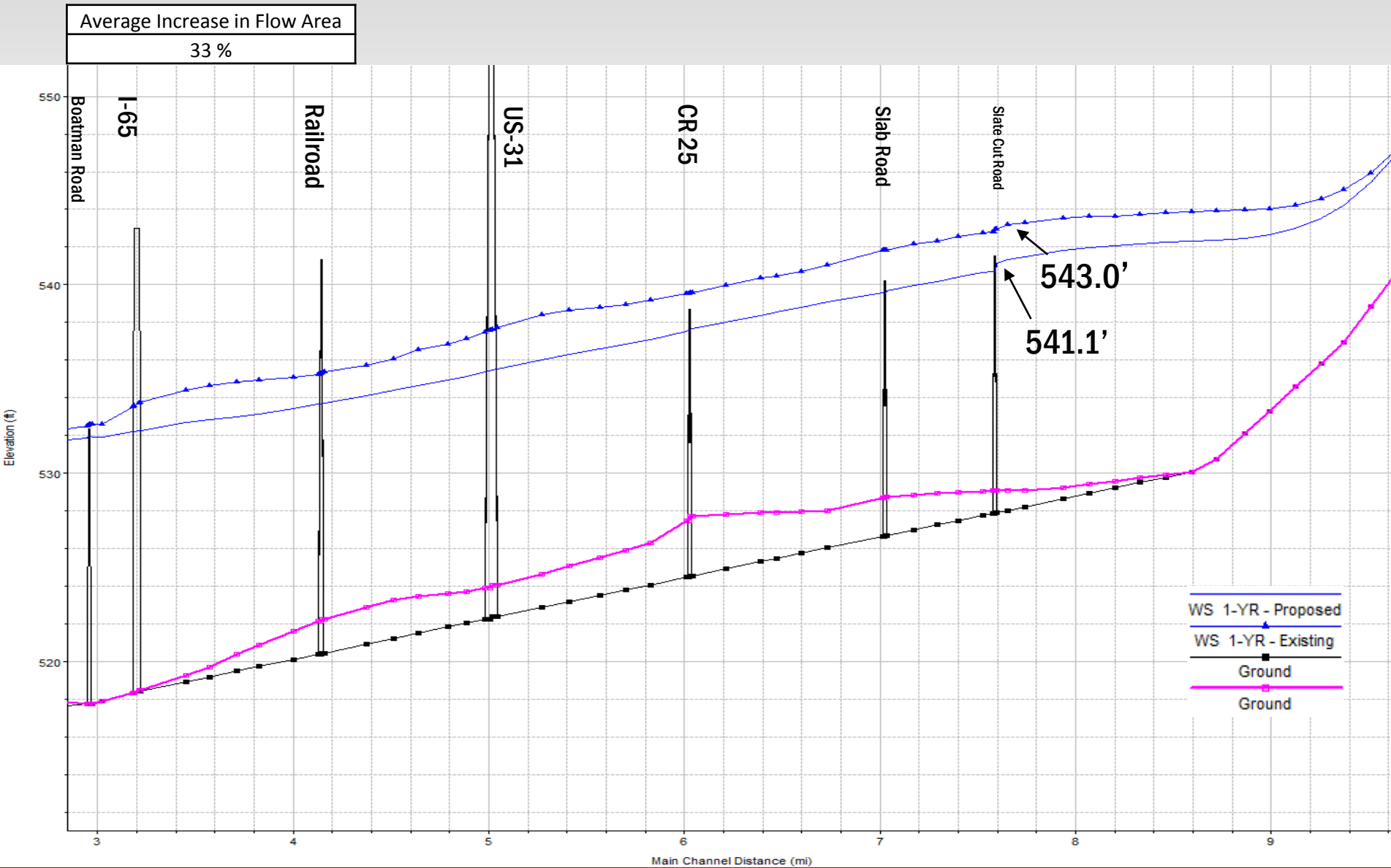
Average Increase in Flow Area
58 %



