DEEP RIVER-PORTAGE BURNS WATERWAY INITIATIVE

Public/Steering Committee Meeting

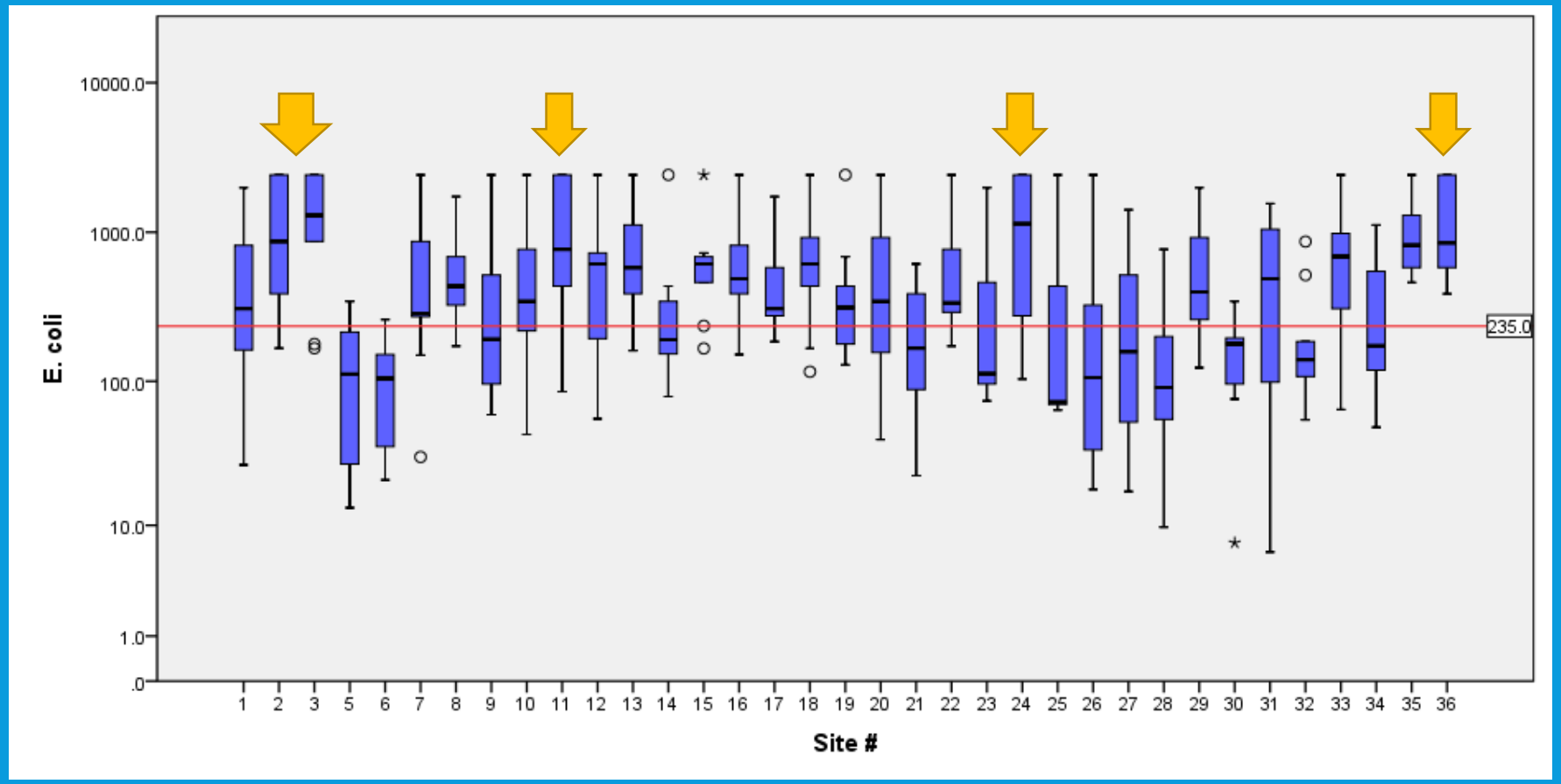
Lake County

February 17, 2015

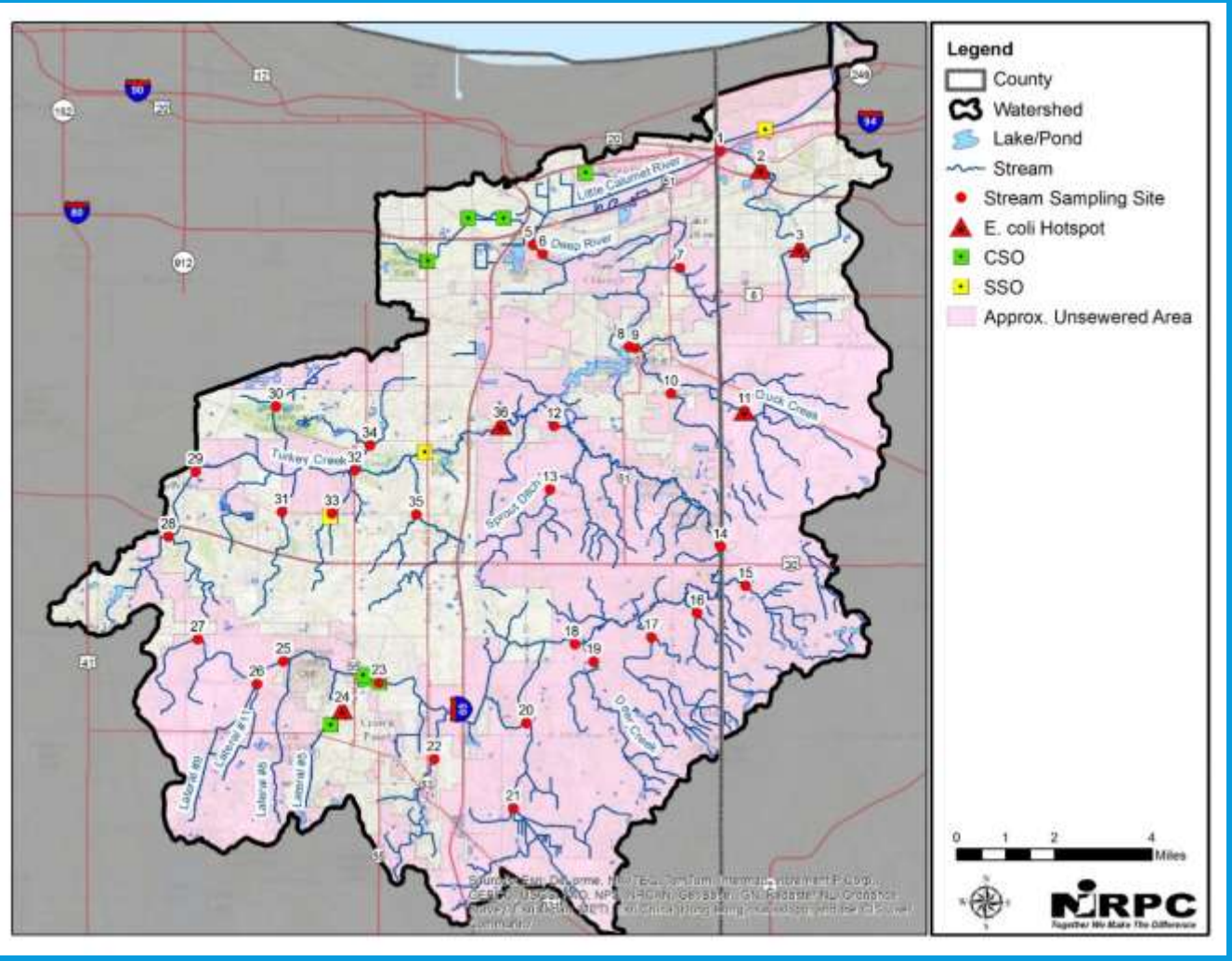
RECREATIONAL USE

Is Water Quality Safe Enough for Swimming?

PROBLEM- ELEVATED PATHOGENS



E. COLI- POTENTIAL CAUSES & SOURCES?

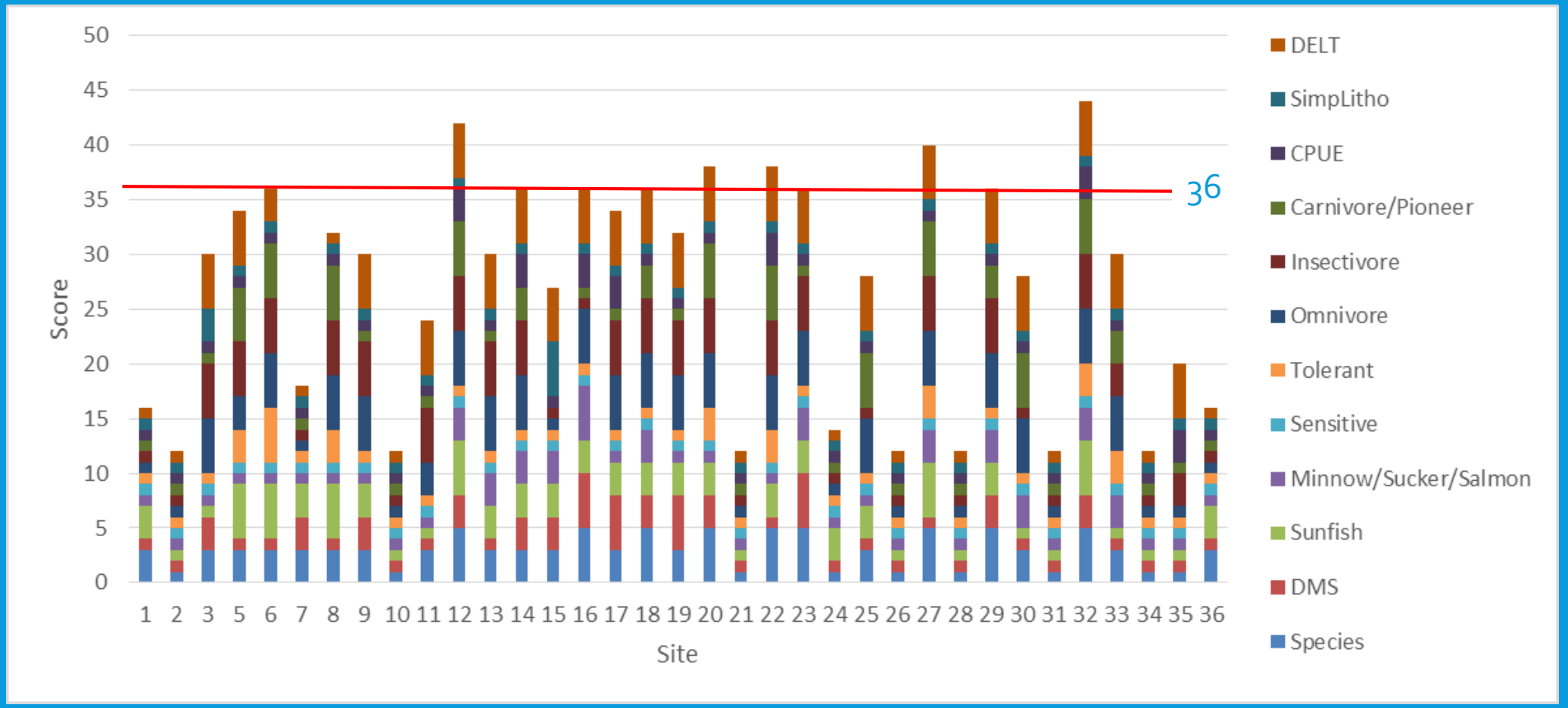


- Significant positive correlation with Total Solids, Total Dissolved Solids, Conductivity, and Chlorides
- Significant negative correlation with forest and wetland cover.
- Exceedances occur across low to moderately high flow stream conditions- Point & Nonpoint Sources

