Kentucky's Nutrient Reduction Strategy

- Stoner Memo
  - Prioritize watersheds on a statewide basis for nitrogen and phosphorus loading reductions
  - Set watershed load reduction goals
  - Ensure effectiveness of point source permits in targeted watersheds
  - Develop watershed-scale plans for agricultural areas that target the most effective practices where they are needed the most

Kentucky's Nutrient Reduction Strategy

- Stoner Memo
  - Identify how the state will use tools to assure stormwater and septic system nutrient reductions from communities not covered by the Municipal Separate Storm Sewer Systems program
    - Septic system criteria
    - Low Impact Development approaches
    - Detergents and Lawn fertilizers

Kentucky's Nutrient Reduction Strategy

- Stoner Memo
  - Accountability and Verification
    - How targeting is done
    - Verification of practices
    - Demonstrate progress
  - Annual public reporting
  - Workplan schedule for numeric criteria development

Kentucky's Nutrient Reduction Strategy

- Prioritize
- Identify source-specific tools for the watershed
- Target tools
- Monitor for success
- Report out

Kentucky's Nutrient Reduction Strategy

- Partnerships
  - Federal
  - State
  - Regulated Community
  - Nongovernmental Organizations
  - YOU

Kentucky's Nutrient Reduction Strategy

- Kentucky is a member of the Gulf Hypoxia Task Force

- Strategy is under development

- Draft by December 31, 2013

- Complex problem

Kentucky's Nutrient Reduction Strategy

- **Prioritize**
- Identify source-specific tools for the watershed
- Target tools
- Monitor for success
- Report out

Kentucky's Nutrient Reduction Strategy

- **Prioritize** watersheds on a statewide basis for nitrogen and phosphorus loading reductions
  - Identify major watersheds (HUC8) that individually or collectively account for a substantial portion of loads
  - Within each major watershed, identify targeted/priority sub-watersheds (HUC12)

Kentucky's Nutrient Reduction Strategy

- **Prioritize**

  - Need ✔

  - Capacity ✔

  - Recovery Potential ❓

Kentucky's Nutrient Reduction Strategy

- Recovery Potential Tool

  - A systematic approach for comparing watersheds and identifying differences in how well they may respond to restoration

  - A technical method for comparing the relative restorability of large numbers of water bodies

Hydrologic Unit Code (HUC)