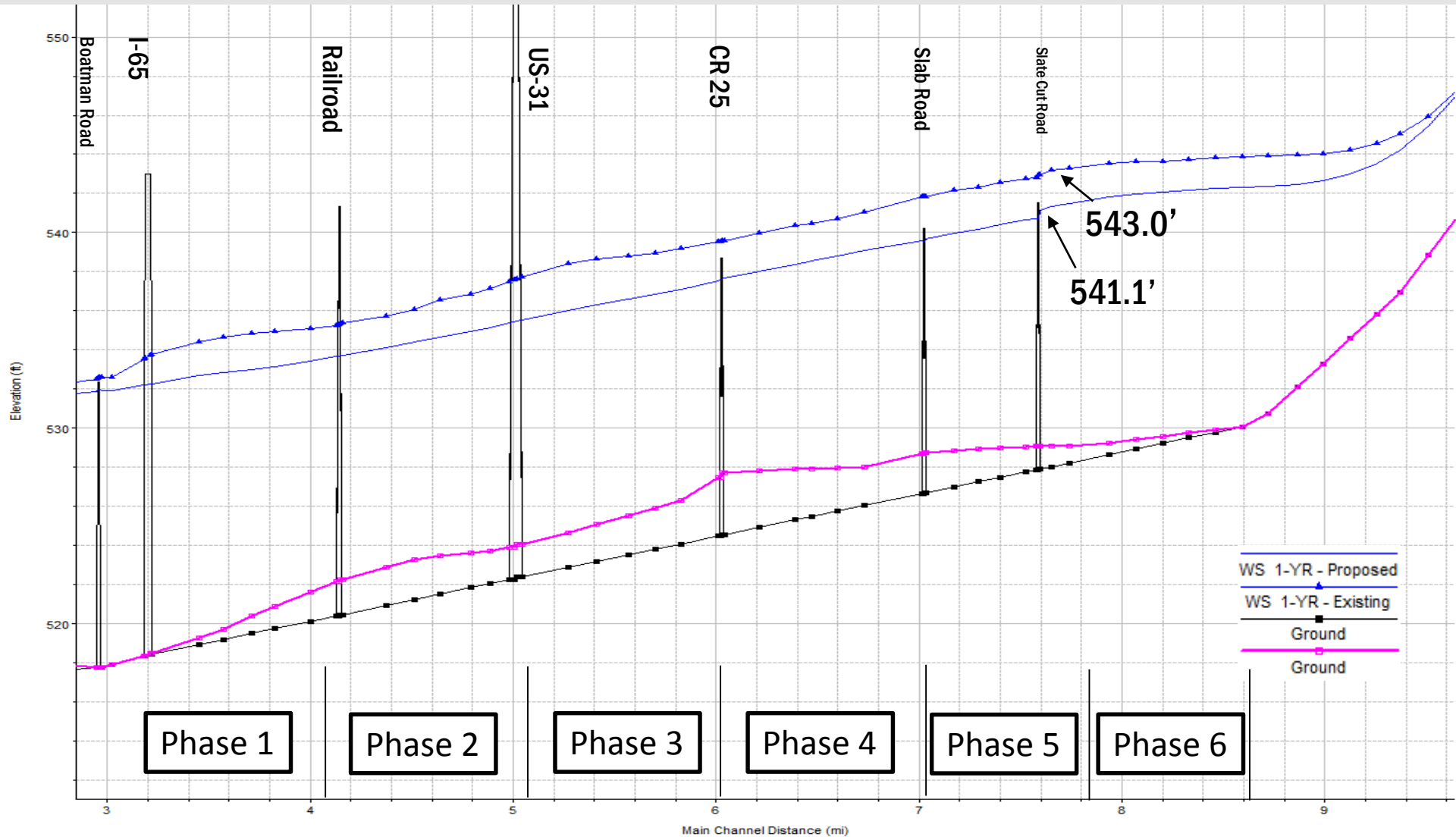
Dredge Downstream of Boatman Road and Eliminate CR 400