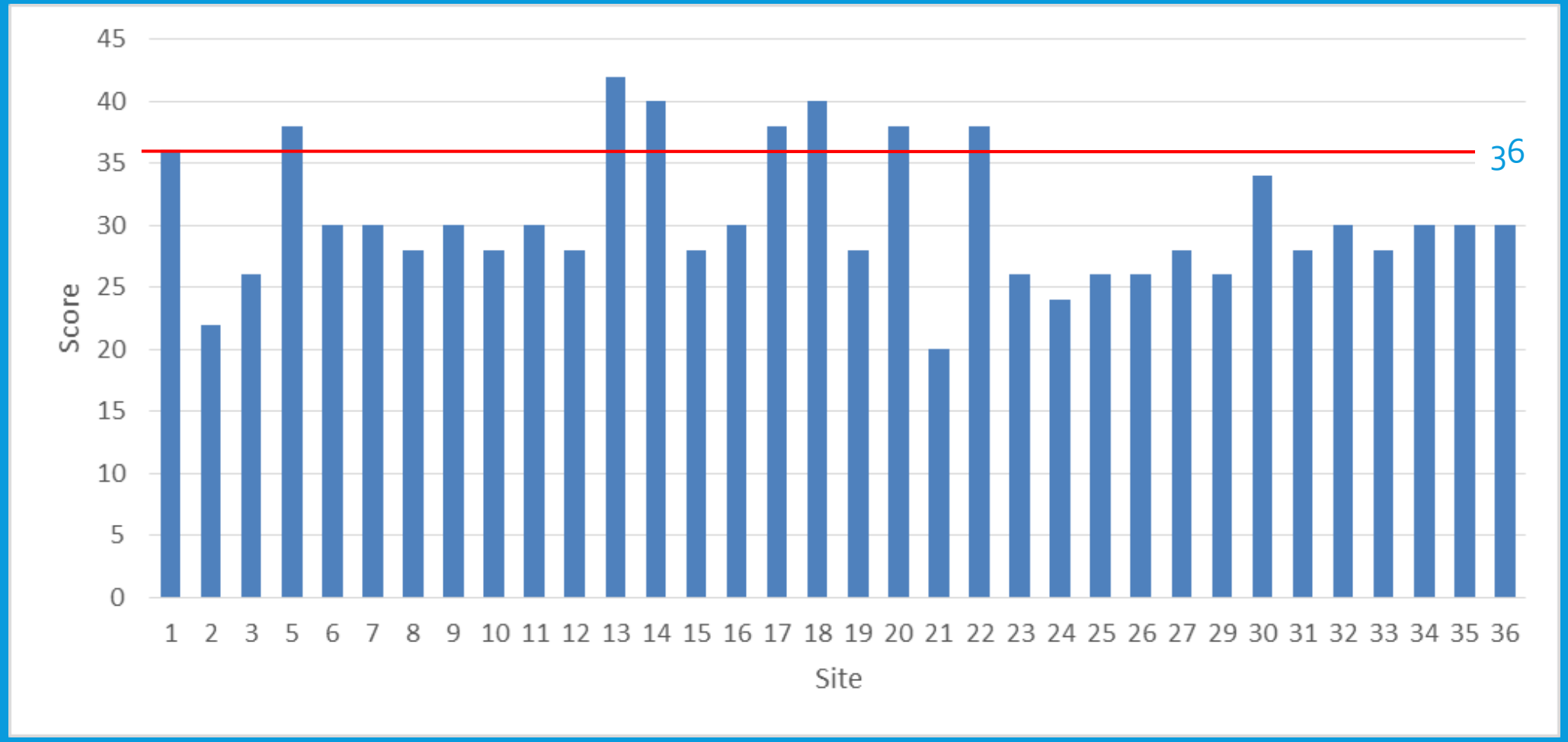
AQUATIC LIFE SUPPORT

Do the Streams Support A Healthy Fishery?

FISH- INDEX OF BIOTIC INTEGRITY



MACROINVERTEBRATE- INDEX OF BIOTIC INTEGRITY



STRESSOR IDENTIFICATION

CANDIDATE CAUSES

- Increased stream temperature
- Low dissolved oxygen levels
- Excess nutrient loading
- Ammonia toxicity
- Sediment loading
- Poor habitat quality

BIOTIC IMPAIRMENT / STRESSOR CO-OCCURRENCE

Site	Biotic Impairment		Candidate Causes/ Stressors											
			↑Temp	↓DO	↑ Nutrients			Toxicity	↑ Sediment		↓Habitat Quality			
	Fish	Macros	Temp	DO	TP	NO3	TKN	NH3	TSS	Turb	QHEI	Emb	Chan	Grad
1	Yes	No	0	+	+	0	0	+	-	+	-	+	+	0
2	Yes	Yes	0	-	-	0	0	0	-	-	+	-	-	-
3	Yes	Yes	0	-	-	0	0	+	-	0	+	-	+	+
5	Yes	No	0	-	+	-	0	0	-	+	-	+	+	0
6	No	Yes	0	-	+	-	0	0	-	0	-	+	+	0
7	Yes	Yes	0	-	+	-	0	0	-	+	+	+	-	+
8	Yes	Yes	0	+	+	-	0	+	-	0	-	+	+	0
9	Yes	Yes	0	-	+	-	0	0	-	-	+	+	+	+
10	Yes	Yes	0	-	+	-	0	-	-	-	+	+	+	0
11	Yes	Yes	0	+	+	0	0	0	-	+	-	+	-	-
12	No	Yes	0	-	+	0	0	0	-	+	-	+	-	+
13	Yes	No	0	-	-	-	0	0	-	+	-	+	+	-
14	No	No	0	-	+	0	0	0	-	-	-	-	-	-

EXPLORING RELATIONSHIPS BETWEEN STRESSORS

		DO	DO % Sat	NH3	NO3	TKN	TP	TSS	Turb	TS	TDS	E coli	pH	Cond	Chl	TOC	COD
DO	Corr.	1.000	.981**	-.730**	.373*	-.581**	-.539**	-.146	-.179	-.294	-.055	.190	.845**	-.253	-.178	-.719**	-.632**
	Sig.	.	.000	.000	.027	.000	.001	.401	.303	.087	.753	.275	.000	.143	.305	.000	.000
	N	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
DO % Sat	Corr.	.981**	1.000	-.762**	.347*	-.562**	-.521**	-.143	-.162	-.332	-.090	.137	.872**	-.299	-.194	-.693**	-.593**
	Sig.	.000	.	.000	.041	.000	.001	.413	.353	.051	.607	.432	.000	.081	.265	.000	.000
	N	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
NH3	Corr.	-.730**	-.762**	1.000	.139	.637**	.612**	.174	.051	.407*	.205	-.026	-.727**	.373*	.385*	.622**	.520**
	Sig.	.000	.000	.	.426	.000	.000	.318	.773	.015	.238	.881	.000	.027	.022	.000	.001
	N	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
NO3	Corr.	.373*	.347*	.139	1.000	.152	.216	-.067	-.211	-.052	-.019	.198	.158	.003	.101	-.090	-.054
	Sig.	.027	.041	.426	.	.384	.212	.704	.224	.767	.914	.254	.363	.986	.563	.607	.756
	N	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
TKN	Corr.	-.581**	-.562**	.637**	.152	1.000	.864**	.381*	.258	.150	.008	-.270	-.539**	.095	.161	.865**	.876**
	Sig.	.000	.000	.000	.384	.	.000	.024	.135	.389	.962	.117	.001	.587	.357	.000	.000
	N	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
TP	Corr.	-.539**	-.521**	.612**	.216	.864**	1.000	.452**	.374*	.151	-.029	-.241	-.587**	.100	.261	.852**	.873**
	Sig.	.001	.001	.000	.212	.000	.	.006	.027	.385	.867	.163	.000	.567	.131	.000	.000
	N	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
TSS	Corr.	-.146	-.143	.174	-.067	.381*	.452**	1.000	.814**	.309	.201	.020	-.017	.151	.133	.388*	.486**
	Sig.	.401	.413	.318	.704	.024	.006	.	.000	.071	.247	.907	.921	.387	.445	.021	.003
	N	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Turb	Corr.	-.179	-.162	.051	-.211	.258	.374*	.814**	1.000	.178	.050	.068	-.037	.096	.163	.354*	.425*
	Sig.	.303	.353	.773	.224	.135	.027	.000	.	.305	.774	.698	.832	.585	.349	.037	.011
	N	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

SIGNIFICANTLY PREDICTIVE VARIABLES

Fish Community Structure

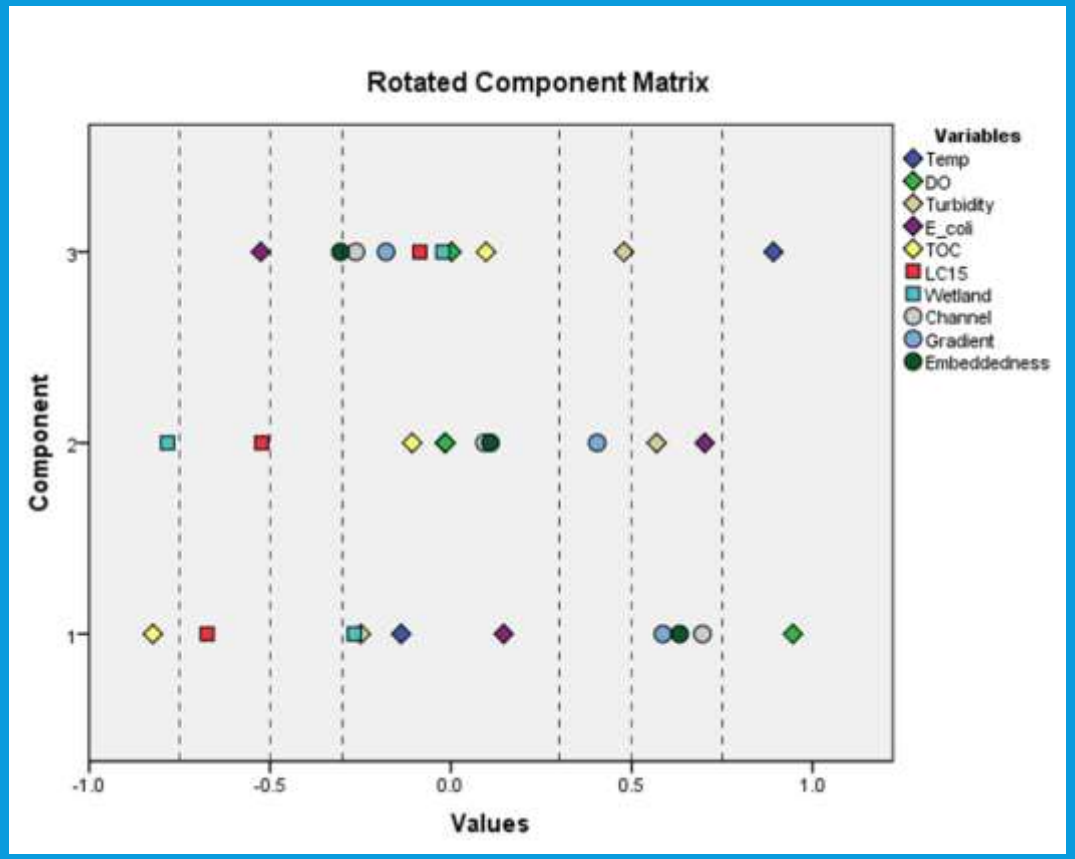
- Water temperature
- Dissolved oxygen
- Turbidity
- E. coli
- Total organic carbon
- Chemical oxygen demand
- Wetland
- Channel morphology
- Stream gradient
- Stream embeddedness