HUC size in Kentucky

	Number in state	Average Square Miles
HUC 8	54	748
HUC12	1301	31

HUC 12
(051002050506)
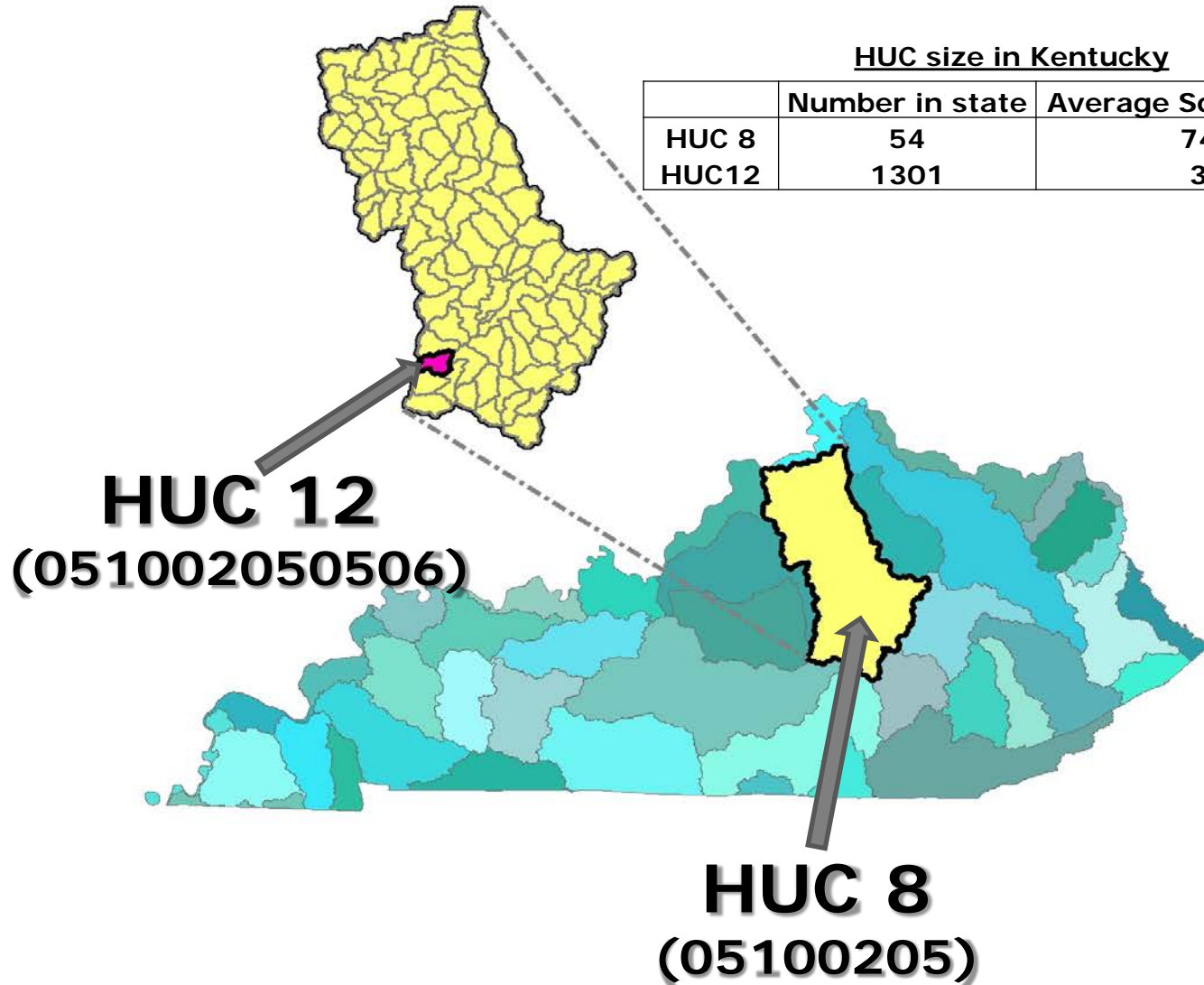
HUC 8
(05100205)

TARGETING NUTRIENT REDUCTION USING RECOVERY POTENTIAL TOOL

HUC 8 – SPARROW MODEL
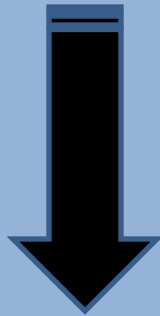
HUC 12 – RECOVERY POTENTIAL TOOL

64 INDICATORS DEVELOPED FOR KY

RECOVERY POTENTIAL – KY INDICATORS

Ecological Indicators

NFHAP_HCI_Condition
Stream_Density
Stream_Order
Topo_Complexity
Percent_Forest
Percent_Forest_In_Corridor
Percent_Wetlands
HUC_Size_Small
Percent_Woody_Veg
Percent_NaturalCover
Percent_Maint_Natural_Cover
Percent_Gain_Natural_Cover
Percent_Natl_Eco_Framework_In_KY
Mean_Combined_Natural_Habitat_Index
Percent_Assessed_No_Pathogens
Mean_Corridor_Slope

Stressor Indicators

Percent_Cropland
Percent_Pasture
Percent_Impervious
Percent_Length_Impaired
Percent_Waterbody_Impaired
Dams_Count
Percent_Pasture_at_Channel
Percent_Crop_at_Channel
Percent_Septic
Percent_Sewered
Impairments_Count
N_Impairments_Count
Percent_Urban
Percent_Urban_In_Corridor
Percent_Impervious_In_Corridor
Phosphorous_Impairments_Count
Percent_Ag_Gain
Percent _Ag _Gain_In_Corridor
NFHAP_HCI_Risk
Percent_Agr_Contiguous_Water
Percent_Impervious_Over5_In Corridor
Percent_Impervious_Over5_In_Corridor_Change
Percent_Impervious_Over15_In Corridor
Pathogen_Impairments_Count
Percent_Urban_Contiguous_Water
Percent_N_Uchange_Contiguous_Water
Corridor_Percent_Ag_On_Steep_Slope
Stressor_Count
Unknown_Stressor_Count
Population
Population_In_Corridor_With_Septic
Percent_Septic_In_Corridor
Percent_Permitted_Mines
Mining_Outfalls_Count
Percent_MS4
CSO_Count
Road_Density
Oil_Gas_Well_Count