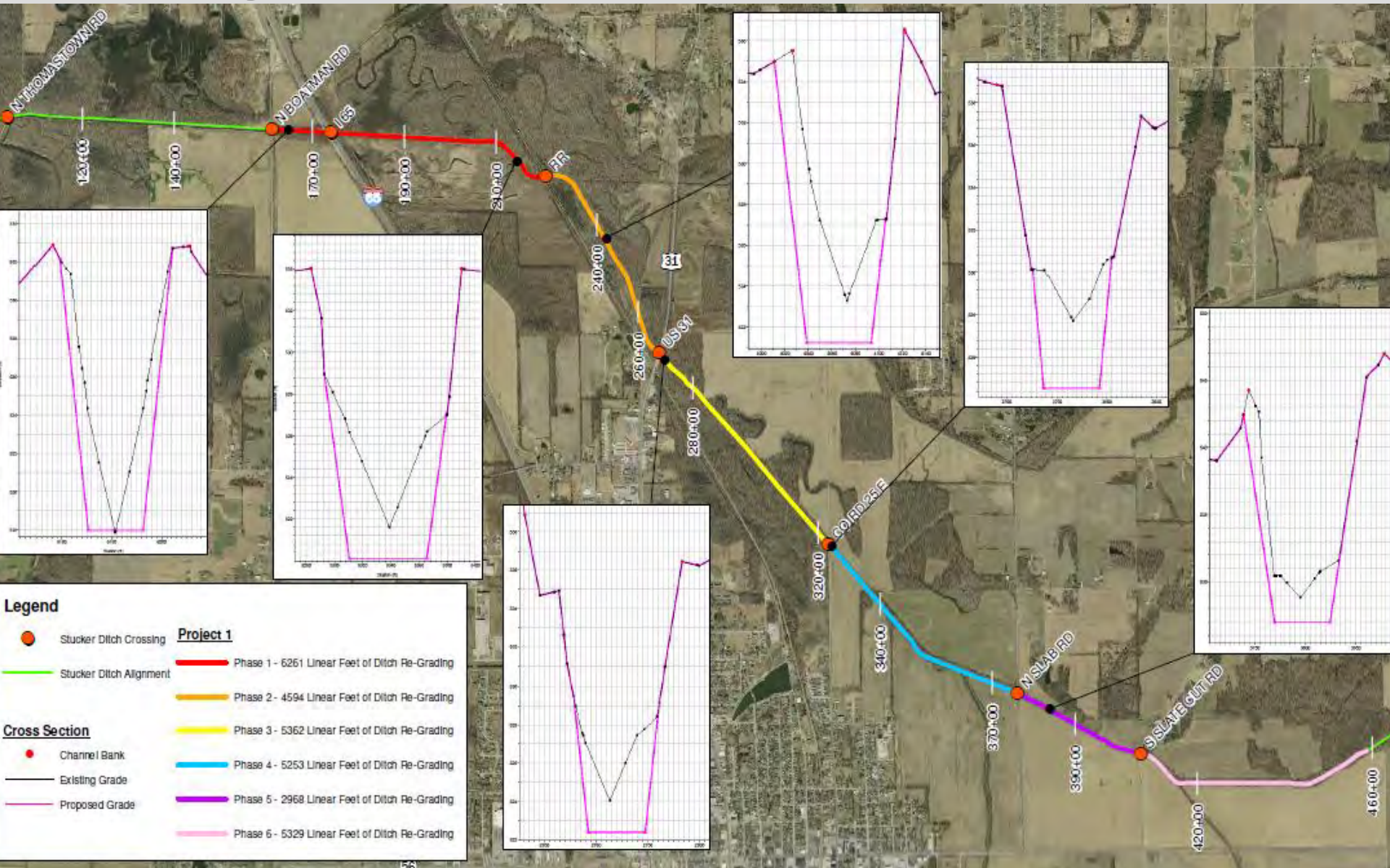
Dredge Upstream of Slate Cut Rd. to Boatman Road



Dredge Upstream of Slate Cut Rd. to Boatman Road



Dredge Upstream of Slate Cut Rd. to Boatman Rd.



