Attachment 5

Adaptive Management for Improving Aquatic Life: Identification and Prioritization System (IPS)

Attachment 5 – IPS

Identification and Prioritization System (IPS)

Active adaptive management calls for a mechanism to integrate baseline data and trend information into management and implementation decisions on an on-going basis. With a robust understanding of the stressors responsible for impairment, based on the analysis of biological responses, the DRSCW developed a mechanism to select implementation projects that:

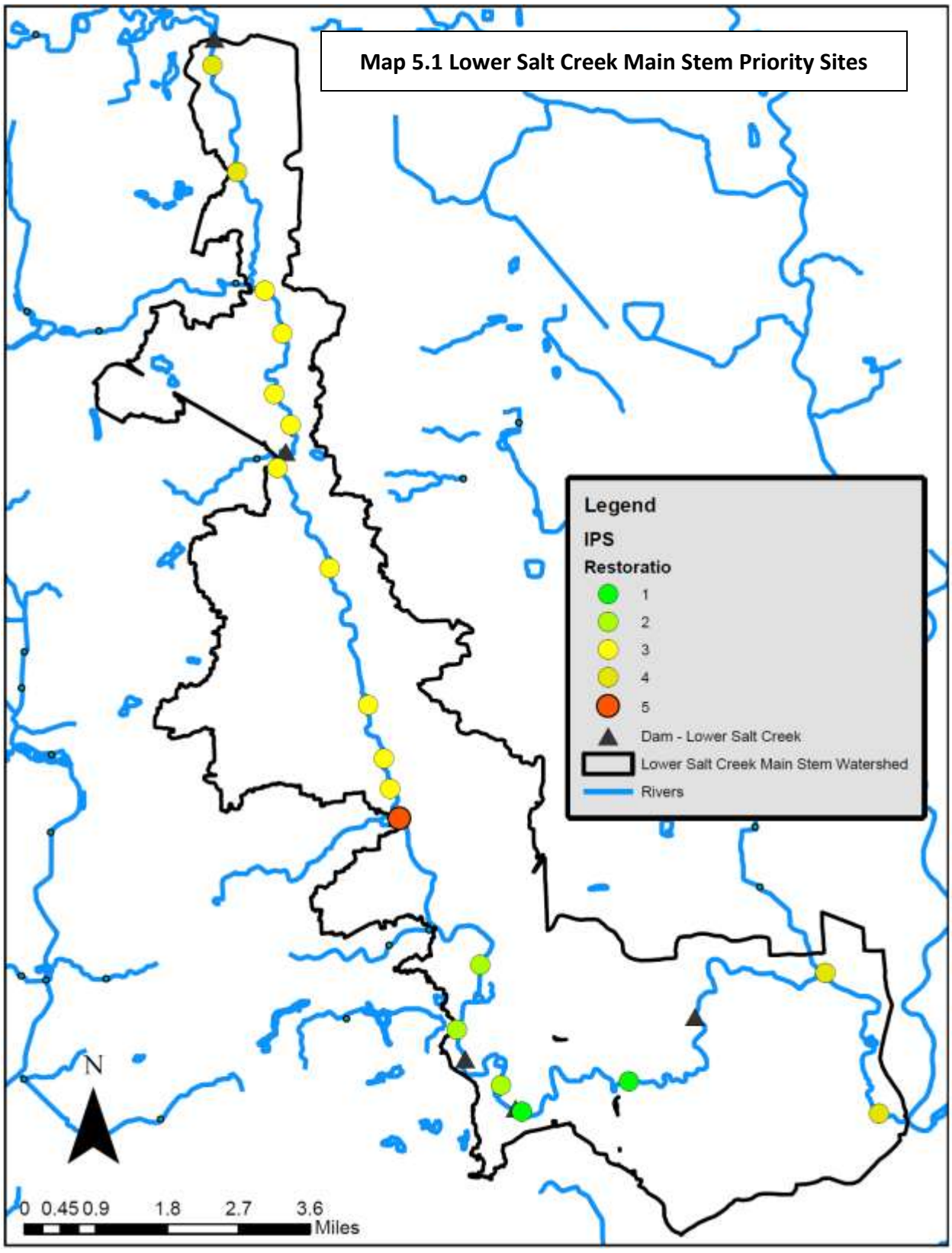
- Identify the most limiting stressors at a reach level
- Prioritize reaches for intervention
- Establish restoration endpoints
- Provide a level of confidence in the likelihood of success
- Provide measurable outcomes

DRSCW used a number of statistical techniques to look at correlations between observed aquatic communities as measured by IBI and 41 possible stressors throughout the Salt Creek and Upper DuPage watersheds. Possible stressors included landscape scale stressors (such as road density and basin size), ambient chemistry (such as chloride and phosphorous concentrations) and physical (using sub components of the QHEI such as measures of buffer width and stream sinuosity). The stressors used in the analysis do not directly list physical barriers to fish movement, such as dams or other control structures, although metrics affected by such structures, such as poor habitat or sediment conditions that exist due to the presence of impounded water upstream of a dam, are included.