Macroinvertebrate Community Structure

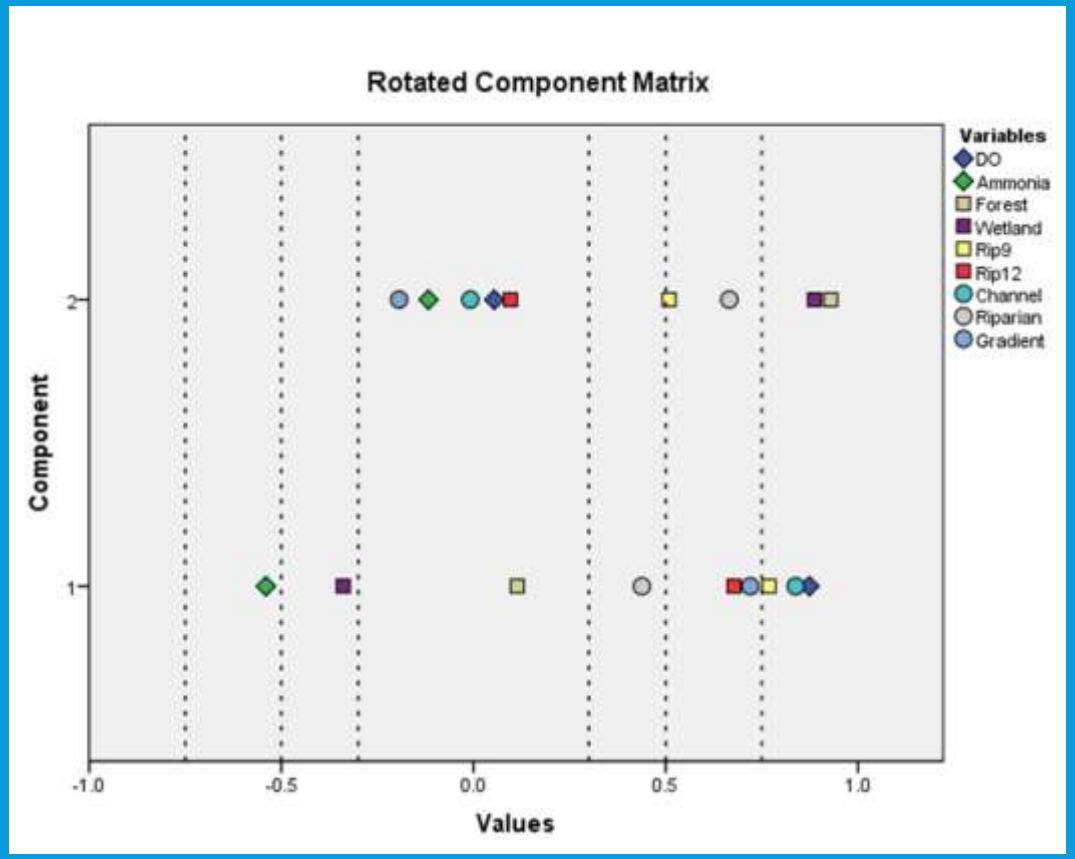
- Dissolved oxygen
- Dissolved oxygen % saturation
- Ammonia
- pH
- Wetland
- Forest
- Scrub/shrub
- Channel morphology
- Riparian quality
- Stream Gradient

WHAT FACTORS BEST EXPLAIN THE VARIABILITY IN COMMUNITY STRUCTURE?