Legend

- Stucker Ditch Crossing
- Stucker Ditch Alignment

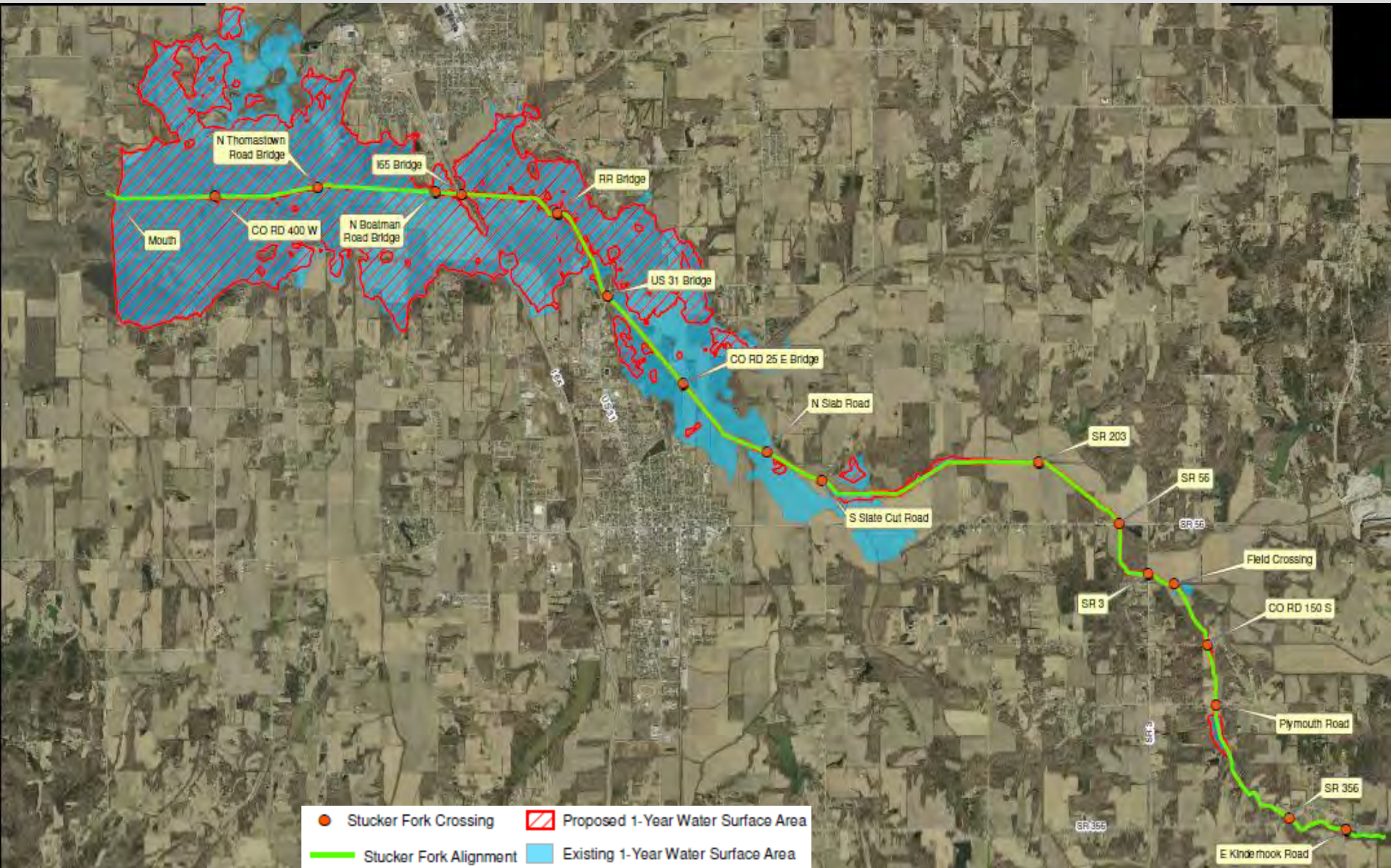
Project 1

- Phase 1 - 6261 Linear Feet of Ditch Re-Grading
- Phase 2 - 4594 Linear Feet of Ditch Re-Grading
- Phase 3 - 5362 Linear Feet of Ditch Re-Grading
- Phase 4 - 5253 Linear Feet of Ditch Re-Grading
- Phase 5 - 2968 Linear Feet of Ditch Re-Grading
- Phase 6 - 5329 Linear Feet of Ditch Re-Grading