Social Indicators

Active_Volunteers_Count
Consent_Decree_Count
Percent_Length_Assessed
Percent_Waterbody_Assessed
Percent_Watershed_Protected_Lands
Low_Jurisdictional_Complexity
TMDL_Count
TMDL_Per_Impairment_Ratio
Percent_Source_Water_Protection_Area
Applied_Practices_Count

RECOVERY POTENTIAL TOOL SETUP

SELECT 3 TO 8 INDICATORS FROM EACH GROUP THAT HELP ANSWER YOUR QUESTION

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
11															
12	**Standard Baseline Fields**			**Ecological Indicator Fields**				**Stressor Indicator Fields**				**Social Indicator Fields**		
13	Number of Baseline	Name of Baseline Fields (use at least 1)		Number of Ecologica	Name of Ecological Indicators	Weights for Ecological		Number of Stressor	Name of Stressor Indicators	Weights for Stressor Indicators		Number of Social Indicators	Name of Social Indicators	Weights for Social Indicators	
14		WATERID			Eco1	1			Stressor1	1			Social1	1	
15		WATERNAME			Eco2	1			Stressor2	1			Social2	1	
16	2			5	Eco3	1		5	Stressor3	1		5	Social3	1	
17					Eco4	1			Stressor4	1			Social4	1	
18					Eco5	1			Stressor5	1			Social5	1	
19															
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34															
35															
36															
37	SET UP INDICATORS														
38															
39															