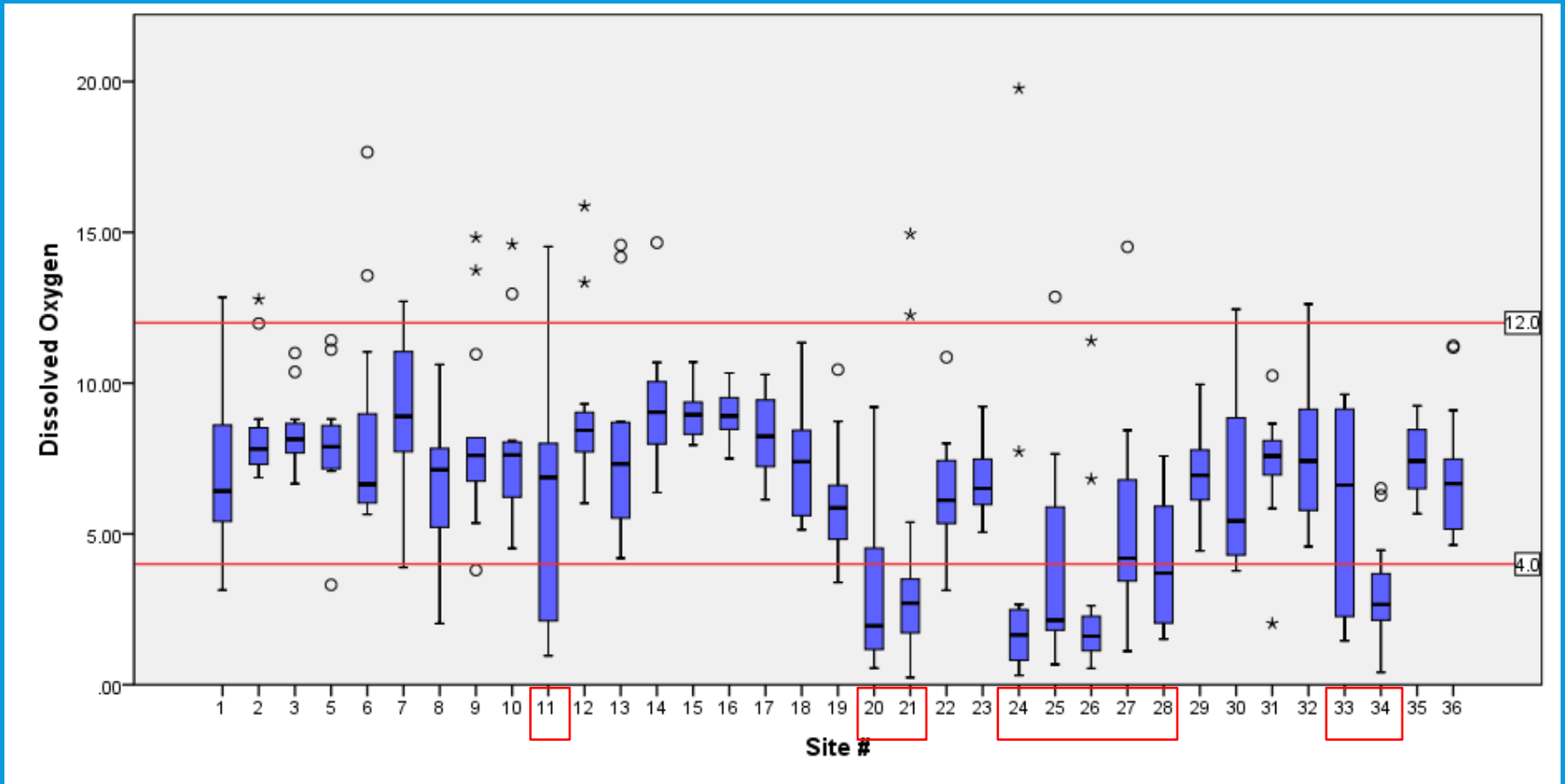
Fish Community Structure



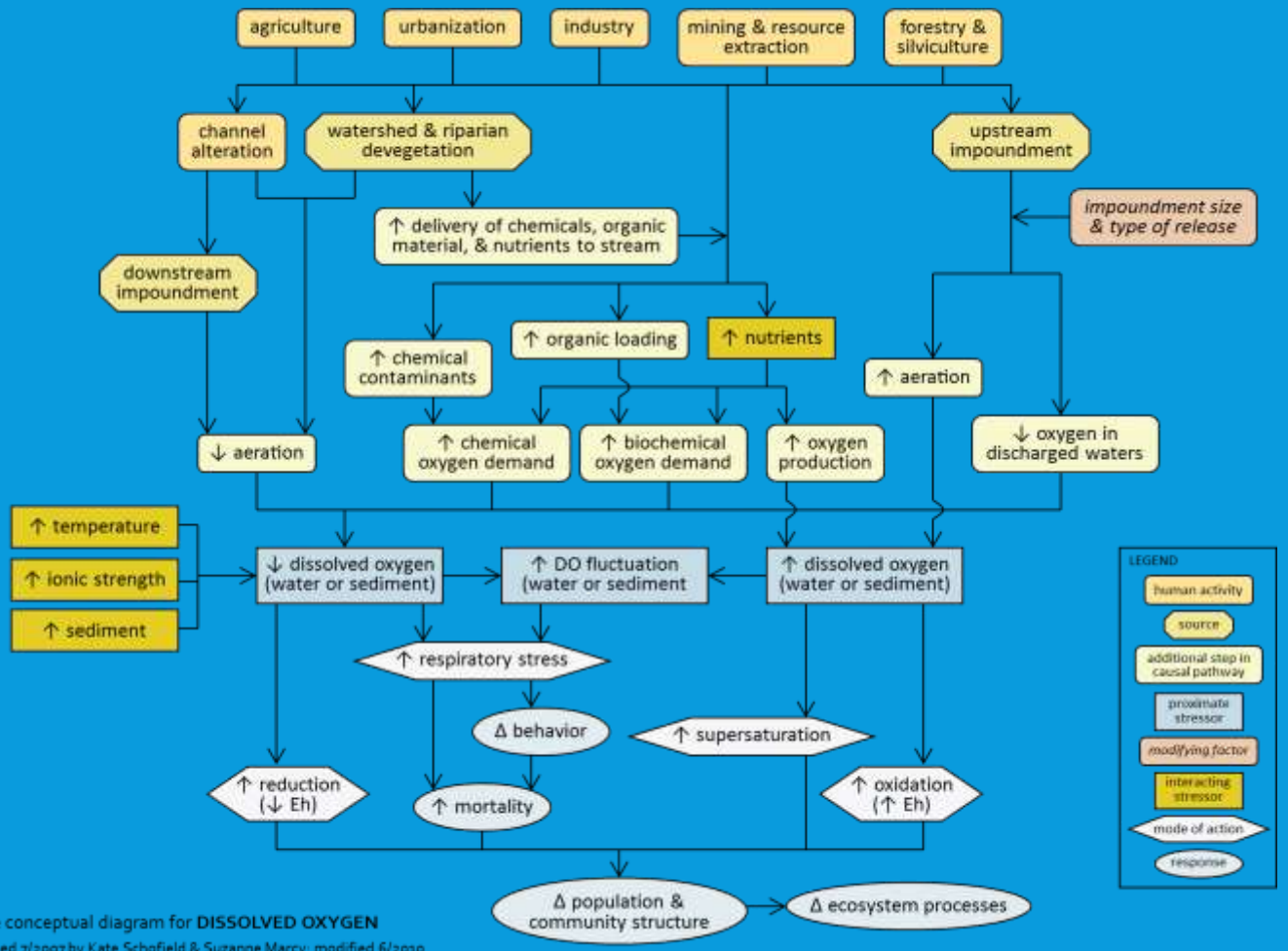
Macroinvertebrate Community Structure



PROBLEM- LOW DISSOLVED OXYGEN



DISSOLVED OXYGEN- CONCEPTUAL CAUSAL PATHWAY

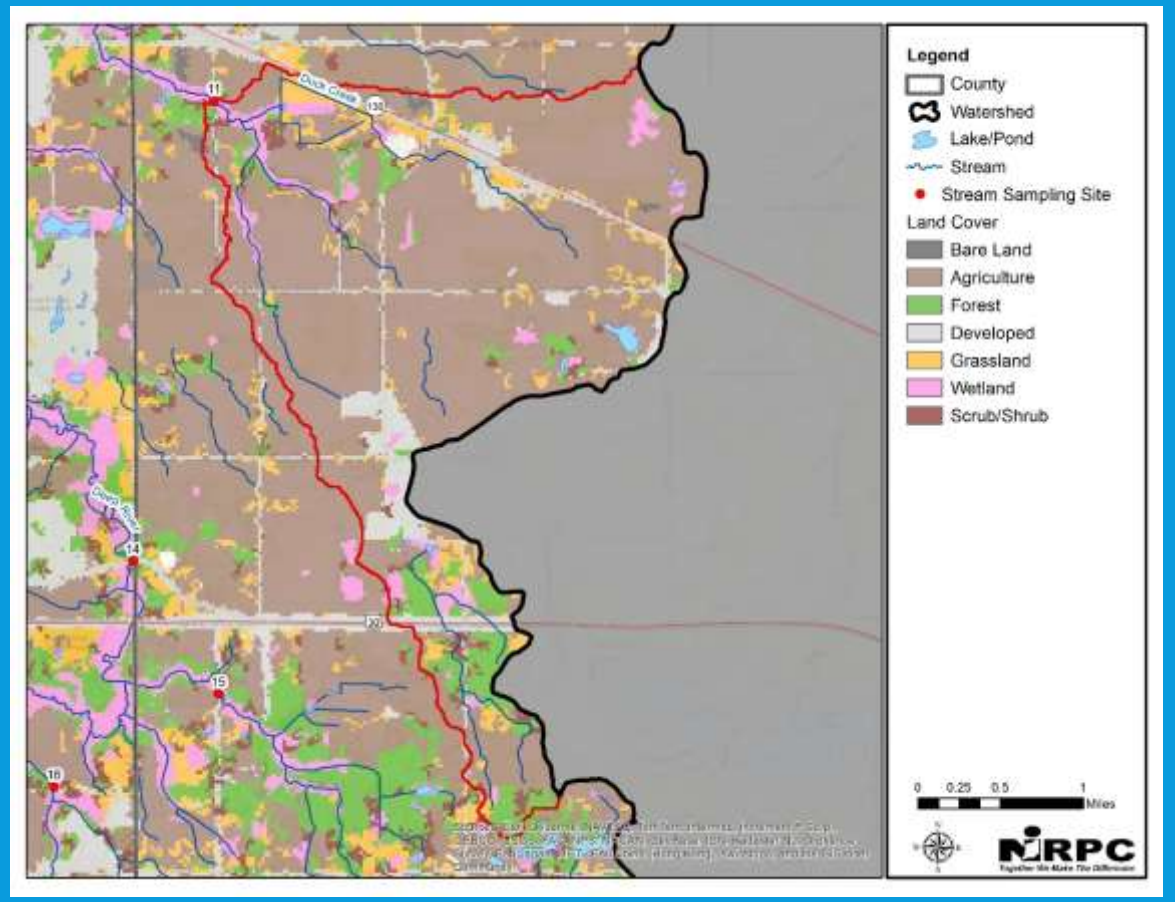


Simple conceptual diagram for **DISSOLVED OXYGEN**

Developed 7/2007 by Kate Schofield & Suzanne Marcy; modified 6/2010

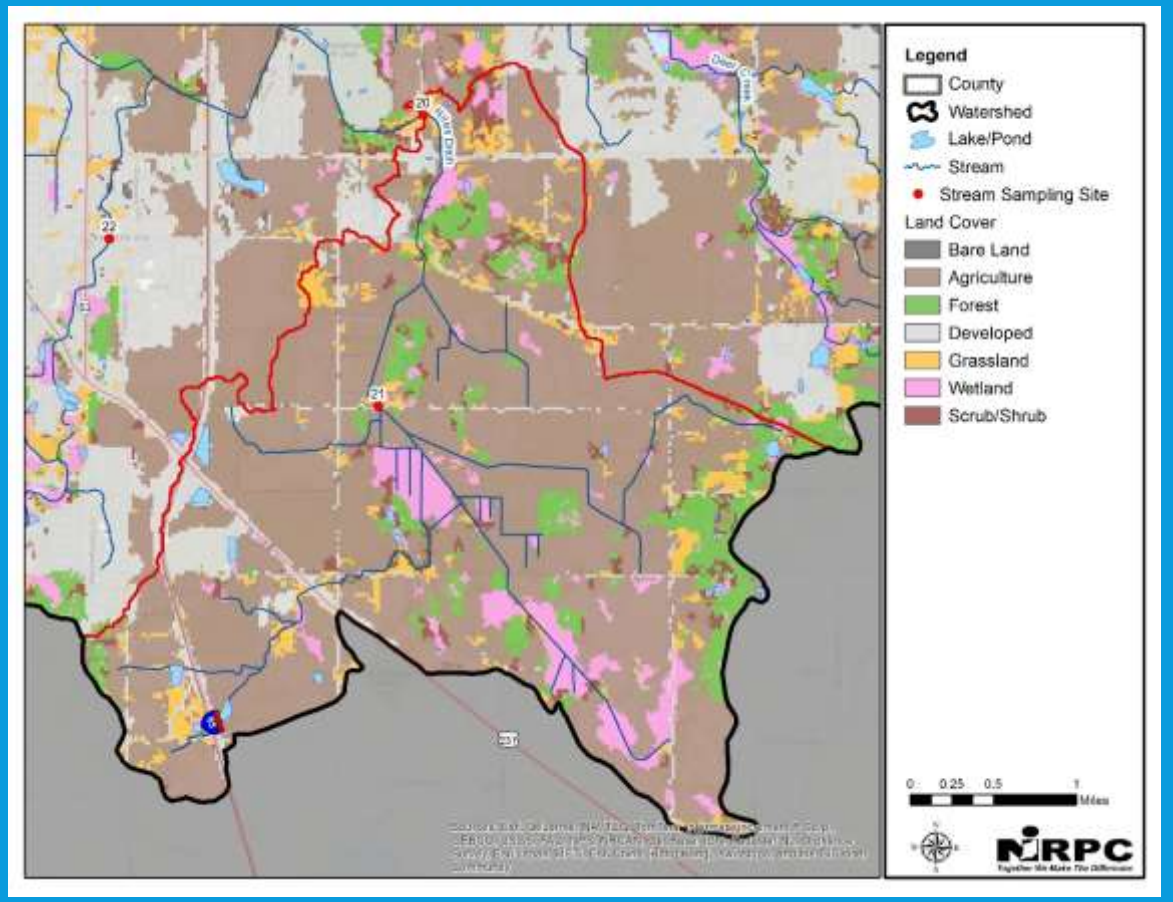
SITE 11

- 69% agriculture, 10% developed
- Riparian area- 28% developed, 22% agriculture
- Channel alteration
- nutrients, organic loading, sedimentation, turbid



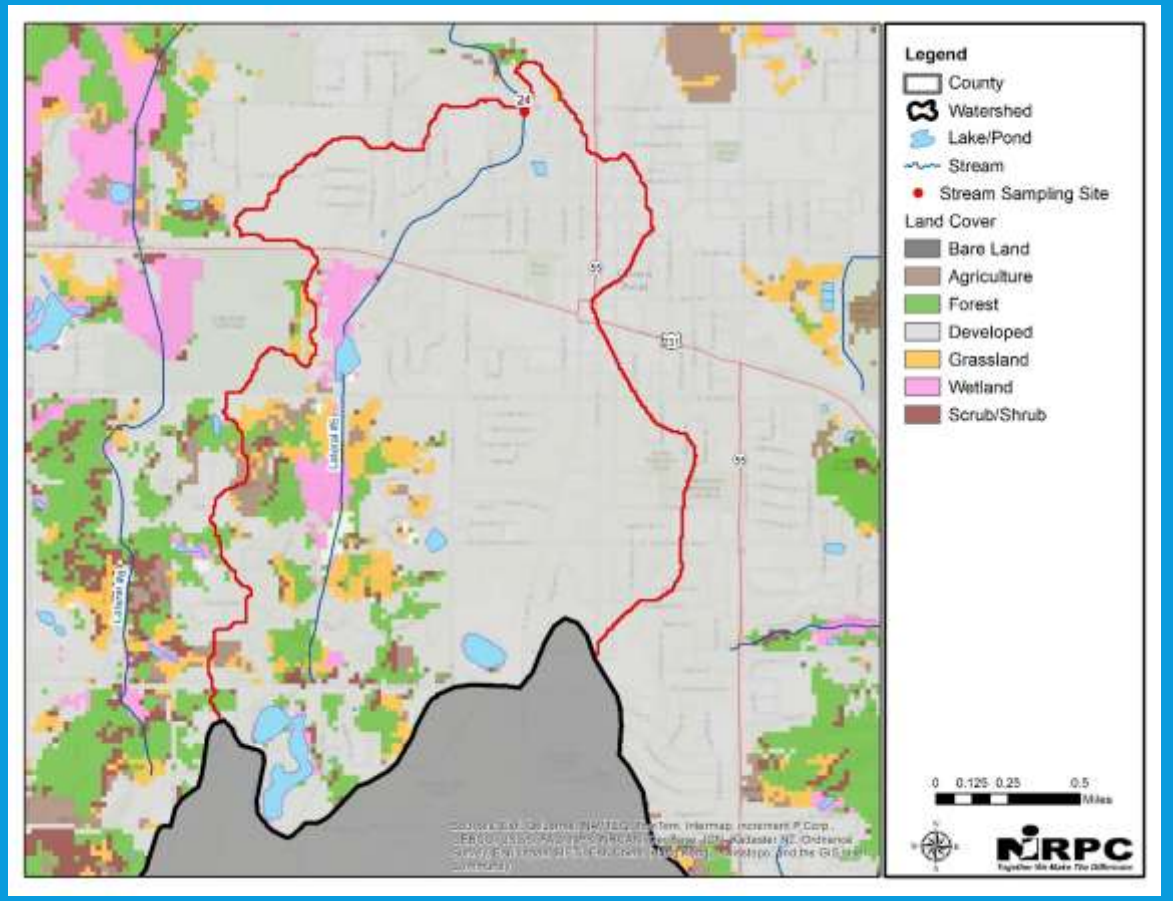
SITE 20 & 21

- 67% agriculture, 8% developed
- Riparian- 60% agriculture, 4% developed
- Channel alteration
- Nutrients, organic loading, sedimentation, turbid