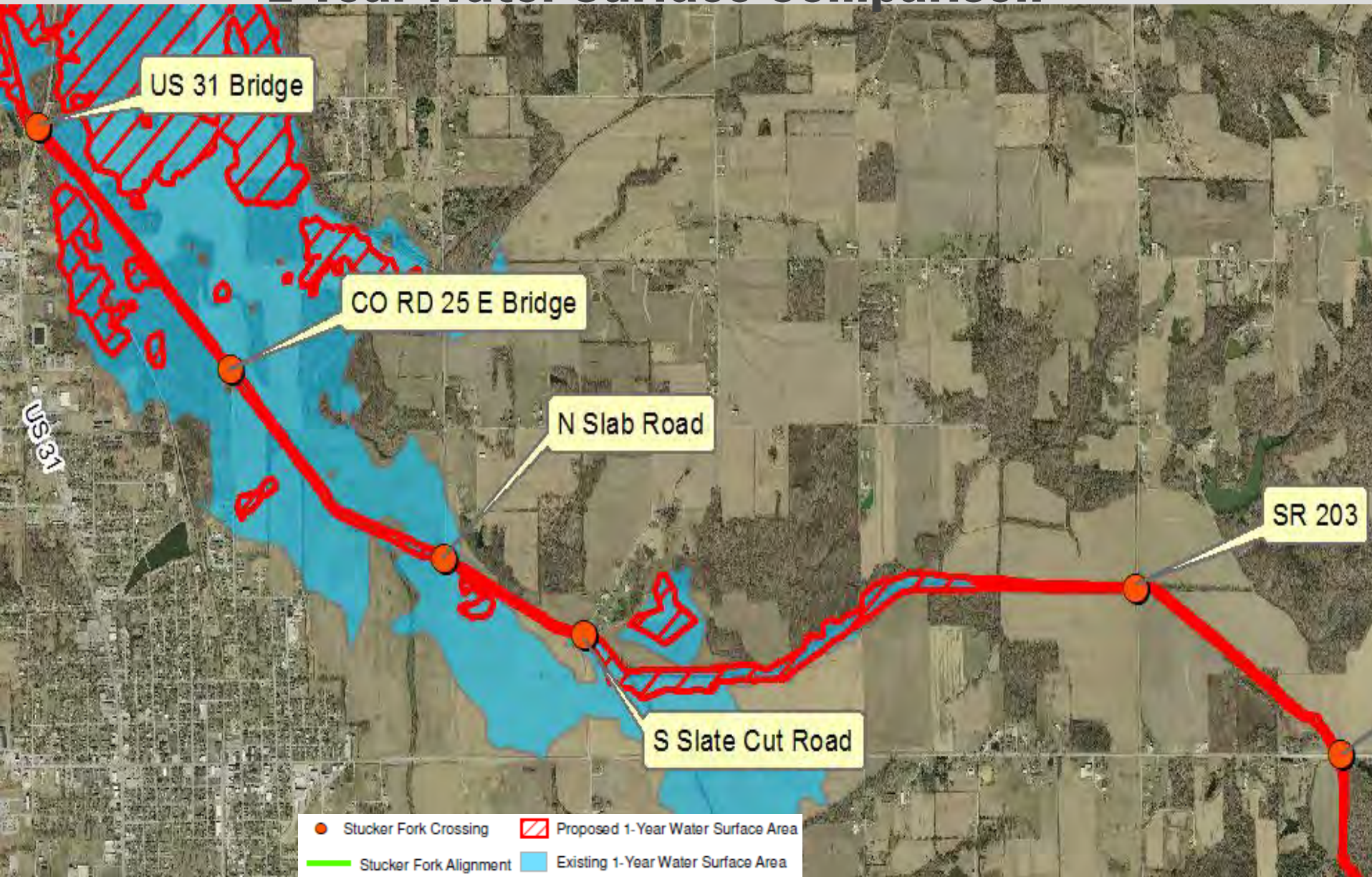
Cross Section

- Channel Bank
- Existing Grade
- Proposed Grade

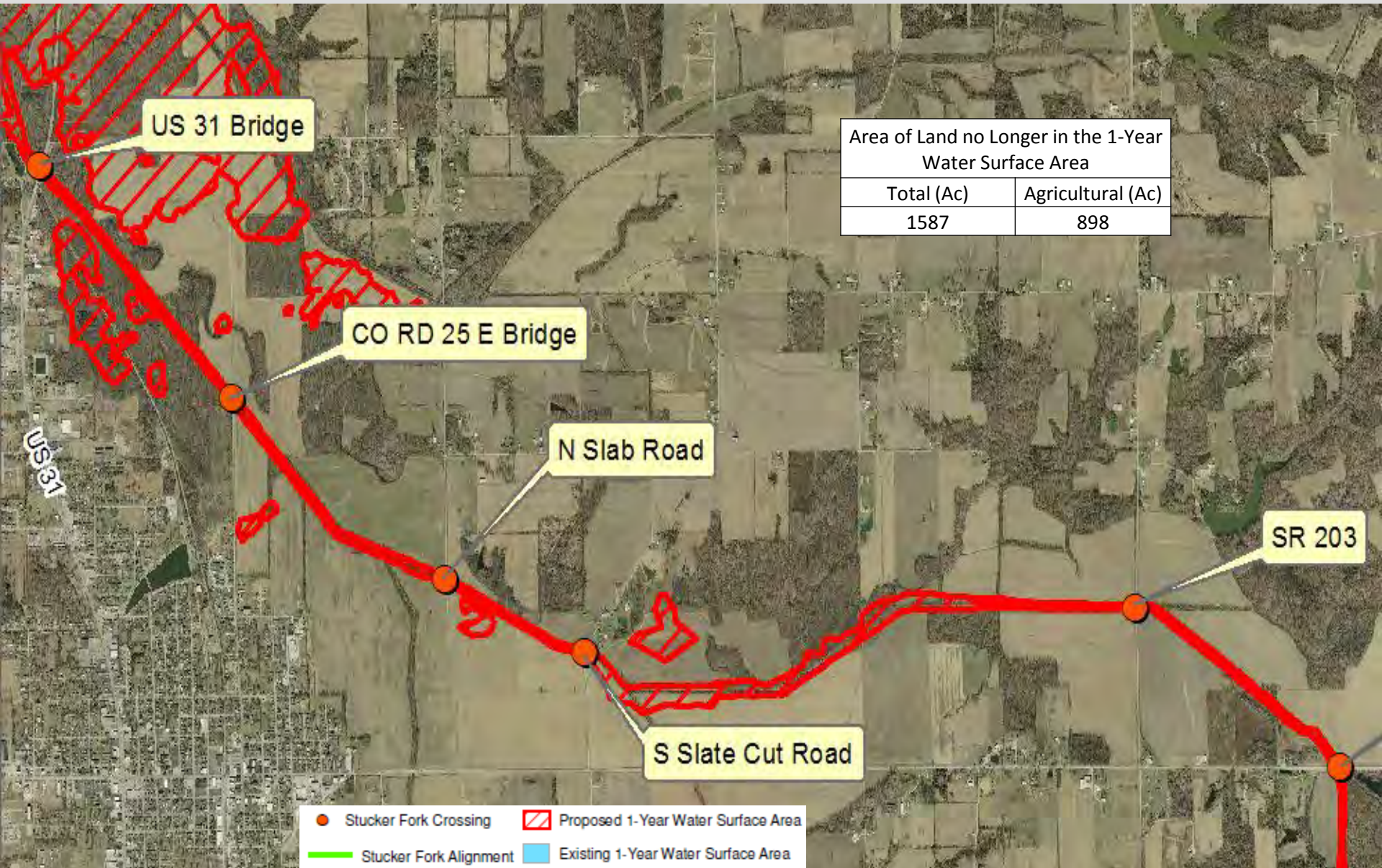
1-Year Water Surface Comparison



1-Year Water Surface Comparison



1-Year Water Surface Comparison



Post-Projects 1-Year Structure Analysis

Crossing/Location	1 YR Model (cfs)	Pressure Flow (Y/N)	Overtopping? (Y/N)	Low Chord (ft)	Roadway Center Line Elevation (ft)	Water Surface (ft)	Low Chord – Water Surface (ft)	Roadway Centerline – Water Surface (ft)
Kinderhook Road	45	N	N	627.66	628	621.13	6.53	6.87
SR 356	90	N	N	600.99	606.91	595.63	5.36	11.28
Plymouth Road	250	N	N	574.12	576.61	570.04	4.08	6.57
CR 150	270	N	N	567.72	570.1	565.72	2	4.38
Field Crossing	280	Y	N	559.04	559.79	559.41	-0.37	0.38
SR 3	1380	N	N	562.25	567.09	556.37	5.88	10.72
SR 56	2360	N	N	565.34	568.54	553.61	11.73	14.93
SR 203	2360	N	N	555.25	557.87	549.09	6.16	8.78
Slate Cut Road	3710	Y	N	540.7	541.52	540.70	0	0.82
Slab Road	3710	N	N	540.2	541.81	539.55	0.65	2.26
CR 25	3870	N	N	538.68	539.91	537.62	1.06	2.29
US 31	3870	N	N	568.07	572.57	535.46	32.61	37.11
Railroad	3870	N	N	541.34	542.09	533.70	7.64	8.39
I65	3870	N	N	542.24	546.08	532.25	9.99	13.83
Boatman Road	3870	N	N	532.35	536.15	531.95	0.4	4.2
Thomastown Road	4300	Y	N	530.07	532.87	530.81	-0.74	2.06
CR 400	4300	N/A	N/A	N/A	N/A	N/A	N/A	N/A