RECOVERY POTENTIAL TOOL
OUTPUT - TABLE

HUC_ID	HUC_Name	ECOINDEX	ECORANK	STRESSORINDEX	STRESSORRANK	SOCIALINDEX	SOCIALRANK	RPISCORE	RPIRANK
060400051005	Bear Creek-Kentucky Lake	50.37	21.00	1.40	1.00	31.59	5.00	58.54	1.00
060400050907	Turkey Creek-Kentucky Lake	55.27	6.00	1.40	1.00	19.28	75.00	53.24	2.00
051301010903	Indian Creek	48.27	34.00	1.40	1.00	26.11	13.00	53.13	3.00
051402030103	Mud Lake-Ohio River	60.93	2.00	1.40	1.00	12.80	300.00	52.67	4.00
051402060202	Sevenmile Creek-Ohio River	60.80	3.00	1.40	1.00	12.80	300.00	52.57	5.00
051301030602	Lily Creek-Cumberland River	46.97	44.00	1.40	1.00	23.96	25.00	50.66	6.00
051001011303	Pond Creek-Licking River	54.80	8.00	1.40	1.00	15.40	203.00	50.14	7.00
051301040506	Bear Creek	42.63	95.00	1.40	1.00	26.38	10.00	49.29	8.00
050901040303	Bruin Creek-Little Sandy River	42.70	94.00	1.40	1.00	24.61	20.00	48.08	9.00
051301010106	Lower Poor Fork Cumberland River	43.87	76.00	1.40	1.00	23.43	30.00	48.07	10.00
051301030202	Wildcat Branch-Cumberland River	48.20	35.00	1.40	1.00	18.75	87.00	47.82	11.00
051301010705	Sanders Creek-Cumberland River	44.70	62.00	1.40	1.00	21.35	47.00	47.18	12.00
051402060704	City of Cairo-Ohio River	64.03	1.00	1.40	1.00	0.30	707.00	45.95	13.00
051302050408	Dry Creek-Cumberland River	55.97	5.00	1.40	1.00	7.96	406.00	45.66	14.00
051002030404	Buffalo Creek-South Fork Kentucky River	46.50	48.00	1.40	1.00	17.00	148.00	45.36	15.00
051401010602	Pattons Creek-Ohio River	48.97	27.00	1.40	1.00	14.04	256.00	45.00	16.00
051002030503	Lower Sexton Creek	42.30	101.00	1.40	1.00	19.43	71.00	44.09	17.00
051301040507	Roaring Paunch Creek	42.17	103.00	1.40	1.00	19.21	76.00	43.84	18.00
051402030705	McGilligan Creek-Ohio River	47.63	39.00	1.40	1.00	13.64	271.00	43.77	19.00