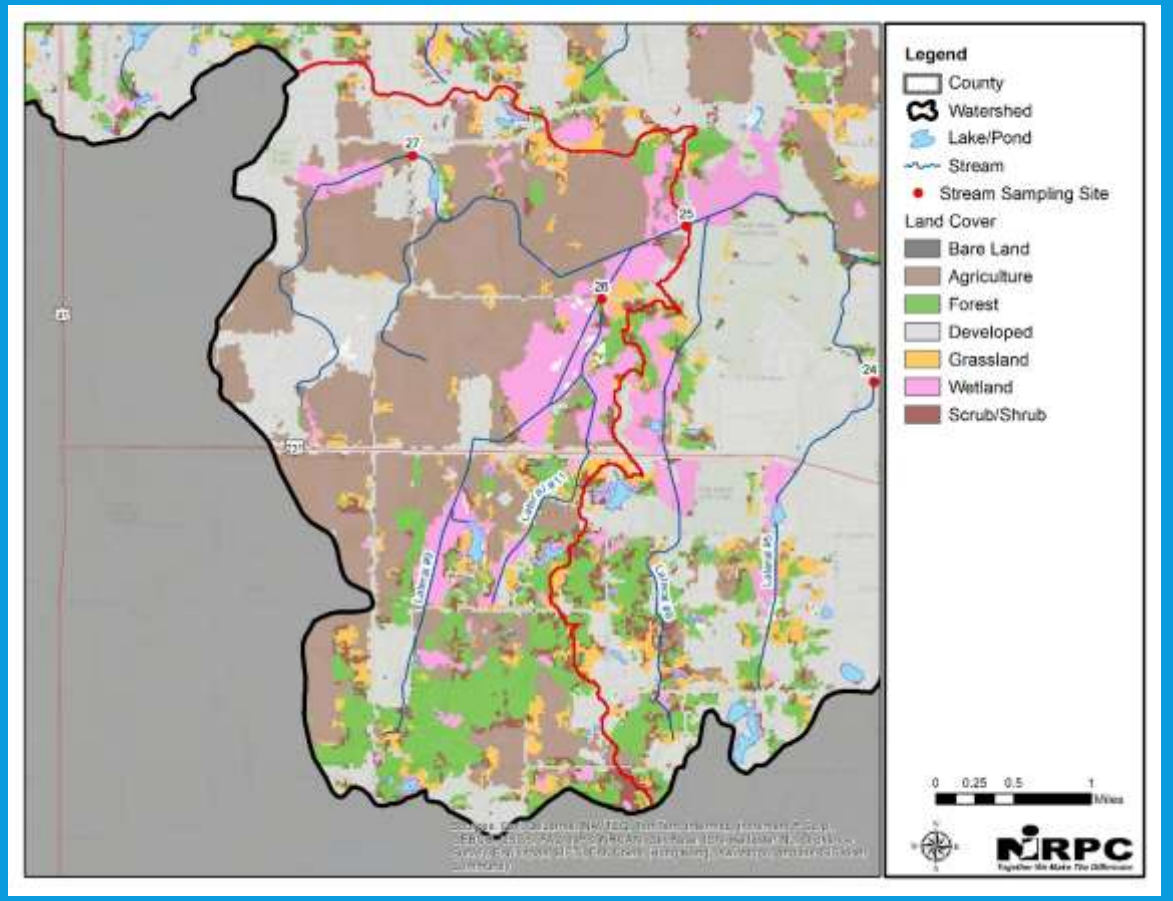
SITE 24

- 81% developed, 2% agriculture
- Riparian- 60% developed, 0% agriculture
- Channel alteration
- CSO upstream
- Nutrients, organic loading, sedimentation



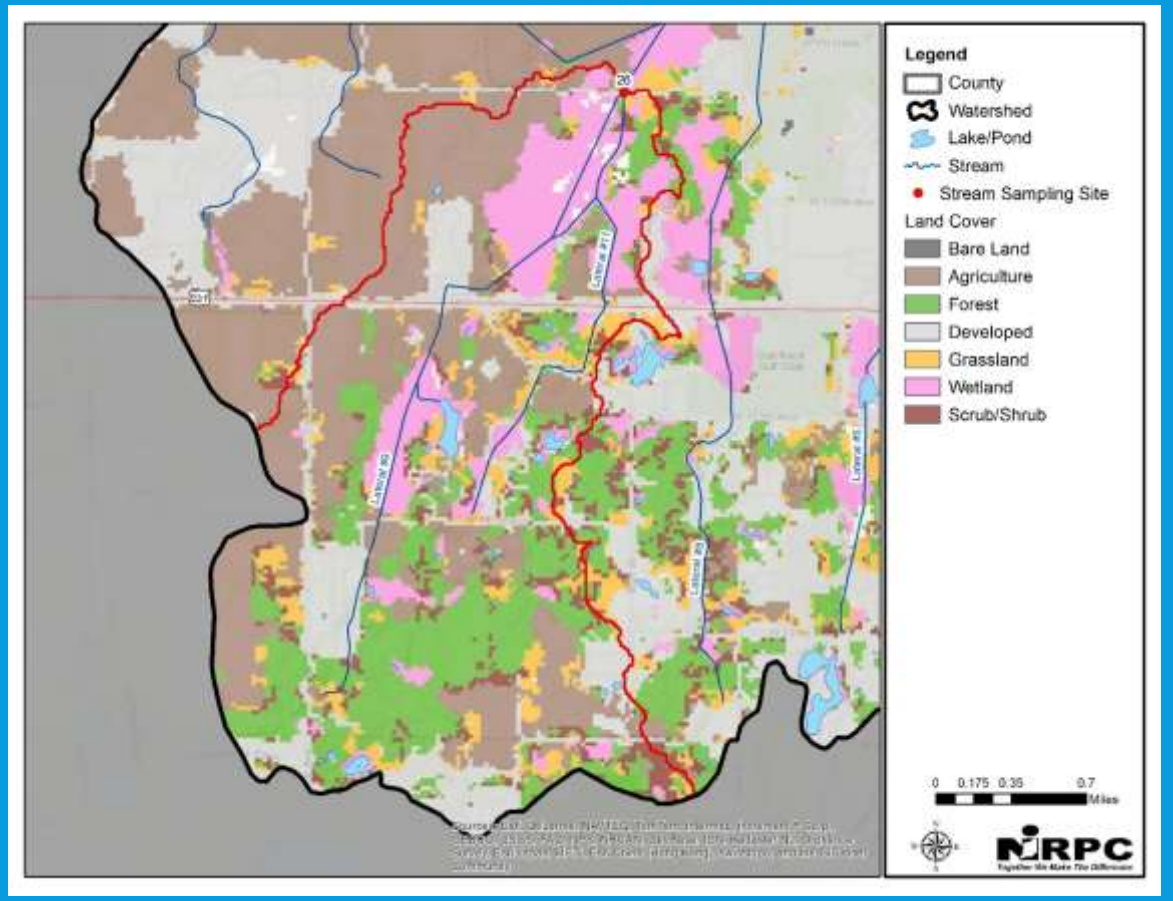
SITE 25

- 43% agriculture, 24% developed
- 31% agriculture, 23% developed
- Channel alteration
- Nutrients, organic loading, sedimentation, turbid



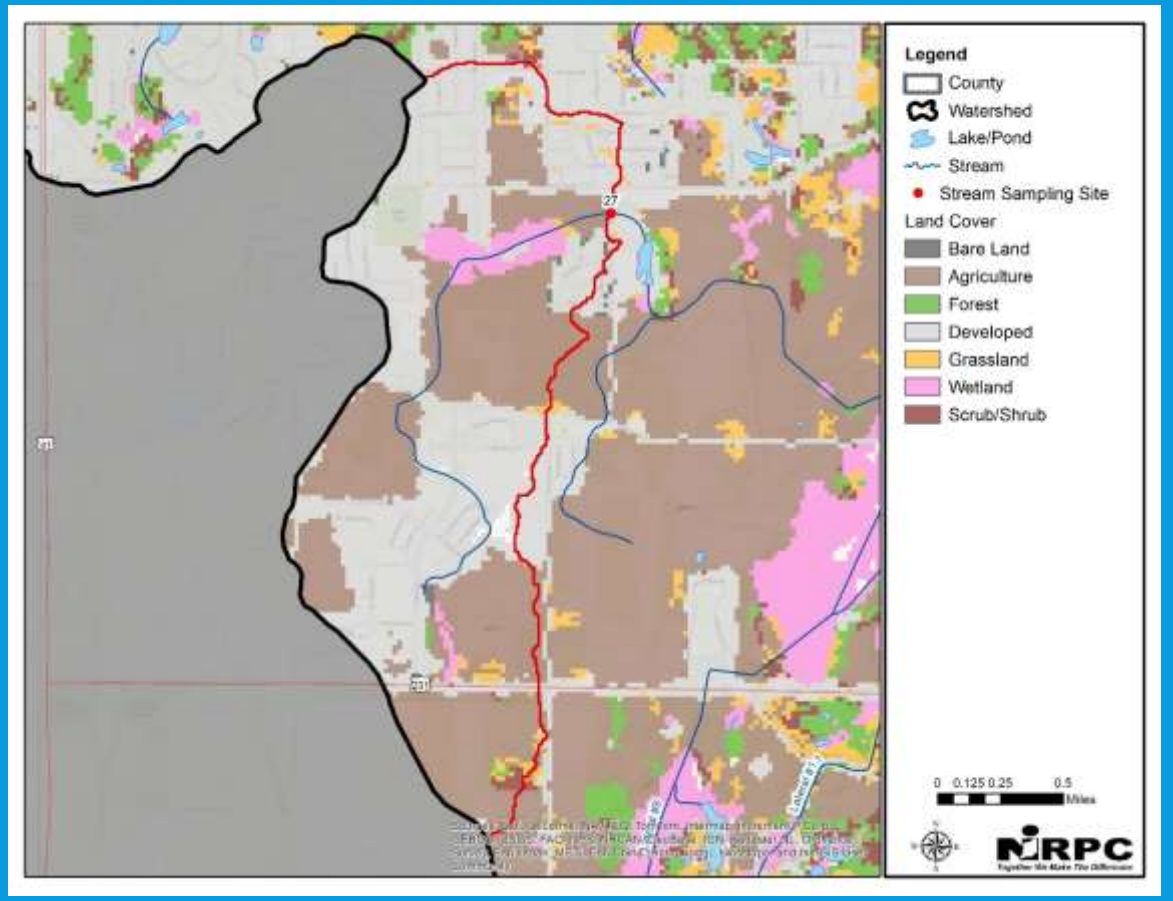
SITE 26

- 33 % agriculture, 16% developed
- Riparian- 26% developed, 11% agriculture
- 14% wetland
- Channel alteration
- Nutrients, organic loading, sedimentation, turbid



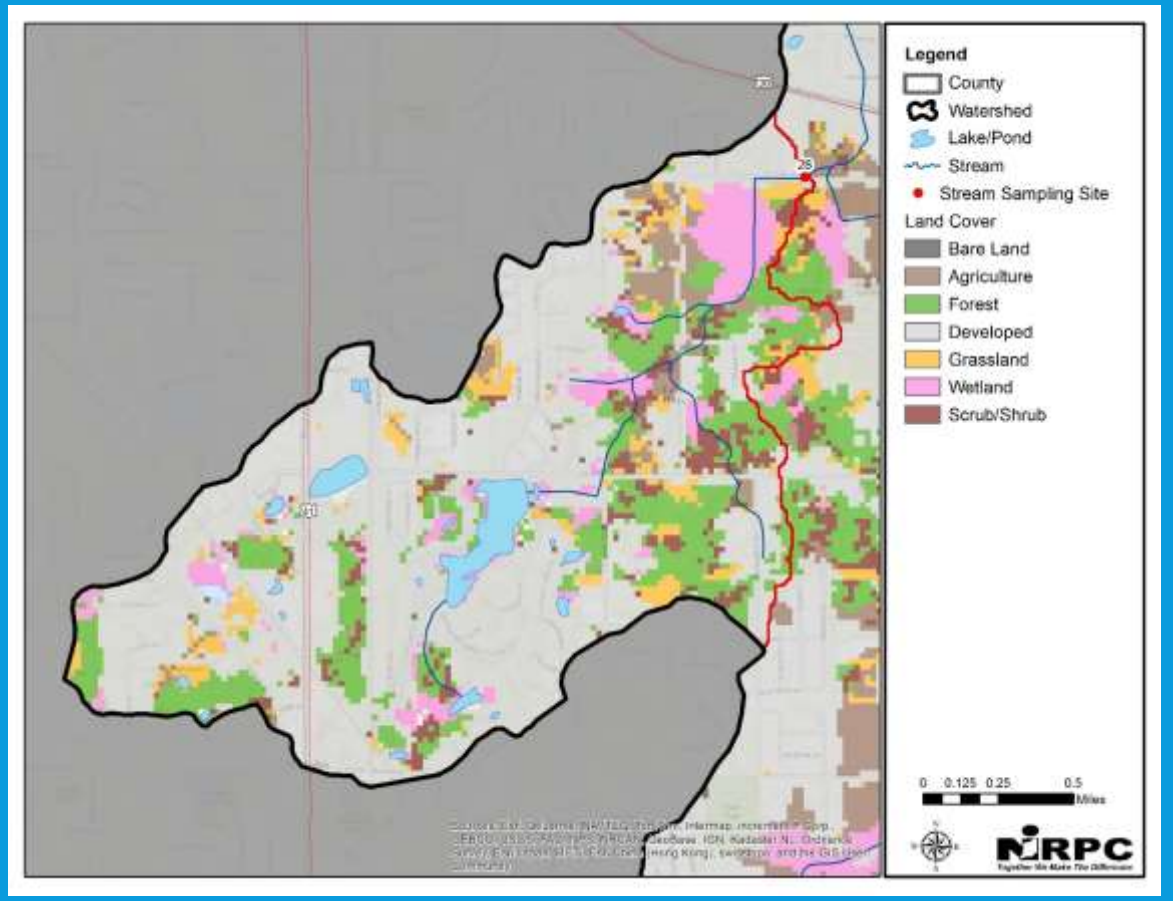
SITE 27

- 49% developed, 44% agriculture
- Riparian- 38% developed, 37% agriculture
- Channel alteration
- Nutrients, organic loading, sedimentation, turbid