3 Structures with Water Surface above Low Chord
No Structures with Water Surface above Bridge Deck
Slate Cut Rd. No Longer Overtopping



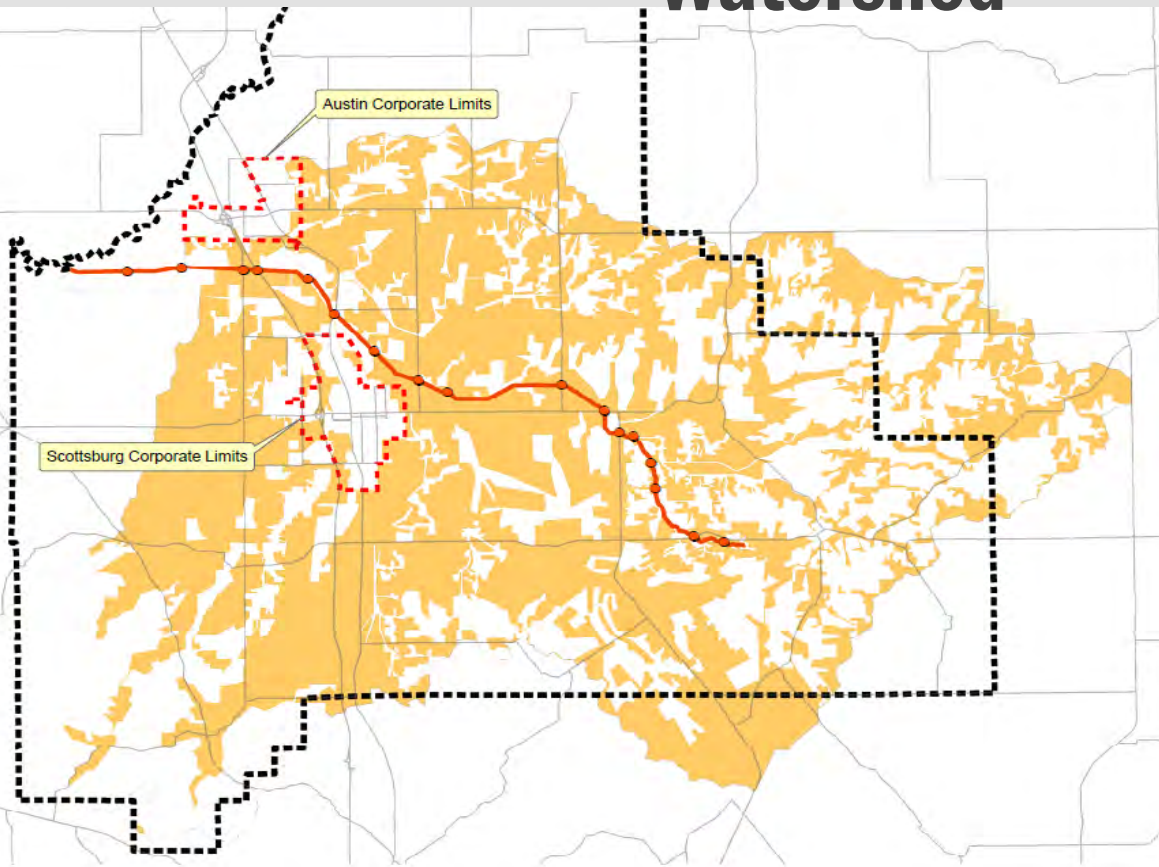


Proposed Watershed Enhancements

Soil Loss Reduction from Agricultural Area of Watershed

47.8 Tons/(Ac-yr) from Bare Agricultural Areas in the Watershed

4.8 Tons/(Ac-yr) from Cover Crop Areas in the Watershed



54.8% Agricultural, 56,000 Ac, 87.7 Sq. Mi.

*1,483,430 Tons/Yr during months **without** cover crops and*

*159,180 Tons/Yr during months **with** cover crops*

Concluding Discussion

- **Modeled Hydrology and Hydraulics for 1-500 Year Storm Events**
- **Assessed 100-Year Storm Event for IDNR**
- **Assessed 1-Year Storm Event for County Projects**
- **Proposed Single Stage Ditch Improvements**



Questions & Answers

Brian Stephens-Hotopp

(317)347-3663 ext. 227

Bstephens-hotopp@hwcengineering.com

Bryan Grotz

(317)347-3663 ext. 235

Bgrotz@hwcengineering.com