051301030205	Martin Creek-Cumberland River	38.37	173.00	1.40	1.00	22.28	41.00	43.32	20.00
051001010302	Craney Creek	36.97	206.00	1.40	1.00	23.38	31.00	43.10	21.00
051002010707	Hell Creek-North Fork Kentucky River	42.40	98.00	1.40	1.00	17.94	114.00	43.10	22.00
051002030204	Elisha Creek-Red Bird River	44.90	61.00	1.40	1.00	15.19	214.00	42.92	23.00
051002010706	Walker Creek-North Fork Kentucky River	43.83	77.00	1.40	1.00	15.98	179.00	42.72	24.00
051301030406	Harmon Creek-Cumberland River	43.17	85.00	1.40	1.00	16.56	162.00	42.66	25.00
050901040301	Caney Creek	43.77	78.00	1.40	1.00	15.86	183.00	42.59	26.00
051002040403	Cavanaugh Creek-Station Camp Creek	43.93	74.00	1.40	1.00	15.60	191.00	42.52	27.00
051402030704	Givens Creek-Ohio River	45.30	58.00	1.40	1.00	13.20	286.00	41.79	28.00
051002030602	White Oak Creek-South Fork Kentucky River	45.00	60.00	1.40	1.00	13.40	280.00	41.71	29.00
051001011302	Phillips Creek-Licking River	41.43	118.00	1.40	1.00	16.66	160.00	41.50	30.00
051401010305	Barebone Creek-Ohio River	44.47	66.00	1.40	1.00	13.10	291.00	41.12	31.00
051401010103	Carmon Creek-Little Kentucky River	40.93	127.00	1.40	1.00	16.11	173.00	40.75	32.00
051401030605	Cedar Creek-Rolling Fork	43.50	81.00	1.40	1.00	13.44	277.00	40.67	33.00
051401010302	Crooked Creek-Ohio River	43.50	81.00	1.40	1.00	13.38	282.00	40.63	34.00
051401030404	Lower North Rolling Fork	40.70	130.00	1.40	1.00	15.59	192.00	40.21	35.00
051301030702	Bear Creek-Cumberland River	40.67	131.00	1.40	1.00	14.74	232.00	39.58	36.00
051002030601	Lower Island Creek	39.67	144.00	1.40	1.00	15.68	190.00	39.53	37.00
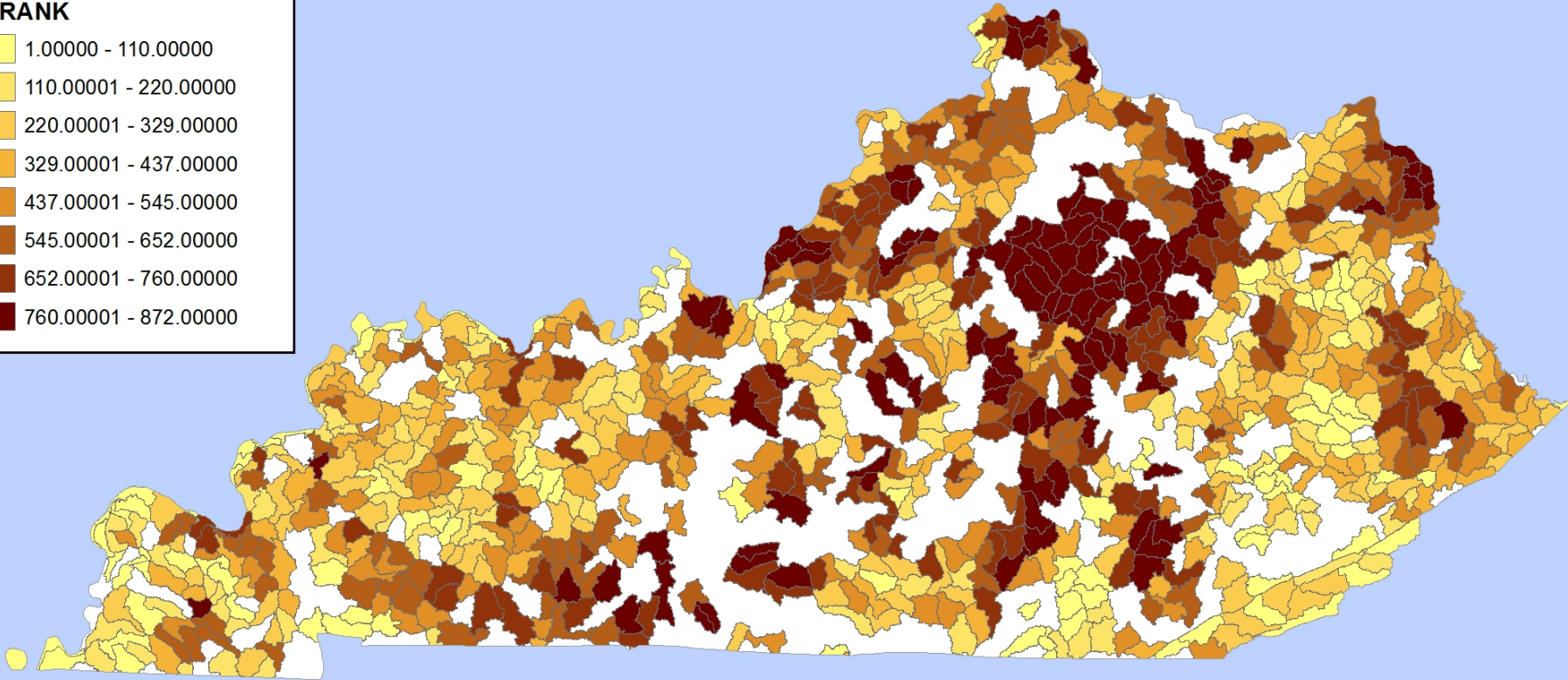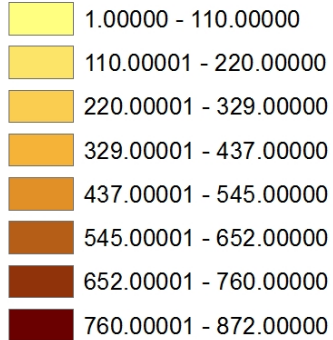
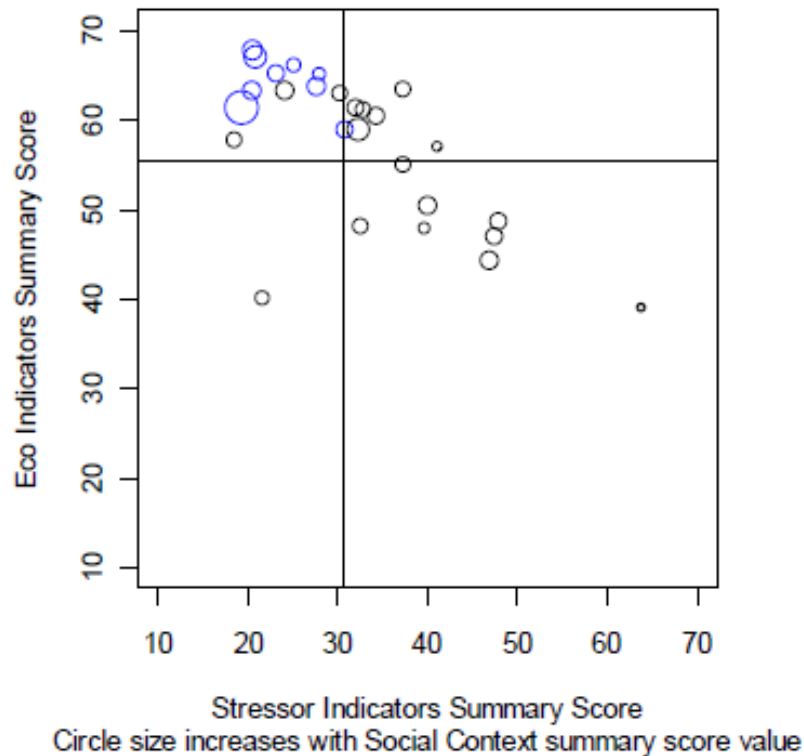# RECOVERY POTENTIAL TOOL
OUTPUT – BUBBLE PLOT