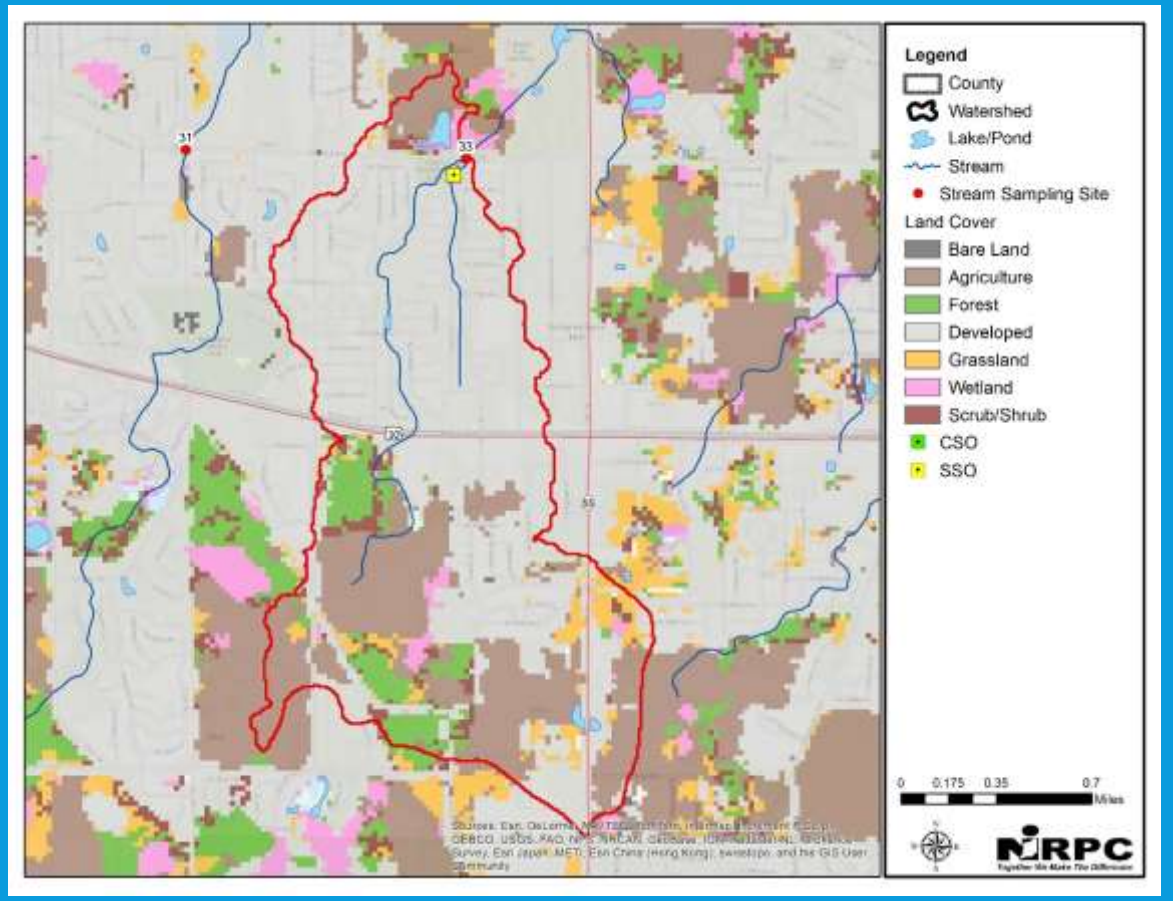
SITE 28

- 61% developed, 4% agriculture
- Riparian- 33% developed, 7% agriculture
- Channel alteration
- Nutrients, organic loading, sedimentation



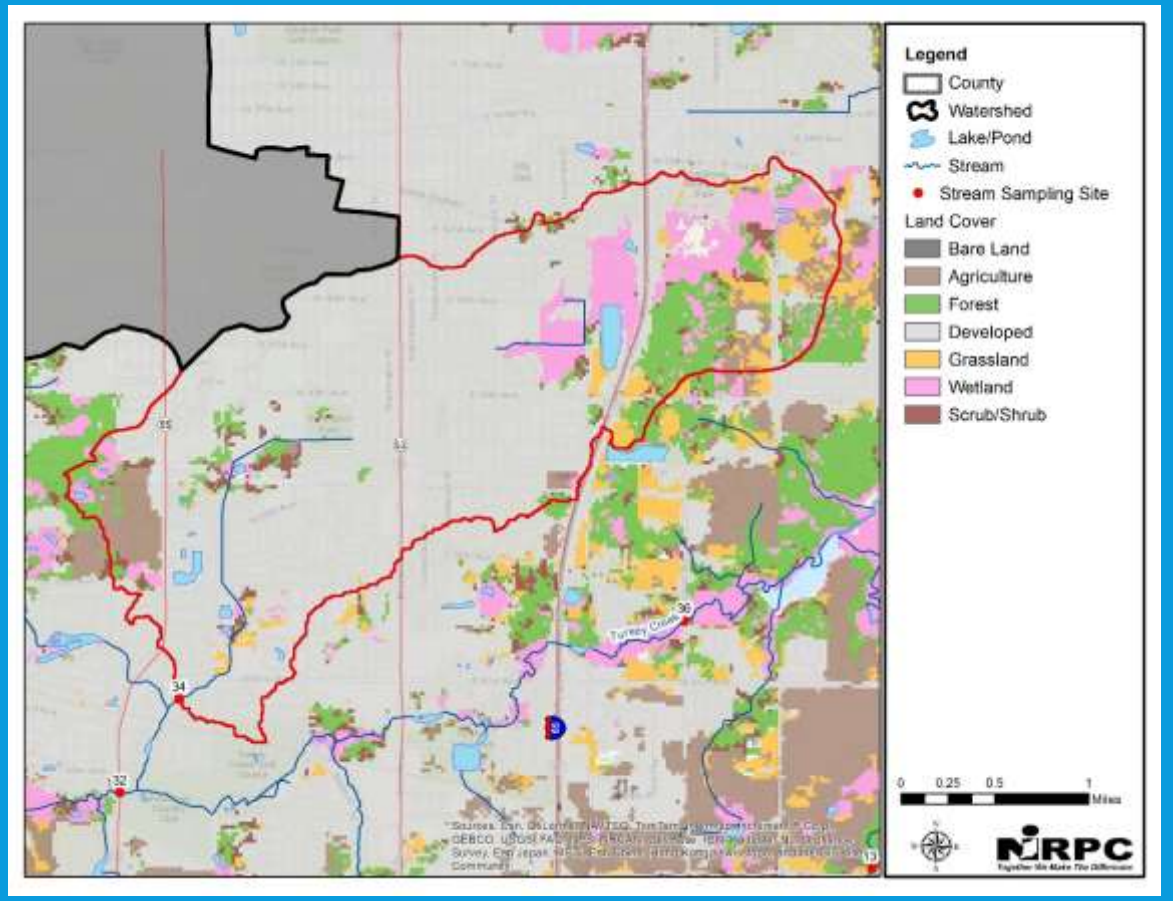
SITE 33

- 62% developed, 25% agriculture
- Riparian- 80% developed, 12% agriculture
- Channel alteration
- Sanitary sewer overflow upstream
- Nutrients, organic loading, sedimentation, turbid