The statistical tool identified certain parameters from a suite of nutrients as stressors with an identifiable correlation to stream biological health. The tool examines relationships between the independent variables and goes further and looks at relationships with the species and taxa from which IBIs are constructed. Ammonia-N and TKN showed significant correlation. The methods used are based on the EPA's Causal Analysis/ Diagnosis Decision Information System (CADDIS) methodology and include cluster analysis, non-metric Multidimensional Scaling and Classification and Regression Trees. A full report on the Identification and Prioritization System (IPS) is available on the DRSCW's website at http://www.drscw.org/prioritization/IPS.Draft322011.pdf. An extract from the system for Plan area sites is available as Appendix 3.

Table 5.1 lists the nine stressors identified by statistical analysis that best correlate with IBI values in current monitoring data. Quantile Regression is then used to examine the relationship between the individual stressor and the fIBI and mIBI scores. Such analysis supplies both thresholds for the stressor response in aquatic communities and information for project planners to design restoration projects. To the list was added physical fragmentation (dams), sediment concentrations of metals and Polycyclic Aromatic Hydrocarbons (PAHs).

Table 5.1 - Proximate stressors identified in causal analysis
Riparian score
Riffle score
Channel score
Substrate score
Pool score
Chloride
TKN
BOD
NH3N


Map 5.1 Lower Salt Creek Main Stem Priority Sites
Legend
IPS
Restoratio
1
2
3
4
5
Dam - Lower Salt Creek
Lower Salt Creek Main Stem Watershed
Rivers
N
0 0.45 0.9 1.8 2.7 3.6
Miles

Neither is used in the statistical methodology for methodological reasons but both have explanatory power in IBI variation, the former in longitudinal IBI plots and the latter is ubiquitous in sediment samples.

Stream segments were graded according to their estimated "restorability." To accomplish this, a composite score based on three restorability factors was created:

- Each site was given a positive score according to its proximity to open space. Open space was calculated based on GIS analysis of aerial images and land use coverage. This variable was an important consideration to insure sufficient physical space exists in the riparian corridor to allow physical enhancement projects.
- Each site was given a negative score relative to the number of proximate stressors (Table 5.1) that existed at the site above the causal thresholds. Site score decreases as the number of proximate stressors identified at the site increases. Having a low number of proximate stressors is assumed to mean that restoring biological integrity to the site would be less complex than at a site with a large number of proximate stressors.
- Each site was given a positive score according to its proximity to the biological threshold for the IBI rankings (thresholds set by Illinois EPA). This criterion is based on the assumption that segments close to compliance would be easier to steer to full compliance than sites with poor assemblages.

The grading exercise ranks projects on a nominal scale of 1-6 in descending order of restorability, and also generates a list of actions that projects should tackle such as buffer creation, chloride abatement or re-meandering. The system was validated by evaluating priority sites with field visits from stream restoration and water quality specialists. Once a site is chosen, projects can be designed based on the data supplied by the tool (targeted on reducing proximate stressors, designed by quantile regression) and by accessing the field data for the site (QHEI subset scores and species data).

In the Plan area the priority site is the cluster of sites between river miles (RM) 8 and 13.5 (SC49, SC52, SC53, SC56, SC55 in Appendix 3) where there are three priority 1 sites. The central feature in this area is the Fullersburg Woods dam which lies at RM 10.8. The dam directly effects to RM 10.8 to RM 11.5 with riffle, substrate, channel, pool all missing and with causal threshold hits for Ammonia-nitrogen and TKN which may be produced in the ponded conditions behind the dam. Likewise the downstream sites seemed to be showing the causal threshold hits for Ammonia-nitrogen and TKN produced behind the dam.

The IPS can also be used to enhance projects at sites that are not prioritized but where a project with surface water impacts is proposed. For example, Oak Meadows is a project proposed under the results of the QUAL2K model described in Attachment 5 and it was a mid-ranked priority project (level 3). However the recommendations of the causal analysis can be integrated into the channel improvement work implemented. IPS found a lack of riffles, riparian habitat, gravel substrates, channel sinuosity and pools. Ammonia-nitrogen and TKN also passed causal thresholds. Therefore, the channel restoration accompanying the dam removal will focus on building those missing elements.