Figure 2A. A 3D bubble plot of Piedmont ecoregion watershed recovery potential from screening run 1. Watersheds that passed bioassessment are in blue, failing watersheds in black. Note that the healthy watersheds clustered in the upper left quadrant due to the combination of high eco/low stressor summary indices. Larger dot size reflects higher social context score.
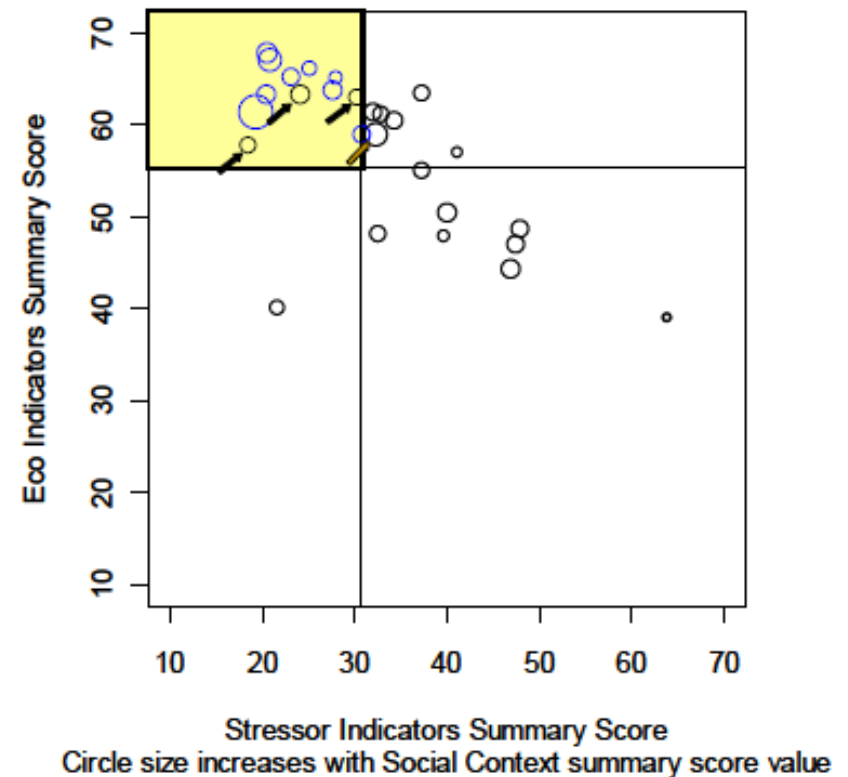
Figure 2B. The same bubble plot modified to demonstrate a simple decision support process for recognizing stronger candidates for restoration of impaired watersheds. First, the Fail watersheds in the upper left quadrant (black arrows in yellow shaded area) are identified. A better than average social context score (larger bubble) plus additional information and expert judgment support the addition (brown arrow) of another watershed from the upper right quadrant.

OTHER USES FOR RECOVERY POTENTIAL TOOL

- HEALTHY WATERSHEDS

- PATHOGEN IMPAIRED WATERSHEDS MOST EASILY RECOVERABLE

- NATIONAL WATER QUALITY INITIATIVE