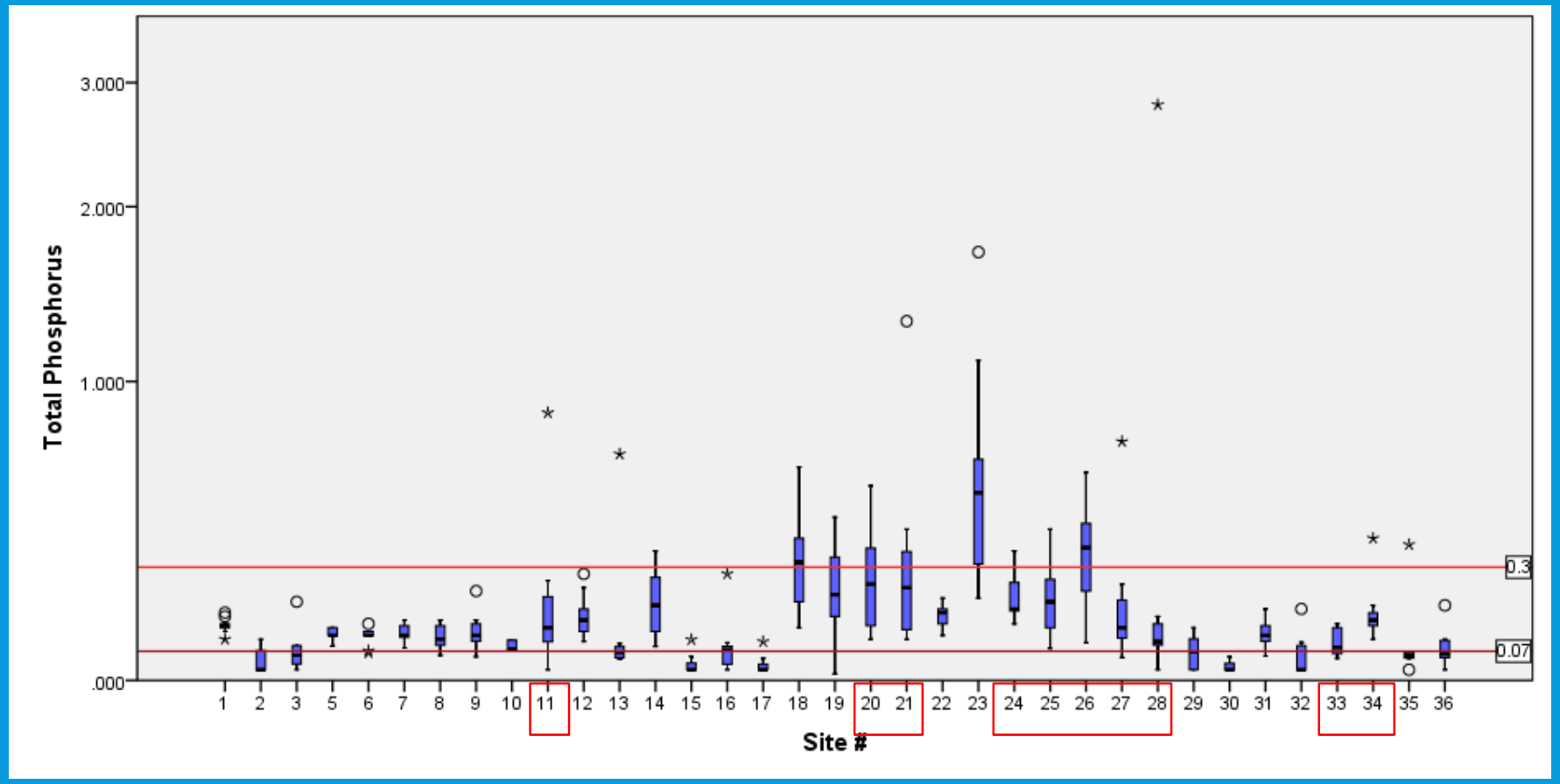


SITE 34

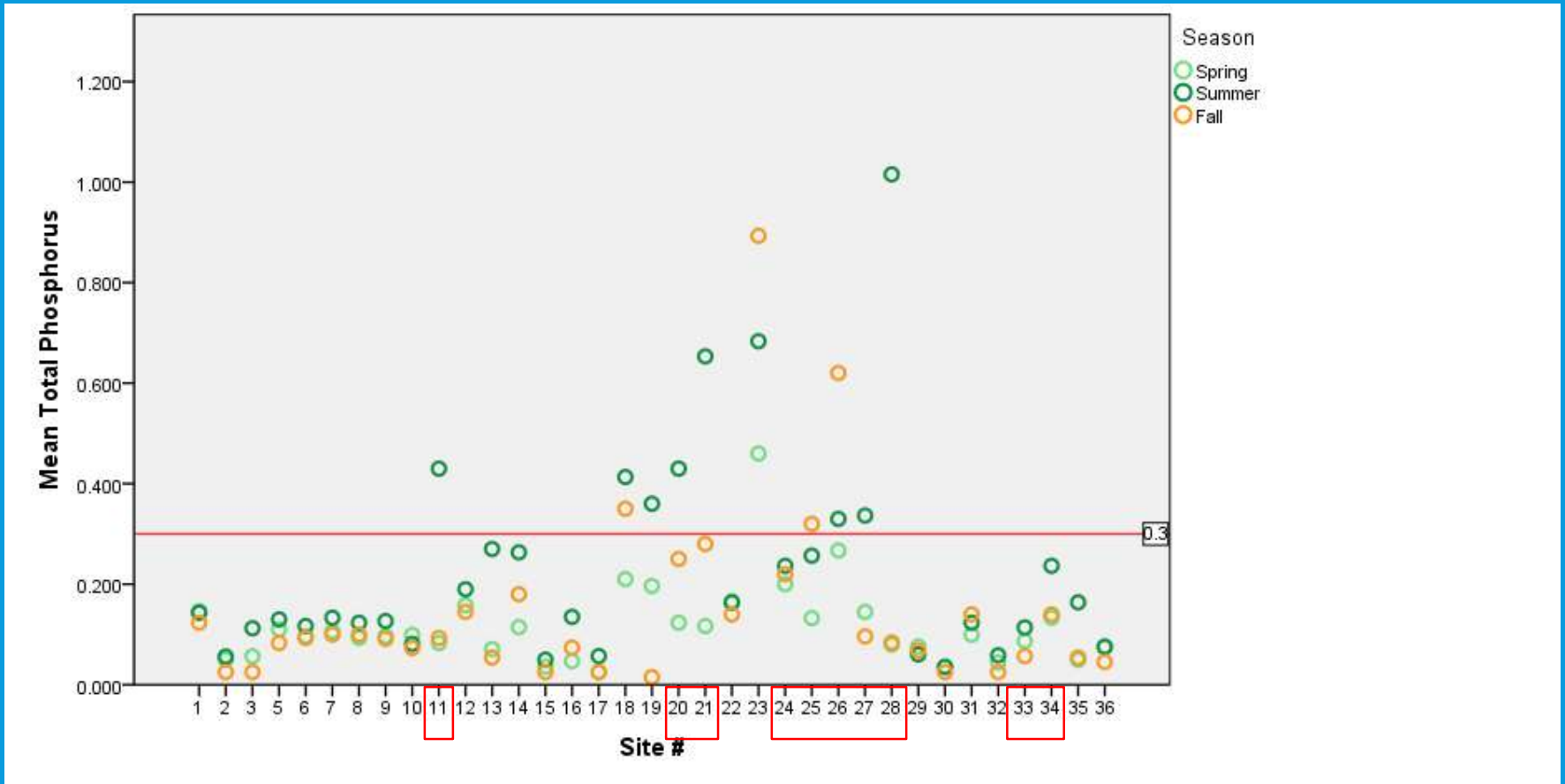
- 73% developed, 4% agriculture
- Riparian- 68% developed, < 1% agriculture
- Channel alteration
- Nutrients, organic loading, sedimentation, turbid



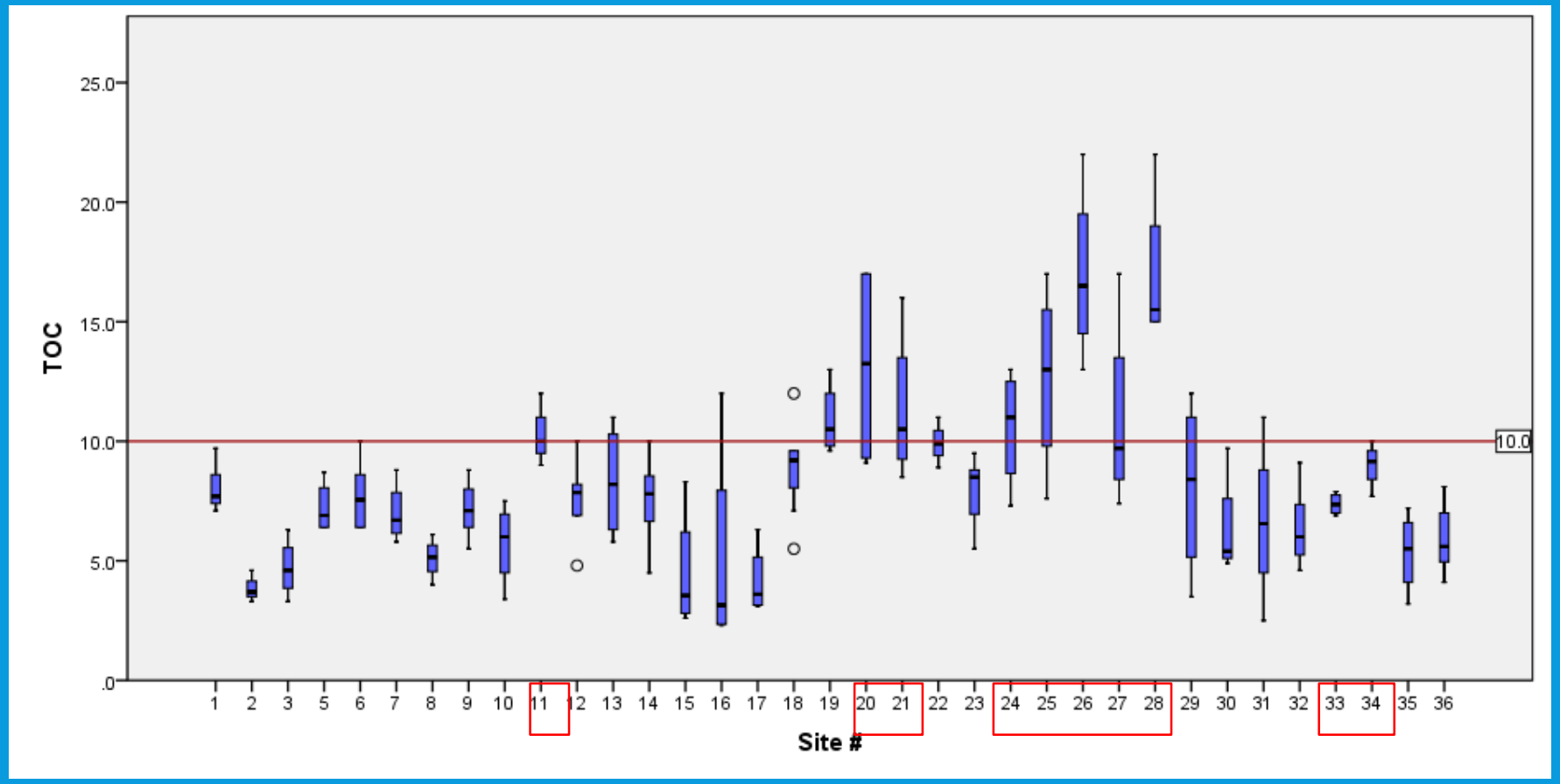
NUTRIENTS- PHOSPHORUS



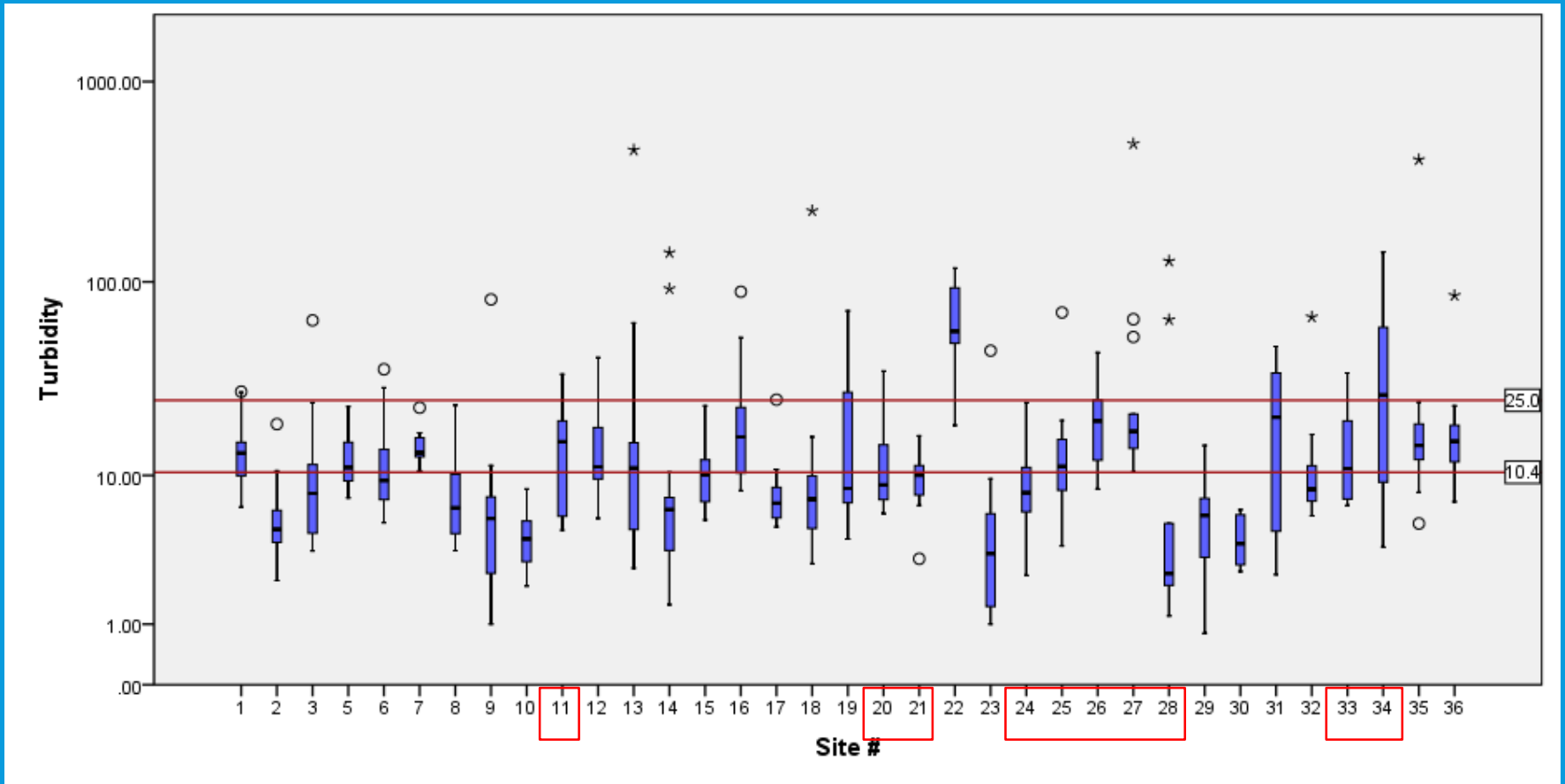
SEASONAL DIFFERENCES IN PHOSPHORUS



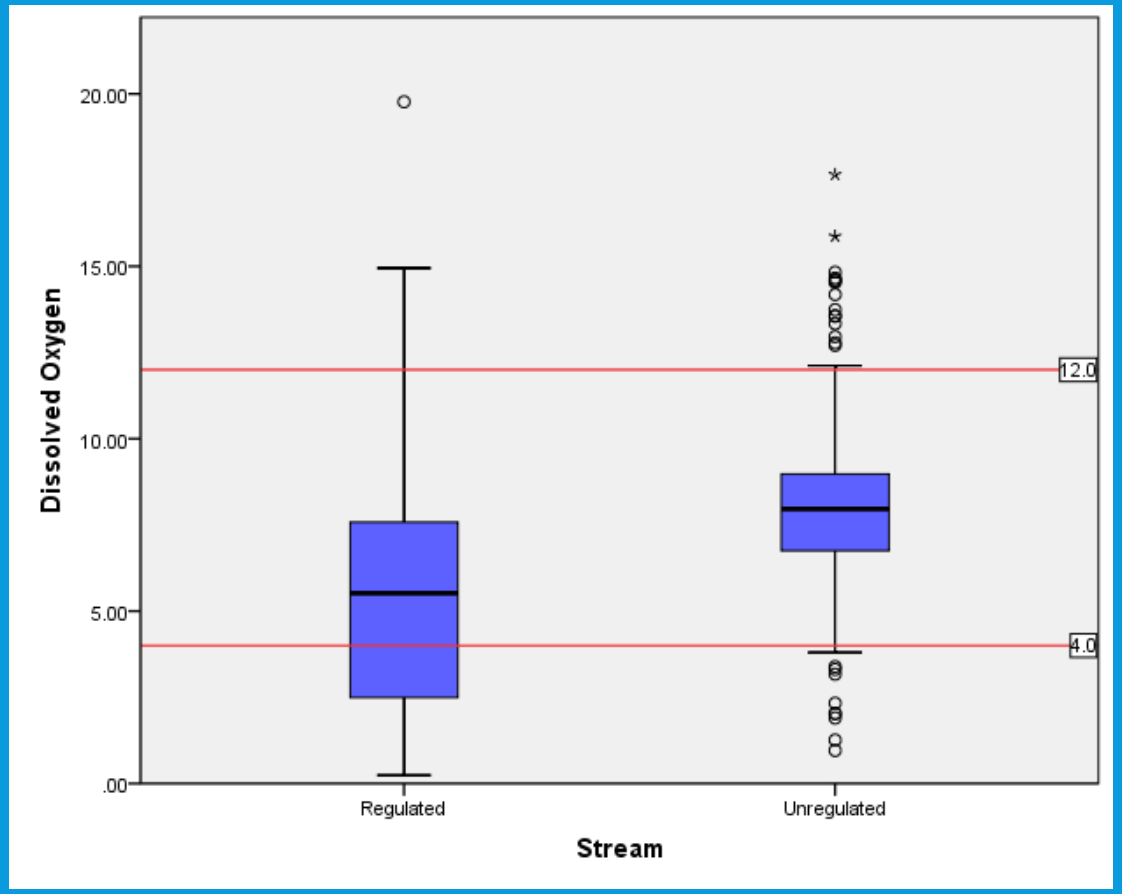
ORGANIC LOADING- TOTAL ORGANIC CARBON



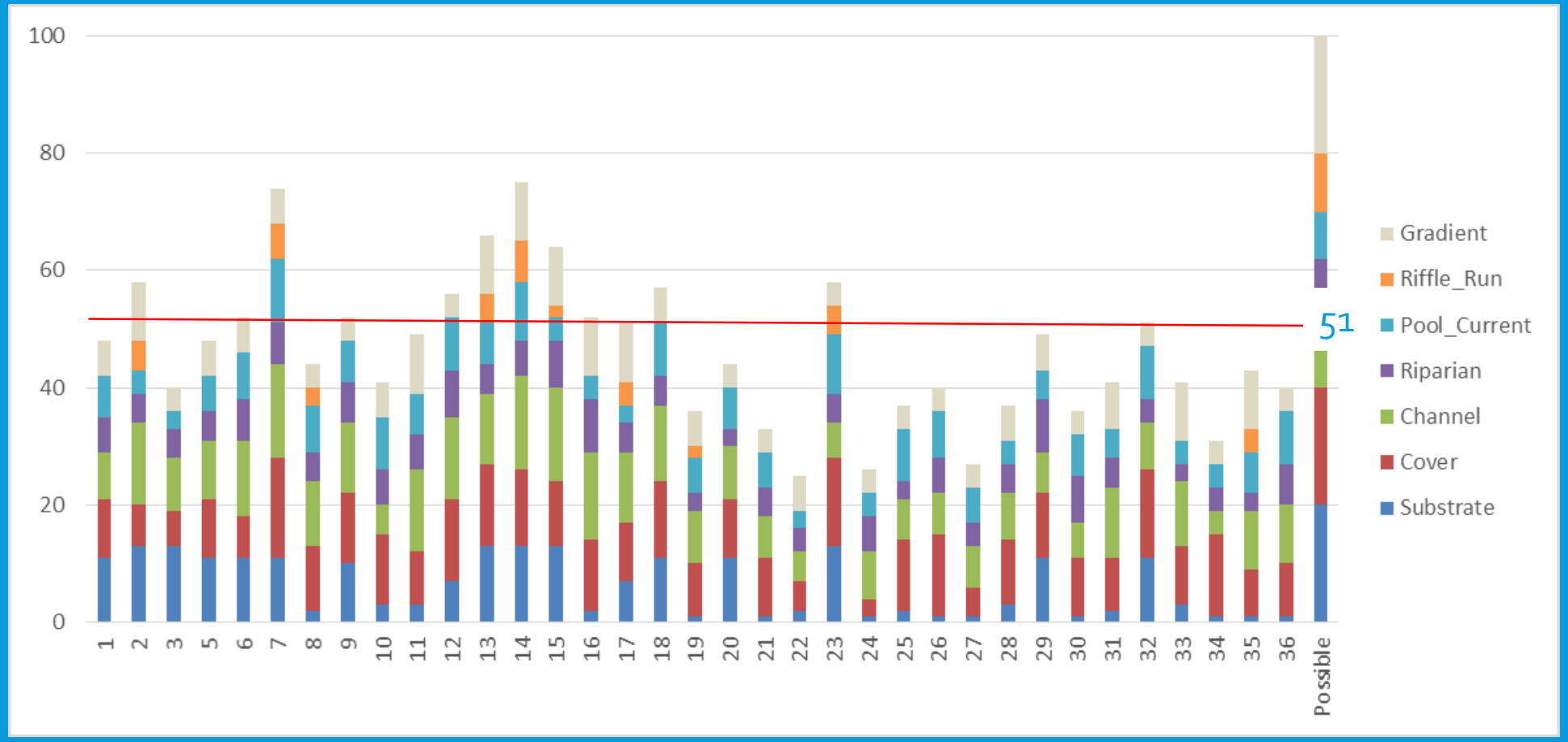
TURBIDITY


Turbidity
1000.00
100.00
10.00
1.00
.00
25.0
10.4
1 2 3 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Site #

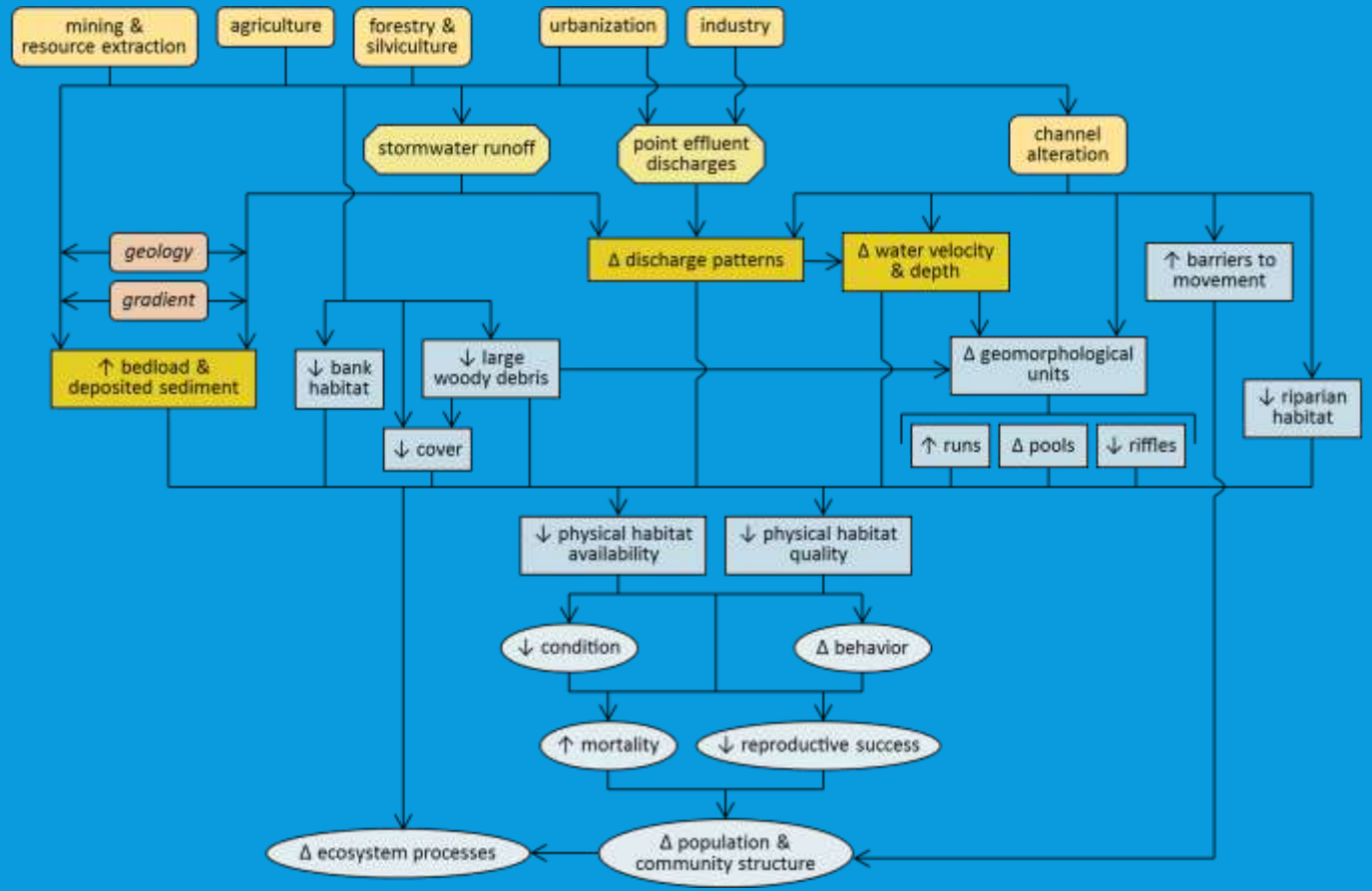
CHANNEL ALTERATION- REGULATED DRAINS



PROBLEM- POOR HABITAT QUALITY



HABITAT- CONCEPTUAL CAUSAL PATHWAY



THE WATERSHED MANAGEMENT PLAN

- Watershed Community Initiative (elements 1-3)
- Watershed Inventory (elements 4-16)
- Identify Problems & Causes (elements 17-18)
- Identify Sources & Calculate Loads (elements 19-21)
- Set Goals & Identify Critical Areas (elements 22-24)
- Choose Measures/ Best Management Practices (elements 25-26)
- Action Register & Schedule (element 27-31)
- Tracking Effectiveness (elements 32-33)

QUESTIONS OR COMMENTS?

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jexl@nirpc.org

http://www.nirpc.org/environment/deep-river-portage-burns-waterway-initiative.aspx